San Joaquin Valley Intelligent Transportation System (ITS) Strategic Deployment Plan

FINAL

Prepared for:

San Joaquin Valley ITS Technical Advisory Committee and Steering Committee
San Joaquin Council of Governments (SJCOG)
California Department of Transportation

Prepared by:

URS
BRW

In Association With:

NET Corporation
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CCS Planning and Engineering, Inc.

September 30, 2001

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U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION
CALIFORNIA DIVISION
980 Ninth Street, Suite 400
Sacramento, CA. 95814-2724

January 8, 2002

IN REPLY REFER TO
HDA-CA
File #: ITS San Joaquin Valley
Document #: S37491

Julia Greene, Chair
Valley Wide COG/Executive Director SJCOG
6 South El Dorado Street, Suite 400
Stockton, CA 95202

Dear Ms. Greene:

SUBJECT: ADDRESSING THE NATIONAL ITS ARCHITECTURE

The Federal Highway Administration (FHWA) has received the San Joaquin Valley Intelligent Transportation System (ITS) Strategic Deployment Plan. We are pleased to see that all eight of the Regional Transportation Planning Agencies (RTPA) have adopted the plan.

Based on FHWA's review, the plan successfully establishes a framework for a regional architecture called for in the Final Rule on ITS Architecture and Standards, Section 940, 23 Code of Federal Regulations. All future ITS projects submitted by any one of the eight RTPAs in which this plan represents shall be based on a systems engineering analysis as specified in 940.11 and shall accommodate the interface requirements and information exchanges as specified in the regional architecture.

It is important to acknowledge that while the San Joaquin Regional ITS Architecture is contained as a document in the plan, it must be considered a process that will be maintained, revised and validated as needed. Starting in 2002, FHWA looks forward to working collaboratively with the San Joaquin Valley RTPAs, Caltrans Districts 6 and 10 and other stakeholders to strengthen the regional architecture through focus groups and to project implementation for the future good of the Region.

The Regional Transportation Plan (RTP) is the logical location to address the Regional ITS Architecture since the RTP contains proposed transportation projects, including ITS and projects with ITS elements looking out over at least a twenty-year planning horizon. The architecture should be accepted and incorporated in sufficient detail as part of the RTP and continually used as a starting point or guide for project development.

Congratulations on the development of a comprehensive ITS Strategic Deployment Plan that represents the interests of each county involved and the San Joaquin Valley as a whole. Should you have any questions, please call Mr. Ken Kochevar, at (916) 498-5853 or Mr. Frank Cechini, at (916) 498-5005.

Sincerely,

/s/Kenneth J. Kochevar

For
Michael G. Ritchie
Division Administrator

cc:
Barbara Goodwin, Council of Fresno County Governments
Ronald Brummett, Kern Council of Governments
Bill Zumwalt, Kings County Association of Governments
Patricia Taylor-Maley, Madera County Transportation Commission
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January 2, 2002

Ms. Julia E. Greene, Executive Director
San Joaquin Council of Governments
6 S. El Dorado St., Ste. 400
Stockton, CA 95202

Dear Ms. Greene:

The Department of Transportation is pleased to approve the final report of the San Joaquin Valley Intelligent Transportation System (ITS) Strategic Deployment Plan for submission to the Federal Highway Administration. This comprehensive report clearly describes and documents all analyses and recommendations for the implementation of ITS in the San Joaquin Valley and has received approval by the San Joaquin Valley Directors and respective boards.

The San Joaquin Valley ITS Strategic Deployment Plan provides a framework for regional ITS planning and coordination, programming, and implementation efforts over the next 20 years. The plan proposes ITS solutions that address transportation needs in the San Joaquin Valley to improve safety and the movement of people, goods, services, and information. It prioritizes ITS projects that support an integrated system, evaluates benefits and cost-effectiveness, and provides deployment guidelines for plan implementation.

The San Joaquin Valley Strategic ITS Deployment Plan includes a regional architecture, which is a blueprint for the deployment of ITS projects within the San Joaquin Valley. Federal regulations require the regions to develop a regional architecture based on the National ITS Architecture and standards. The regional ITS architecture ensures that ITS projects in the San Joaquin Valley are eligible for federal funding.

The plan was funded with state and local matching funds. It is the result of the cooperative effort of the eight Central Valley Counties, Partners, Stakeholders, Caltrans Offices of Planning and Traffic Operations (Districts 10 and 6), and Headquarters – Department of New Technology

and Research. Everyone involved in the development of the San Joaquin Valley ITS Strategic Deployment Plan deserves recognition for their contribution, dedication, skill, and support toward the completion of this very important planning document.

We appreciate the opportunity to participate with the San Joaquin Council of Governments in managing this challenging project, and resolve to maintain our commitment to the integrity of the plan.

Sincerely,

Jane E Berg for

DANA COWELL
Deputy District Director
Planning, Modal & Local Assistance Programs

cc: Alan McCuen, District 6, Division Chief
Cathy Felkins, Caltrans – New Technology and Research
Douglas Smith, URS/BRW

San Joaquin Valley Transportation Planning Agencies Director's Association

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48

San Joaquin Council of Governments

Council of Fresno County Governments

Kern Council of Governments

Kings County Association of Governments

Madera County Transportation Commission

Merced County Association of Governments

Stanislaus Council of Governments

Tulare County Association of Governments

January 2, 2002

RECEIVED
JAN - 7 2002
KERN COUNCIL OF GOVERNMENTS

Mr. Frank Cechini, Information Systems/ITS Manager
Federal Highway Administration
980 9th Street, Suite 400
Sacramento, CA 95814-2774

Dear Mr. Cechini:

As Chair of the Valley Wide Council of Governments, I am pleased to submit the enclosed San Joaquin Valley Intelligent Transportation System Strategic Deployment Plan (ITS/SDP) to the Federal Highway Administration (FHWA).

The completed Plan represents over 22 months of work. It involved the collaborative effort of the eight (8) Regional Transportation Planning Agencies comprising the San Joaquin Valley along with other key representatives from i.e., FHWA, Caltrans Districts 10 and 6, New Technology and Research, local cities, Transit Districts, California Highway Patrol. The dedication of all the agencies involved, along with the guidance from the consulting firm of URS/BRW produced a comprehensive San Joaquin Valley ITS/SDP that complies with the National ITS Architecture.

All comments on the final draft of the ITS/SDP have been addressed and incorporated into the document. The Policy Boards of all the RTPAs have reviewed and adopted the Plan. Unilaterally, the regions recognize the Plan's importance and regional impact, and have made a commitment to maintain the integrity of the Plan. Please refer to the enclosed executed resolutions and staff report with minutes.

As the administrative funding arm for this project, Caltrans District 10, along with Caltrans District 6, and the Department of Transportation's New Technology and Research contributed a significant amount of staff time and support towards this project. The involvement of these state agencies had a positive impact on the quality of the ITS/SDP. Their endorsement and continued support of the Plan is documented in the enclosed letter from Dana Cowell, Chief Transportation Planning of Caltrans District 10.

Thank you for the support and guidance you and your staff provided throughout the development of the ITS/SDP. Please feel free to call me at (209) 468-3913 if you have any questions.

Sincerely,

Julia E. Greene

JULIA E. GREENE
Chair, Valley Wide Council of Governments

Enclosures

cc Barbara Goodwin, Council of Fresno County Governments
Ronald Brummett, Kern Council of Governments
Bill Zumwalt, Kings County Association of Governments
Patricia Taylor-Maley, Madera County Transportation Commission
Jesse Brown, Merced County Association of Governments
Gary Dickson, Stanislaus Council of Governments
George Finney, Tulare County Association of Governments
Dana Cowell, Caltrans District 10
Alan McCuen, Caltrans District 6
Cathy Felkins, Caltrans New Technology and Research
Douglas Smith, URS/BRW

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E.0 Executive Summary

E.1 ITS Overview

Intelligent Transportation Systems (ITS) can be defined as the application of technology to make smarter use of our transportation infrastructure. ITS deployments focus on providing enhanced management and information capabilities for transportation managers and the traveling public. Overall, ITS represents a viable and effective option in the "toolbox" of solutions to transportation problems in the San Joaquin Valley Region.

This document identifies and prioritizes ITS Projects for the San Joaquin Valley Intelligent Transportation System (ITS) Strategic Deployment Plan. These projects were prioritized through a development process that mapped the region's needs to ITS market packages. Market Packages define ITS building blocks for meeting user needs within the guidelines defined by the National ITS Architecture. The selection of Market Packages was the first of two steps in the development of a full ITS system architecture for the San Joaquin Valley. A technical depiction of existing and planned ITS elements and the relationships between them, both technical and institutional, is the subject of specific sections of the SDP.

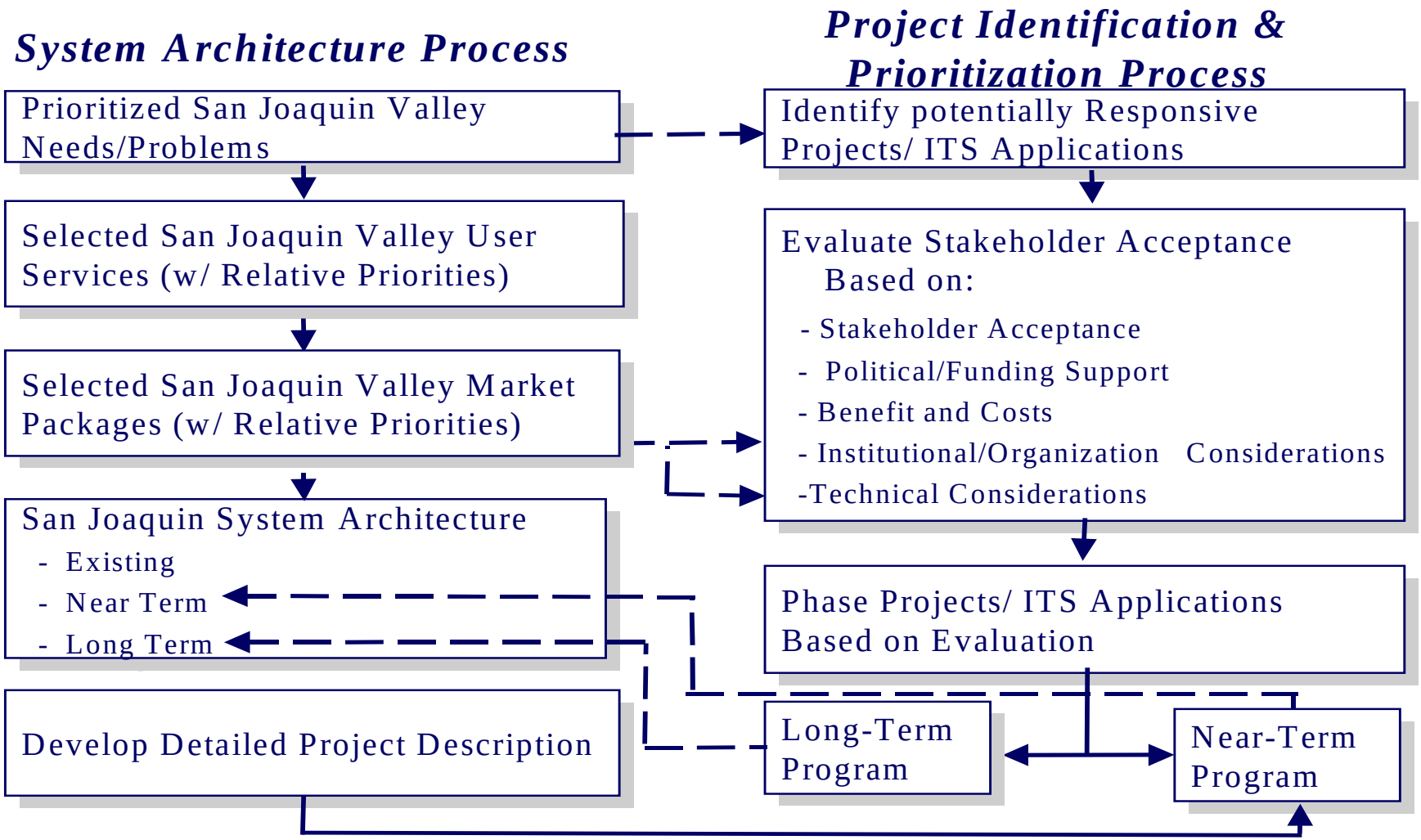
The process to develop a system architecture begins with identification of local transportation needs/problems (identification of needs/problems is documented in Section 3.0). Next, those local needs/problems are translated into the common (i.e., National ITS Architecture) vocabulary of User Services. User Services describe the services that will be provided to transportation system users and which will address the specific needs/problems (the selection of San Joaquin Valley ITS User Services is also addressed in Section 3.0).

After identifying User Services, Market Packages are selected that provide the various technical functions required to implement the selected User Services. The relationship between User Services and Market Packages defined in the National ITS Architecture is an important, but not the sole consideration in Market Package selection for a specific region. Other factors have been considered in the selection, and in the relative prioritization, of Market Packages for the San Joaquin Valley.

Using the identified San Joaquin Valley ITS User Services and Market Packages, the ITS system architecture itself will be developed for the region. Although the list of San Joaquin Valley User Services and Market Packages themselves do not constitute the ITS system architecture, they are critical building blocks upon which the architecture can be further articulated, as will be documented in Section 4.0.

As portrayed in Figure E.1, the relative priority of the San Joaquin Valley Market Packages is but one consideration in the identification and ultimate phasing of specific ITS projects. Many additional considerations, including benefits and costs, public and political acceptance, funding potential, institutional issues, and other technical considerations, will be considered as specific projects are identified and detailed phasing recommendations are made (i.e., projects for Year 1, Year 2, etc.). Whereas the final project implementation phasing recommendations will be quite specific, and will reflect a wide range of factors in addition to the priority of Market Packages, the system architecture, which is fundamentally a "big picture", long-range depiction, will not include fine distinctions in phasing.

Figure E.1: Relationship between System Architecture and Project Identification and Prioritization



The eight counties of the San Joaquin Valley: Fresno, Kern, Kings, Madera, Merced, San Joaquin, Stanislaus, and Tulare oversaw the preparation of a "blueprint" to guide the implementation of Intelligent Transportation Systems (ITS). The Intelligent Transportation System (ITS) Strategic Deployment Plan (SDP) for the San Joaquin Valley Region is a 20-month study jointly funded by California Department of Transportation (Caltrans) and the individual counties with San Joaquin Council of Governments (SJCOG) serving as project administrator. The San Joaquin Valley region represents one of the last geographic areas in California to develop an ITS Plan. Two ITS Strategic Plans have been completed for portions of the San Joaquin Valley: Fresno County (1999) and Kern County (1997). The San Joaquin Valley ITS Strategic Deployment Plan will reference and build upon these plans. The San Joaquin Valley plan will also reference, and as appropriate coordinate with, several other plans, including: Central Coast ITS Strategic Deployment Plan, Sacramento Area EDP, San Francisco Bay Area EDP, Sierra Nevada SDP, and the LA/Ventura SDP.

ITS technologies refer to a wide variety of tools and techniques that focus on addressing transportation problems by improving the efficiency and safety of the existing transportation infrastructure through the application of communications, computing, information and other "high level technologies." They include more immediately recognizable features such as: emergency call boxes, changeable message signs, signal synchronization and preemption, and Highway Advisory Radio; and also more advanced technologies including Traffic Operations Centers, Automatic Vehicle Location devices, information kiosks, and electronic payment services for transit and tolls.

The Strategic Plan is a road map to implement an integrated system of technology based transportation strategies.

While ITS incorporates many new and emerging technologies, such systems are not completely new to the San Joaquin Valley. Transportation agencies in the region have already implemented technology-based solutions such as:

- Interconnected traffic signal control systems to improve traffic flow in larger downtown areas like Stockton, Fresno and Bakersfield, as well as in smaller cities such as Modesto, Visalia and Ceres.

- Roadside motorist aid call boxes along highways in Kern and San Joaquin Counties to help in providing emergency and roadside assistance to motorists.

- Closed circuit TV (CCTV) cameras on State Route (SR) 99 and I-5 in Stockton, and at the I-5/SR-4 interchange in San Joaquin County to help monitor congestion and respond to incidents and blockages more quickly.

- Weather and changeable message signs (CMS) on SR 99, I-5, SR 198, and SR 41 that provide motorists with roadway condition information to aid in their travel decisions.

- The implementation of Yosemite Area Traveler Information System (YATI) by Merced CAG to provide tourist with area information.

These activities are a partial foundation for a more complete set of integrated ITS applications that will help keep people and goods moving more safely and efficiently within and through the Valley in the coming decades. The expectation is that strategic use of technologies will benefit a broad cross-section of interests, such as tourism, movement of agricultural and other products, transit travelers, and auto drivers. It will also help local agencies with their jobs of managing congestion, providing mobility improvements, and improving air quality. To be most effective, the systems need to be integrated, sharing information that can be used within and outside the Region to improve travel mobility and safety.

Although the San Joaquin Valley has seen the implementation of some basic technology-based strategies or intelligent transportation systems applications, there has not been a comprehensive, systematic look at ITS opportunities until now. The San Joaquin Valley ITS Strategic Deployment Plan identifies a 20-year strategy, but will also include a detailed, short-term component identifying specific projects for implementation in the first few years after adoption.

Caltrans envisions these TOS elements as part of a comprehensive system. Implementation is somewhat fragmented due to sporadic funding. Funding is a critical concern. One approach utilized by Caltrans, is to include ITS elements in construction projects as they come on line. The construction schedule does not necessarily follow the same sequence as our long-range TMS plan. So implementation of ITS elements as a comprehensive system, requires extra coordination efforts.

The Plan includes recommendations for Valley-wide and interjurisdictional initiatives to address problems that affect the entire region, as well as recommendations for projects that will address specific local problems throughout the Valley.

The SDP is intended to provide a starting point for regional ITS coordination, programming, and implementation efforts over the next twenty years. Over the past decade, ITS has become a recognized tool for improving the operation and efficiency of the transportation system. Several agencies in the San Joaquin Valley have already undertaken various ITS deployment efforts ranging from traffic signal system improvements to transit management systems and from enhanced

emergency service Computer Aided Dispatch to freeway surveillance projects.

The development of this Plan represents a new level of effort in the coordinated deployment of ITS projects. The objectives of the study are to:

1. Gain the participation of transportation stakeholders and community members;

2. Identify transportation needs that have the potential to be addressed by ITS technologies;

3. Evaluate which ITS elements would be beneficial, cost-effective and implementable to meet the identified needs; and

4. Develop a plan outlining the short-, medium-, and long-range application of ITS technology including specific operations and maintenance plans and financing.

Technical oversight for the San Joaquin Valley ITS SDP was provided by the ITS Technical Advisory Committee (TAC), composed of representatives of federal, state and local transportation organizations representing the Valley's transportation interests. The ITS Technical Advisory Committee consists of the following members:

- California Highway Patrol (CHP)
- California Trucking Association
- California Department of Transportation – District 10
- California Department of Transportation – District 6
- California Department of Transportation, New Technology and Research Program
- Council of Fresno County Governments (COFCG)
- Federal Highway Administration (FHWA)
- Kern Council of Governments (Kern COG)
- Kings County Association of Governments (KCAG)
- Madera County Transportation Commission (MCTC)
- Merced County Association of Governments (MCAG)
- San Joaquin Council of Governments (SJCOG)

- San Joaquin Valley Air Pollution Control District (SJVAPCD)
- Stanislaus Council of Governments (StanCOG)
- Tulare County Association of Governments (TCAG)

The San Joaquin Valley COG Directors are providing Policy Level oversight in the role of a Steering Committee for this Plan.

The San Joaquin Valley ITS SDP is intended to establish the need for ITS investments in the Valley, identify relative priorities to direct ITS investment in the region, and to identify specific projects to be deployed to address identified needs. The phasing of the recommended projects reflects the relative priorities identified in the development of the plan.

In concept, the SDP is intended to guide all ITS investment in the region, in so much as every attempt has been made in the development of the plan to involve all interested agencies and to reflect their needs and priorities in the recommended ITS investment program. The Strategic Deployment Plan is expected to play a particularly significant role in directing ITS investments planned and programmed by the Regional Transportation Plan (RTP) and Transportation Improvement Plan (TIP) processes administered by the Metropolitan Planning Organizations (MPOs) and Regional Transportation Planning Authorities (RTPA's) within the region.

However, there will be some ITS investments made in the Valley based on priorities established at the state level, utilizing state funds (as opposed to utilizing funds dedicated to regionally prioritized investments). It should also be noted that despite the expressed priorities of the Strategic Deployment Plan, private companies will invest or withhold investment based on their own priorities, and therefore private sector involvement or lack of involvement may significantly influence the actual phasing of specific ITS investments in the Valley.

E.2 Vision for ITS Deployment

The Strategic Plan is a starting point for bringing these technological approaches together into an integrated plan.

The SDP is a starting point for bringing these technological approaches together into an integrated plan. We do not expect that this system will be built right away, nor do we expect that government will achieve it alone. It will require a partnership of institutions, and a lot of it will occur without government involvement at all. The remainder of this Executive Summary describes how the Strategic Plan is structured, identifies some of the highlights, and indicates some of the probable keys to success. The body of the report tells the story in more detail.

ITS has begun to permeate virtually every dimension of transportation, just as computers are permeating so many facets of everyday life. This

is partly why the dimensions of ITS are somewhat difficult to grasp. Not only are there many possible applications of ITS, but these applications and opportunities are changing on almost a daily basis. What may have looked like a good strategy a year ago becomes superseded by the next major innovation. How then does one plan in such a dynamic environment? The situation cries out for a "blueprint", a framework within which public agencies can make decisions about the ITS strategies to invest in and when may be the right time to invest.

A vision is simply a guide for where we want to go and, to an extent, how we want to get there.

We can think of the ITS strategy for the Valley in terms of a progression from an overall vision to priorities for specific projects. A vision is simply a guide for where we want to go and, to an extent, how we want to get there. A strategic direction has been defined to support and provide additional detail to the vision. The strategic direction consists of general principles that apply as we seek to achieve the vision. The vision and related strategic direction for the Valley are defined in the body of the report.

ITS project concepts have been defined that are appropriate to the Valley, both for short and long term. ITS concepts can be thought of as types of recommended ITS projects that are not specific to a location or agency.

The ITS Technical Advisory Committee developed a vision for the SDP and ITS deployment in the San Joaquin Valley. This vision states:

"The ITS vision for San Joaquin Valley is to enhance the quality of life, mobility and the environment through coordination, communication and the integration of ITS technologies into the Valley's transportation systems."

The vision and goals for regional ITS deployment are discussed in detail in Section 2.0.

In order to assess the types of ITS projects best suited to the San Joaquin Valley Region, the ITS Subcommittee identified the priority transportation problems and ITS user needs. This identification occurred through responses to surveys and a series of workshops and meetings.

Table E.1 displays the priority problems identified by the TAC. Problems were ranked based on scoring criteria applied by transportation stakeholders in a series of exercises conducted in the early phases of the project.

Table E.1: Summary List of Problem Priorities

Priority Level	Problem
Priority 1	* Traffic congestion, especially due to incidents
	* Incidents and delay due to weather conditions (including fog, blowing sand and flooding)
	* Conflicts between trucks and other traffic, including congestion and accidents
	* Truck routing, including failure to specify routes, enforcement, and the impact of trucks on roadway surfaces
	* Traffic signal coordination, especially across jurisdictions
	* Speeding and red-light running
	* Connections between transit services, including between local and inter-city or regional, and between fixed-route and demand-responsive service.
	Interjurisdictional coordination of traffic strategies, including construction and maintenance, traffic management and compatibility of equipment
	Information for travelers, including traffic and weather/pavement, and including both local and long-distance travelers
	Air quality impacts of travel
	Delays and congestion at railroad crossings, especially to emergency vehicles
	Funding for transportation, including maintenance, road-building and ITS
	Inadequate planning data and analysis tools (e.g., GIS), especially across agencies
	Under-appreciation of the need for and benefits of ITS
Priority 2	Mechanisms and structures to promote long-term agency coordination (i.e., beyond the strategic planning stage)
	Managing traffic at incident scenes, especially interjurisdictional coordination of incident-related traffic diversions
	Lack of truck parking
	Insufficient fixed-route transit service, including no service or excessively long travel times
	Safety and security on fixed-route transit vehicles and at facilities
	Substandard roadway design
	Accidents and delay associated with agricultural vehicles
	Gaps in the roadway system

Table E.1: Summary List of Problem Priorities

Priority Level	Problem
	Coordination among emergency responders, including getting the right equipment on site quickly
	Specific traveler information for truckers, including traffic, weather, truck routes and parking and services
	Inadequate transit schedule and route information
	Inadequate parking for motorists, including park 'n rides
	Improved operation of existing public traveler information systems, including more responsiveness and greater consistency
	Locating accident scenes, especially in rural areas
Priority 3	Accidents involving pedestrians or bicycles
	Delays at commercial vehicle facilities
	Finding help in highway emergencies
	Inadequate pedestrian or bicycle facilities
	Transit schedule adherence
	Lack of transit amenities to attract riders who have other options
	Land use policies in conflict with transportation objectives
	Insufficient demand-responsive transit service, including no service or excessively long travel times
	Emergency vehicle delays at railroad crossings
	Safety and security on demand-responsive transit vehicles and facilities

Notes:
* = Especially high priority problem, based on triangulation of deficiency assessment results

Source: June 2000
BRW, Inc.

Due to the leadership role played by the TAC (which is composed primarily of regional transportation agency representatives who should be relatively aware of the range of problems in their jurisdiction), the development of the final problems list began with the TAC problems rankings shown in Table E.1. That list was then adjusted as follows:

- Some related problems, or problems that logically would be addressed together, were combined, in order to simplify and focus the listing.

- Priorities were checked against the results of the operations analysis.

- Some of consulting team's higher priority problems was moved up relative to their place on the TAC list, in cases where the stakeholder input supported it.

- Some of the higher priority problems identified through the survey, interviews and outreach workshops were moved up relative to their place on the original TAC list.

User needs for the purposes of ITS planning are defined as a series of ITS user services. Simply put, a user service represents a type of ITS functionality. For example, the user service known as Pre-Trip Travel Information focuses on deployment of ITS functions which provide travelers with transportation conditions information before they leave home or initiate their trip. User services were defined as part of the ITS National Architecture effort in order to promote the development of standards and common ITS descriptions across the nation.

User Services were selected and prioritized based on two criteria: (1) their relationship with the priority problems identified for the Region; and (2) their relationship with the preliminary project concepts developed by the ITS TAC. In general, the Region indicated the highest priority for Travel and Traffic Management, as well as Public Transportation Management, user services. Initial gaps between priority problems and user needs were identified as a part of this process. This gap analysis resulted in the addition of projects from the Pre-Trip Traveler Information and Traveler Services Information user services. The ITS TAC determined that Commercial Vehicle Operations user services were best dealt with at the national, state, and valleywide levels. The Region determined that the most effective benefits to be provided by the Region to commercial vehicle operators would stem from enhancing transportation management and information dissemination functions within the Region. User services are discussed in greater detail in Section 3.0 of the Report.

Table E.2 presents the San Joaquin Valley ITS Market Packages. The relative priorities reflect the adjustments made based on the screening level evaluation. As noted in previous technical documents, consistent with the approach taken to date in the National ITS Architecture, separate rural User Services or Market Packages are not being developed for the San Joaquin Valley. However, some Market Packages are particularly relevant to the rural environment and it is useful to identify them, as has been done in Table E.2. This identification is not definitive, but represents a basis for possible future delineation of urban/rural distinctions in the San Joaquin Valley ITS system architecture and/or in program and project recommendations.

One particular ITS elment that is very recognizable is Freeway Service Patrol (FSP). Several of the regions have contracted FSP services in urban highway areas. FSP is part of the ATMS 8 – Incident Management System Market Package.

Table E.2: Final San Joaquin Valley ITS Market Packages

Priority 1 Market Packages		**Priority 2 Market Packages**	
ATMS1	Network Surveillance	ATMS10	Electronic Toll Collection
ATMS2	Probe Surveillance	ATMS11	Emissions Monitoring and Management
ATMS3	Surface Street Control	ATMS13	Standard Railroad Grade Crossing
ATMS4	Freeway Control	ATMS14	Advanced Railroad Grade Crossing
ATMS5	HOV Lane Management	ATMS15	Railroad Operations Coordination
ATMS6	Traffic Information Dissemination	ATMS16	Parking Facility Management
ATMS7	Regional Traffic Control	ATMS19	Regional Parking Management
ATMS8	Incident Management System	APTS5	Transit Security
ATMS9	Traffic Forecast and Demand Management	APTS6	Transit Maintenance
ATMS12	Virtual TMC and Smart Probe Data	CVO2	Freight Administration
ATMS18	Road Weather Information System	CVO3	Electronic Clearance
APTS1	Transit Vehicle Tracking	CVO4	CV Administrative Processes
APTS2	Transit Fixed-Route Operations	CVO5	International Border Electronic Clearance
APTS3	Demand Response Transit Operations	CVO6	Weigh-In-Motion
APTS4	Transit Passenger and Fare Management	CVO7	Roadside CVO Safety
APTS7	Multi-modal Coordination	CVO9	CVO Fleet Maintenance
APTS8	Transit Traveler Information	CVO10	HAZMAT Management
ATIS1	Broadcast Traveler Information	New	Mobile Traffic Management/Enforcement
ATIS2	Interactive Traveler Information	**Priority 3 Market Packages**	
ATIS3	Autonomous Route Guidance	CVO8	On-board CVO Safety
ATIS4	Dynamic Route Guidance	New	Animal-vehicle Collision Countermeasures
ATIS5	ISP Based Route Guidance	ATMS17	Reversible Lane Management
ATIS7	Yellow Pages and Reservation	ATIS6	Integrated Transportation Management/Route Guidance
ATIS8	Dynamic Ridesharing	ATIS9	In Vehicle Signing
AVSS1	Vehicle Safety Monitoring	AVSS2	Driver Safety Monitoring
AVSS7	Driver Visibility Improvement	AVSS3	Longitudinal Safety Warning
CVO1	Fleet Administration	AVSS4	Lateral Safety Warning
EM1	Emergency Response	AVSS5	Intersection Safety Warning
EM2	Emergency Routing	AVSS6	Pre-Crash Restraint Deployment
EM3	Mayday Support	AVSS8	Advanced Vehicle Longitudinal Control
AD1	ITS Data Mart	AVSS9	Advanced Vehicle Lateral Control
AD2	ITS Data Warehouse	AVSS10	Intersection Collision Avoidance
AD3	ITS Virtual Data Warehouse	AVSS11	Automated Highway System
New	Emergency Vehicle Maintenance		
New	Dynamic Warning System		
New	Safe Speed Advisory		

	= Particularly applicable to rural/intercity areas identified as "highly applicable to rural needs and suitable for the rural environment in the National ITS Architecture)

E.3 Highlights of the ITS Strategic Plan for the San Joaquin Valley

One can think of the ITS strategic direction in the Valley in terms of both regional and county-level concepts. It is important to have a regional system to provide benefits to longer distance travel. More localized systems are needed to address needs and challenges at a more targeted level. Often, problems are common among local geographic areas, and agencies can benefit by addressing those issues in a consistent manner. Therefore, integration of regional and local systems through an effective communications network will help derive the maximum benefit from these investments, both regionally and locally. The Regional ITS Architecture shows how this integration can occur.

E.3.1 Valleywide Strategic Direction

A cornerstone of the ITS SDP for the Region is the continued development of two regional Transportation Management Center's (TMC). TMC's will involve a variety of elements typically associated with a situation where conditions in the field are monitored and decisions are made concerning traffic management, traveler information, incident response, and public safety. The two regional Caltrans TMC's involve a partnership of Caltrans and the California Highway Patrol (CHP). Up to this point, planning for the Valley has focused on the development of a Regional TMC at District 6 (Fresno) with a "satellite" TMC for District 10 (Stockton). The recommendation in the Strategic Plan is to move forward with a more fully functional TMC for both districts that has many of the elements of a TMC in a more urban setting, but that is tailored to the urban and rural character of the Valley. Personnel in charge of the TMC will:

- Monitor traffic flow through roadway sensors and CCTV cameras at strategic locations
- Control ramp meters installed in congested freeway sections to help traffic flow more smoothly
- Serve as a focal point for regional traveler information that would include, for example, sending messages to strategically placed roadside changeable message signs (CMS) or highway advisory radio (HAR) systems and providing traveler information to kiosks located at rest areas, truck stops, etc. to allow long-distance traffic to avoid major incidents and road closures.
- Coordinate communications with the CHP to more rapidly respond to traffic incidents and better perform incident management activities

Other ITS projects recommended in the Plan include:

- Curve Warning Systems
- Alternate Route Plans Database/Website
- Regional Traveler Information System
- CMS at Key Decision Points
- Expansion of Caltrans Traffic Operations Center and TMC's
- Weather/ATMS Integration and Automation
- Data Exchange Network (DEN)/Communications Interties
- Dynamic Speed Signing System for weather conditions
- Remote ATIS workstations
- Integration of Communication Channels
- Commercial Vehicle Parking Management System
- Smart Call Box Systems
- CVO Traveller Information System
- CADD Integration System
- Integrated Smart Corridors in selected urban areas
- 511 System
- Truck Stop Information Demo
- Completion of Valleywide GIS Mapping
- Regional ITS Design Guidelines
- Portable CMS Pool
- EVP Deployment
- Advanced Railroad Highway Interface Deployment
- Dynamic Alternate Route signing system
- Regional Transit Information Systems

- National Park ATIS (Combining Yosemite, Kings Canyon and Sequoia NPS)

The key to making this ITS strategic plan work at a regional level is integration. This integration is in the form of the Valley Agencies working together, sharing information, and coordinating activities. Integration in the form of one Agency coordinating dispatching activities for an entire County, one Agency notifying its neighbors that there's been an incident and alternate routing should be considered, or one Agency installing a vehicle location system and having others use the same technology for both scale-of-economy and interoperability. This SDP provides the opportunity and the roadmap for the San Joaquin Valley Agencies to jointly follow so that ITS integration is achieved from the beginning.

E.3.2 Priority Projects in Fresno County:

- Fresno/Clovis Regional ATMS Completion Project, Phase 3
- Fresno/Clovis area Signal Coordination
- FAX Fare Equipment Deployment and Transit Management System Expansion

E.3.3 Priority Projects in Kern County:

- Smart Call Box System Deployment
- Smart Studs Demo Project
- Incident Management Procedures
- Communication Network, Phase II
- Kern County Regional Communication Links
- RWIS with CCTV System
- Bakersfield TOC Expansion
- GET Fare Equipment Deployment

E.3.4 Priority Projects in Kings County:

- Hanford Central Traffic Signal Control System
- KART AVL Demo
- Hanford Traffic Signal Coordination
- Portable Changeable Message Signs
- Railroad Grade Crossing Treatments

E.3.5 Priority Projects in Madera County:

- Curve Warning System on County Roads
- AVL/Silent Alarm System
- Next Bus System for County Transit
- TOS Expansion in County along State Highways
- Transit Information System

E.3.6 Priority Projects in Merced County:

- Advanced Railroad Grade Crossing projects
- Central Traffic Signals Control for Merced and Atwater
- Next Bus Arrival Sign System for Transit
- Yosemite.com System Deployment

E.3.7 Priority Projects in San Joaquin County:

- San Joaquin Transit Electronic Fare Payment (coordinate with MTC's regional system)
- Vanpool Vehicle Traffic Probes Project
- Stockton area signal coordination
- Fare Equipment Deployment at SMART
- Stockton ATMS Expansion, Phase 2
- Curve Warning System on County Roads

E.3.8 Priority Projects in Stanislaus County:

- MAX AVL System
- Modesto/Ceres Signal Coordination

- MAX Fare Equipment Deployment
- Modesto/Ceres ATMS Expansion

E.3.9 Priority Projects in Tulare County:

- Fast Pass Electronic Fare Collection System
- City of Visalia Transit AVL/silent alarm system
- Visalia/Tulare traffic signal system Central Control
- Visalia/Tulare Arterial Signal Coordination
- Visalia EVP Signal Project
- Porterville EVP Signal Project
- Porterville Red Light Enforcement Project

E.4 Deployment Initiatives

Implementation of ITS raises challenges that are not typically in other types of more traditional strategies. An ITS Deployment Element is presented in Section 7.0 of the SDP that highlights some keys to successful deployment of an ITS Project. Some of the key factors to remember include the following:

- Coordinate with partner agencies and integrate your systems with others (as appropriate) – think of the possible regional benefits of what you are doing, not just the local benefits
- Use proven technology – this will reduce the risk of failure and usually help to minimize maintenance costs
- Take advantage of as many private sector initiatives as possible – use of the Internet, wireless communications, and information services already offered by the private sector can help to contain costs
- Make sure the technological applications address specific needs – some of the monuments to failure have been systems installed mainly because the technology was impressive, but the need was lacking
- Keep the applications as simple and straightforward as possible – greater complexity means greater costs for both installation and maintenance
- Consult individuals who know the intricacies of designing and procuring ITS – there is considerable expertise available

through Caltrans, FHWA, and local agencies in larger metropolitan areas who can provide advice

- Make sure that you have thought through how you will operate and maintain the systems – resources usually need to be devoted to keeping systems going once they are built

E.5 Benefits of the ITS Strategic Plan

There are a number of important reasons why you should pay attention to the Strategic Plan:

- It represents a coordinated effort between agencies that have responsibility for planning and programming projects throughout the San Joaquin Valley and includes individual ITS Projects that should be implemented in the Valley as building blocks to this integrated system

- It contains information that will be helpful in implementing useful ITS Projects

- It contains ITS Projects for deployment that provide certain benefits that help meet regional and local air quality requirements/mandates

- It improves the transportation environment by reducing congestion, improving efficiency and resolving transportation related problems

- It contains the San Joaquin Valley Regional ITS Architecture which will provide the following:

    - Conformance with the Regional ITS Architecture ensures that ITS Projects in the Valley are eligible for Federal funding

    - Added role of the Metropolitan Planning Organizations (MPOs) and Regional Transportation Planning Agencies (RTPA) to determine conformance at acceptable level to FHWA/FTA

    - Provide interconnectivity to other regions such as the Central Coast and Sierra Nevada

- It contains ITS Projects for which Regional and Local agencies will need to determine funding priorities

    - ITS Projects are qualified for Federal and State funding/programs

- ITS Projects will compete against more "traditional" transportation projects
- Need to "mainstream" ITS Projects into the San Joaquin Valley's traditional transportation planning processes:
  - Regional Transportation Plans (RTPs)
  - Federal and Statewide Transportation Improvement Plans (STIP)
  - Short and Long Range Transit Plans (SRTPs and LRTPs)
  - Congestion Management Programs (CMPs)
  - Congestion Mitigation and Air Quality (CMAQ) funds

E.6 A Focus on Implementation

The next steps in the SDP involve its implementation. Lead agencies have been defined in the Plan, and these lead agencies will need to take the initiative to move ITS Projects forward by identifying funding, developing a design, and taking it through procurement. A plan of action to implement the Regional ITS Architecture has been provided in the SDP to identify specific activities for which individual agencies should be accountable. It is recommended that the ITS Technical Advisory Committee remain active, meeting on a periodic basis and evolving into an ITS Deployment Committee, to guide the implementation of the Plan. The Committee has served as an excellent forum for the exchange of information and resolution of issues, and can be a continuing vehicle for ensuring that ITS is integrated at the regional level.

The SJV Regional ITS Architecture provides a framework for the deployment of ITS applications. The Regional ITS Architecture incorporates the existing and planned ITS projects and provides a roadmap for future deployment. Additional planning efforts will be required in the future as highway and transit applications within and around the SJV are considered. While the SJV Regional ITS Architecture is contained as a document, it must be considered a process which will be maintained, revised, and validated as needed. A coordinated effort among the stakeholders involved now will ensure that this effort continues and ITS is mainstreamed into future projects.

Table E.3: ITS Deployment Action Plan

Action	Responsible Agency					
	Caltrans New Tech & Research	Caltrans District 6 and 10	CA Highway Patrol	MPO/RPTA	County/Local	FHWA/FTA
Project Continuance and Outreach						
Continue Stakeholder Outreach	•	•	•	•		
Develop Marketing Strategy	•					
Provide Updates on National ITS Developments	•	•				•
Demonstrate the Benefits to RTPAs, MPOs and COGs	•	•	•	•		
Expand Architecture Development and Education	•	•				•
Maintain ITS Inventory		•			•	
Strategy for Implementation						
Increase Regional Support	•	•				
Mainstream ITS into Program and Project Prioritization		•		•	•	
Modify Project Organization		•		•		
Emphasize Traveler and CVO Information	•	•				
Maintain and Update Regional Architecture	•	•	•	•	•	•
Secure Demonstration and non-Traditional Funding	•	•	•	•	•	•
Public Private Partnership Task Force	•	•	•	•	•	•

1.0 Introduction

The San Joaquin Valley Intelligent Transportation Systems (ITS) Strategic Deployment Plan (SDP) summarizes the region's existing transportation conditions and identifies various deficiencies and opportunities for ITS applications. It also defines the ITS User Services and Market Packages associated with the regions transportation priorities. Finally, the document defines some priority projects that have been identified as having Valley-wide benefits.

Overall, this Plan provides information in the following general areas:

- **Overview** – brief summary of the existing and projected transportation circulation conditions and resources.
- **Background** – identify existing and planned ITS and related facilities/services in the region.
- **Regional Priority Problems** – assessment and ranking of regional problems related to transportation in the San Joaquin Valley.
- **Regional Opportunities** – summary of the project ideas submitted by survey respondents and outlines of preliminary project concepts developed through outreach and field review efforts.
- **ITS User Services –** identify what user services are and the highest priority user services that best meet the needs of the region.
- **ITS Market Packages -** define market packages and identify which ones enable the highest priority user services to meet regional needs. These market packages lead into the framework of a Regional Architecture.
- **Regional Architecture** – the definition of a Regional Architecture that follows the model developed by the National ITS Architecture and conforms to the adopted FHWA rule and FTA policy on architecture and standards.
- **ITS Deployment –** Finally, a definition of ITS programs and projects recommended for deployment that will provide benefits to the Region.

1.1 Project Background and Goals

The eight counties of the San Joaquin Valley: Fresno, Kern, Kings, Madera, Merced, San Joaquin, Stanislaus, and Tulare have prepared this Plan to guide the implementation of Intelligent Transportation Systems (ITS). The ITS Strategic Deployment Plan (SDP) for the San Joaquin Valley Region was jointly funded by Caltrans and the individual counties with San Joaquin Council of Governments (SJCOG) serving as project administrator. The San Joaquin Valley region represents one of the last geographic areas in California to develop an ITS Plan.

Figure 1.1 provides a graphic illustration of the numerous ITS projects and plans that have been implemented or are in progress throughout

the state of California. As indicated in Figure 1.1, two ITS Strategic Plans have been completed for portions of the San Joaquin Valley: Fresno County (1999) and Kern County (1997). The San Joaquin Valley ITS Strategic Deployment Plan references and builds upon these plans. The specific approach to coordinating the San Joaquin Valley ITS Strategic Deployment Plan with these two plans is explained in Section 1.6. The San Joaquin Valley plan also references, several other plans shown in Figure 1.1, including: Central Coast ITS Strategic Deployment Plan, Sacramento Area COG EDP, San Francisco Bay Area EDP, Sierra Nevada EDP, and the LA/Ventura SDP.

ITS technologies refer to a wide variety of tools and techniques that focus on addressing transportation problems by improving the efficiency and safety of the existing transportation infrastructure through the application of communications, computing, information and other "high level technologies." They include more immediately recognizable features such as: emergency call boxes, changeable message signs, signal synchronization and preemption, and Highway Advisory Radio; and also more advanced technologies including Traffic Operations Centers, Automatic Vehicle Location devices, information kiosks, and electronic payment services for transit and tolls.

Although the San Joaquin Valley has seen the implementation of some basic technology-based strategies or intelligent transportation systems applications, there has not been a comprehensive, systematic look at ITS opportunities until now. The San Joaquin Valley ITS Strategic Deployment Plan identifies a 20-year strategy, and also includes a detailed, short-term component identifying specific projects for implementation in the first few years.

The Plan includes recommendations for Valley-wide and interjurisdictional initiatives to address problems that affect the entire region, as well as recommendations for projects that will address specific local problems throughout the Valley.

The Strategic Deployment Plan is intended to provide a starting point for regional ITS coordination, programming, and implementation efforts over the next twenty years. Over the past decade, ITS has become a recognized tool for improving the operation and efficiency of the transportation system. Several agencies in the San Joaquin Valley have already undertaken various ITS deployment efforts ranging from traffic signal system improvements to transit management systems and from enhanced emergency service Computer Aided Dispatch to freeway surveillance projects.

The development of this Plan represents a new level of effort in the coordinated deployment of ITS projects. The objectives of the study were to:

1) Gain the participation of transportation stakeholders and community members;

2) Identify transportation needs that have the potential to be addressed by ITS technologies;

3) Evaluate which ITS elements would be beneficial, cost-effective and implementable to meet the identified needs; and

4) Develop a plan outlining the short-, medium-, and long-range application of ITS technology including specific operations and maintenance plans and financing.

Figure 1.1: ITS Strategic Planning Projects in California

1.2 Benefits of ITS

Intelligent Transportation System improvements can provide a wide range of benefits in a cost-effective manner, often at less expense than through traditional strategies such as adding traffic lanes or building new roads, or increasing bus fleets and driver rosters. Benefits of many of the most mature and widely adopted ITS strategies, including traffic signal coordination, incident management and transit vehicle tracking and schedule adherence monitoring, have been proven around the country and the world. For the newer, emerging ITS strategies, such as traveler information services, some benefits have been proven and many more appear quite achievable.

Examples of some of the more significant benefits of ITS include the following:

- Reduced delays and vehicle emissions at traffic signals through improved signal coordination.
- Reduced delays, emissions and secondary accidents at freeway incident scenes through faster incident identification and clean-up and traveler advisories.
- Improved on-time performance for transit and reduced travel times through vehicle tracking, schedule adherence monitoring and traffic signal priority treatment.
- Improved motorist and transit rider safety and security through video monitoring, emergency call devices and faster response.
- Reduced traveler frustration and increased convenience and security through accurate, up-to-the-minute information on traffic conditions, alternate routes, transit routes and schedules, parking and attractions.
- Reduced delays and reduced administrative costs for commercial vehicle operators through streamlining of credential and other administrative processes and through weight and safety inspection pre-clearance.
- Reduced traffic accidents and reduced accident injury severity through advanced warning of hazardous traffic conditions; enhanced speed, traffic signal, railroad crossing and stop sign enforcement; enhanced railroad crossing sensing and warning systems; and faster and more effective identification and response to traffic incidents.

1.3 ITS Planning Process

The ITS planning process is much like any other transportation planning activity with the focus on technological solutions. One of the primary areas of emphasis of ITS planning is the extensive involvement and participation by the stakeholders of the region. This is especially important in ensuring interagency integration, addressing potential

institutional issues early, and providing the necessary education and awareness of advanced technology transportation solutions.

Using the federal ITS planning process as a guideline, the overall approach to achieving the stated project goal has been to perform the following tasks:

Task 1: Develop Institutional Framework and Consensus Building

Task 2: Inventory of Existing and Planned Transportation Systems

Task 3: Define Existing and Future Transportation Related Deficiencies and Opportunities

Task 4: Identify User Service Objectives and ITS Vision

Task 5: Establish Performance Criteria

Task 6: Identify and Screen Market Packages

Task 7: Develop ITS Market Package Plan

Task 8: Identify and Analyze Functional Areas

Task 9: Define Market Package Functional Requirements and Develop Regional Architecture

Task 10: Identify and Screen Technology Options

Task 11: Identify Near Term Projects

Task 12: Develop ITS Strategic Deployment Plan and Outreach Materials

1.4 Stakeholder Participants

Technical oversight for the San Joaquin Valley ITS Strategic Deployment Plan was provided by the ITS Technical Advisory Committee (TAC), composed of representatives of federal, state and local transportation organizations from throughout the Valley. The ITS Technical Advisory Committee consisted of the following members:

- California Highway Patrol (CHP)
- California Trucking Association
- Caltrans – District 10
- Caltrans – District 6
- Caltrans New Technology and Research Program
- Council of Fresno County Governments (COFCG)

- Federal Highway Administration (FHWA)
- Kern Council of Governments (Kern COG)
- Kings County Association of Governments (KCAG)
- Madera County Transportation Commission (MCTC)
- Merced County Association of Governments (MCAG)
- San Joaquin Council of Governments (SJCOG)
- San Joaquin Valley Air Pollution Control District (SJVAPCD)
- Stanislaus Council of Governments (StanCOG)
- Tulare County Association of Governments (TCAG)

The San Joaquin Valley COG Directors provided Policy Level oversight.

Table 1.1 lists the agencies/organizations of approximately 400 key stakeholders, identified by the TAC and the Project Team, that provided input to the San Joaquin Valley ITS Strategic Deployment Plan and/or participated in the ITS Subcommittee. Input from the TAC, stakeholders, as well as others, were instrumental in the development of the information presented in the Plan. Information was collected and assembled from existing documents and responses to the ITS inventory and user needs survey.

Table 1.1: San Joaquin Valley ITS Strategic Deployment Plan Stakeholders

Agricultural Interests	Automobile Club of California
California Highway Patrol	California Trucking Association
Caltrans – District 6	Caltrans – District 10
Caltrans – New Technology & Research Program	Council of Fresno County Governments
Emergency Service Providers	Farm Bureaus
Federal Highway Administration	Federal Railroad Administration
Federal Transit Administration	Fresno Area Express
Golden Empire Transit District	Kern Council of Governments
Kern Regional Transit	Kings County Association of Governments
Local Jurisdictions	Local Police Departments
Local Transit Operators	Madera County Transportation Commission
Meadows Field Airport	Merced County Association of Governments
Port of Stockton	San Joaquin Council of Governments
San Joaquin Valley Air Pollution Control District	San Joaquin Valley Railroad
Sheriff Departments	Stanislaus Council of Governments
Tourism Industry	Tulare County Association of Governments
Union Pacific Railroad	United Parcel Service

Source: BRW, Inc. June 2000

1.5 Relationship to Fresno and Kern County ITS Plans

As noted in Section 1.1, two ITS Strategic Plans were recently completed for subregions within the San Joaquin Valley: Fresno County (1999) and Kern County (1997). Both of those efforts were comprehensive, in terms of both needs assessment and the development of recommendations, and aside from some selective updating, those efforts were not repeated as part of the development of the San Joaquin Valley ITS Plan.

The overall approach to incorporating the Fresno and Kern County plans into this planning process was to coordinate at the project development and system architecture stages. Since those plans included recommendations responsive to the needs identified for those areas, the most effective juncture at which to reference and potentially integrate those plans with the broader San Joaquin Valley plan is at the stage where projects and project relationships were developed. Given this approach, needs assessment and prioritization efforts for this plan focused primarily on the other counties in the Valley. The relationship

between those previous plans and the valley-wide plan was established through projects and program recommendations.

1.6 Benefits of an ITS Strategic Deployment Plan

The San Joaquin Valley ITS SDP represents a concerted effort by the transportation stakeholders in the region to enhance the management and information capabilities related to the transportation network, as well as better coordinate and integrate these capabilities

The construction of the national roadway network was paralleled by advancements in management philosophy, information systems, and network technologies. While it has become apparent that we can no longer simply build ourselves out of the current and projected transportation problems, it has also become apparent that the opportunity to better manage the transportation network through improved information has arrived.

Enhanced management capabilities are the key to achieving the previously mentioned benefits, and are the overarching goal of this SDP. In order to improve our capabilities and better manage the transportation network, three crucial areas must be addressed.

- **Sensory/Communications Infrastructure** – The sensory and communications infrastructure in the transportation network must be comprehensive and consider how that network behaves.

- **Coordinated/Standardized Management Systems Deployment** – The deployment of management systems must be closely coordinated and standardized to the maximum extent possible in order to simplify the integration of information and management systems.

- **Integrated and Coordinated Operations** – Simply building information and management systems that communicate with one another is not enough to reap the benefits of better management. The transportation network has developed much like any complex organization with different portions of the network being managed and controlled by different agencies and departments within agencies. On top of all the interlaced management structures are the users of the transportation network. The users do not readily recognize or understand the complexities of operating and maintaining the network, they simply desire to use it to move from point A to B. With the growing ability to jointly manage the network, the managers and operators of the network must alter their behavior and standard operating procedures (SOP) to center around integrated operations. It is not enough that coordinated operations become a part of the way we do business on the transportation network. Day to day operations must eventually center around coordinated operations.

The SDP is the first step towards addressing each of these three crucial areas at a regional level. Through the needs assessment and numerous infrastructure projects defined in this Plan, the major needs of the regional information systems infrastructure are addressed. The need for coordinated and standardized management systems deployments are recognized in the system architecture and the systems and regional integration projects defined in the operational strategies and program management sections of this Plan.

The SDP represents an opportunity for the Region to work towards:

- A more integrated and seamless transportation network;
- A network in which each agency and/or operator works together to achieve efficient operations without regard to arbitrary jurisdictional or departmental boundaries;
- A network in which sharing information, ideas, and control becomes more common than not; and most importantly,
- A network that better meets the current and projected needs and demands of the traveling public.

1.7 Will ITS Actually Happen?

The simplest answer is that it is already happening. ITS represents a move to a more "command and control-oriented" transportation system that crosses all available modes and transportation resources. In the past, traffic management has largely been non-real time, non-adaptive, and based on spotty historical data. However, technology is nothing new in the transportation field. For example, one of the first computer controlled traffic signals was tested at an intersection near Los Angeles International Airport in the early 1960's. Despite its consistent use, technology is just now beginning to provide the transportation professional with reasonable real-time adaptive options and the capability to respond to a rapidly changing travel environment. As previously independent systems are expanded and connected, the ability to provide command and control options continues to grow.

Numerous state, regional and local transportation and emergency service agencies in the Region have developed a substantial ITS infrastructure. This infrastructure currently supports activities ranging from signal operations to freeway surveillance and incident response. Unfortunately, many of the desired connections and additional field equipment to fully provide a command and control environment are not in place. This Strategic Plan outlines systems and projects that would bring the desired capabilities to this region.

At the national level, the problems of urban traffic congestion and air quality have been recognized. The Intermodal Surface Transportation

Efficiency Act (ISTEA) of 1991 established national goals for the development and implementation of advanced technologies to address these problems through coordinated programs. Part B of Title VI of this legislation established Intelligent Vehicle Highway Systems (IVHS) initiatives that included a focused program to address the highest priority corridors in the country. The term IVHS has since been renamed to Intelligent Transportation Systems (ITS) to reflect the multi-modal nature of the program. The most recent federal transportation legislation, known as the Transportation Equity Act for the 21st Century or TEA-21, continues the role of ISTEA in promoting the application and deployment of ITS. TEA-21 takes a significant role in "mainstreaming" ITS into the general transportation planning and programming process. The ultimate goal is for ITS to be viewed simply as another effective tool for managing transportation problems, rather than an independent component within the transportation field.

Mainstreaming refers to the process of integrating ITS elements into larger transportation improvement projects for increased efficiency in deployment.

The nation is moving forward. The San Joaquin Valley has already taken significant steps towards deploying ITS infrastructure components. This SDP provides a framework for ITS deployment that meets the Region's vision and problems, by presenting an integrated, multi-modal, phased strategic plan. The Plan represents the opportunity to coordinate ITS deployment efforts in the Region and to ensure the ability to integrate the numerous systems that will be deployed both today and in the future.

1.8 Plan Development Methodology

Preparation of the SDP has generally followed the ten step ITS Planning Process developed by the Federal Highway Administration. This process is illustrated in Figure 1.2.

The federal ITS planning and deployment process emphasizes the significance of a strategic approach, a user-needs perspective, and a strong institutional coalition. The deployment of ITS should be structured and strategic in order to protect against the inefficient allocation of resources and to ensure that ITS potential can be fully realized. Deployment should be based upon solving local user needs rather than simply looking for opportunities to utilize new technologies. Finally, successful deployment depends upon the development of an institutional framework and coalition of transportation agencies and other stakeholders. Such a coalition and the cooperation it fosters helps to ensure that each agency's needs, constraints, opportunities and responsibilities are addressed and that the resulting system meets the needs and expectations of each agency, the public, and elected officials.

1.8.1 Development of the ITS Strategic Deployment Plan

As applied in the Region, the ten step FHWA deployment planning process consisted of the three major areas of activity which include:

- Agency Coordination and Stakeholder Outreach
- Development of ITS Projects
- Technical Assessments

ITS Stakeholder Outreach efforts included:

- **Steering and Technical Advisory Committee meetings**
- **Agency/Committee Reports**
- **Stakeholder Interviews and Surveys**
- **Outreach Workshops**
- **TAC and Board presentations**
- **Website and Newsletters**

Agency Coordination and Stakeholder Outreach

The Valley ITS Technical Advisory Committee (TAC) developed the ITS Strategic Plan in a coordinated and cooperative manner. During the course of the Strategic Plan development, the Subcommittee met on a regular basis to develop goals and objectives, review needs and problems, discuss proposed program areas and priorities, and review deliverables.

Key stakeholders were kept informed of the Strategic Plan developments through ITS meetings, outreach newsletters, and the MCAG web site. Workshops were held to inform and solicit input from a diverse range of Regional transportation stakeholders including transit agencies, trucking firms, and local governments. Stakeholders were provided an opportunity to review draft products and identify and discuss information specific to their concerns.

Surveys were distributed to a broad range of public and private transportation stakeholders in the Region including: chambers of commerce, economic development councils, public advocacy groups, law enforcement agencies, fire/emergency service agencies, local cities, as well as regional and state organizations. Each stakeholder was asked to assess their transportation related problems, needs, and potential solutions. Interviews were conducted with many of these same stakeholders on a one-on-one basis. Stakeholder input from the surveys and interviews was shared with the TAC and influenced the development of the SDP.

Development of ITS Projects

The central element of the SDP is the definition of projects that will be deployed to deliver the enhanced efficiencies available through ITS. A preliminary set of ITS program areas and project definitions was developed through direct interaction with the ITS TAC. A preliminary potential project list was submitted to the TAC based on the problems and needs assessment performed in the early stages of the SDP's development. The TAC further refined these projects in a workshop and a series of breakout groups focusing on each stakeholder's area of interest. Progressive versions of the project definitions were submitted to the TAC for review, culminating in the project definitions provided in this Plan.

Technical Assessments

In addition to the outreach, needs definition, and project development activities which comprised the majority of the effort in developing the SDP, several technical assessments were performed by the consulting team for review by the TAC and inclusion in the ITS SDP. These assessments included the development of a regional system architecture to define how the various ITS systems could be integrated, as well as various technical reviews and documentation.

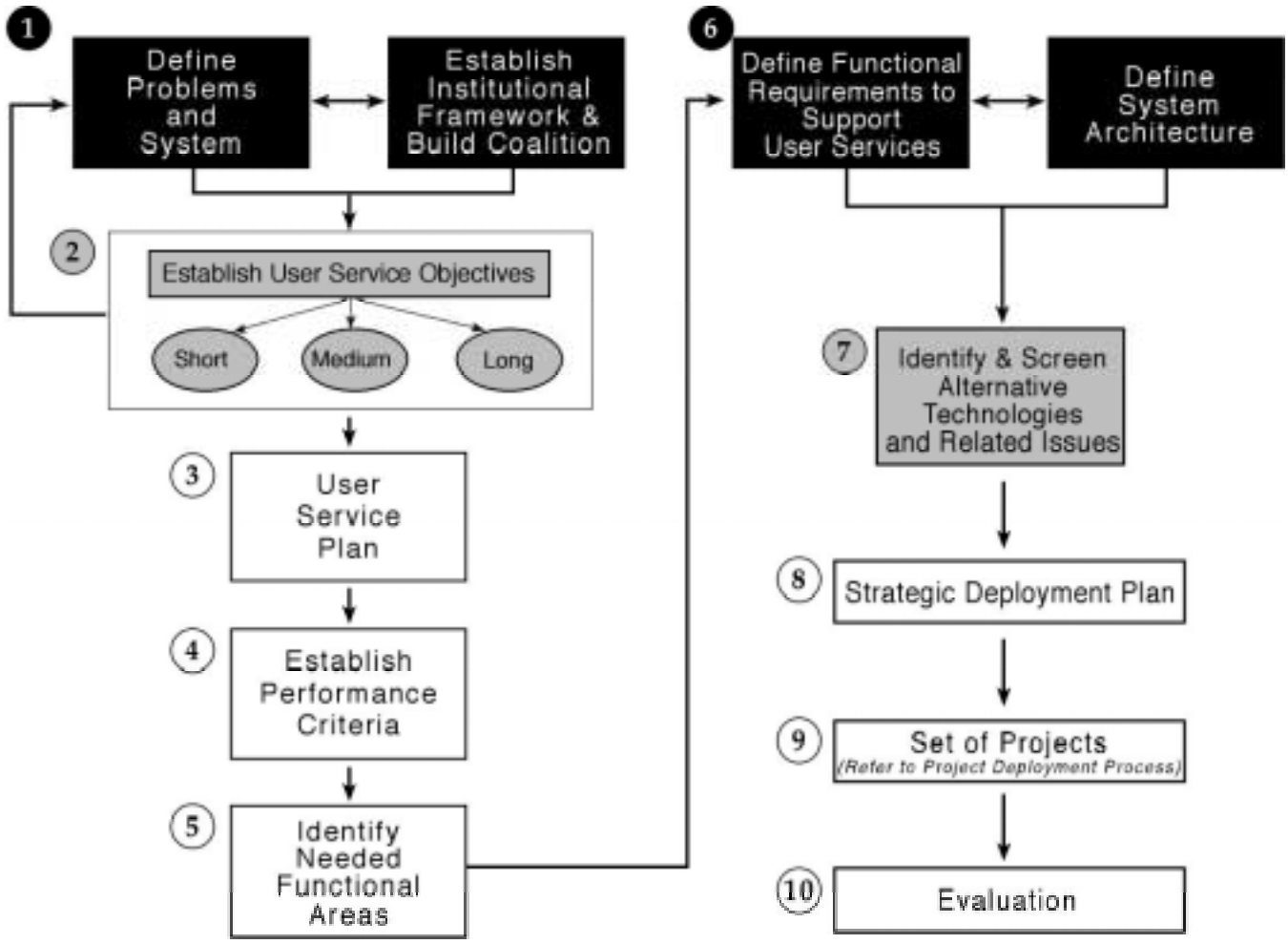


Figure 1.2: ITS Strategic Planning Projects in California

1.9 Strategic Deployment Plan Elements

There are nine Sections in this SDP. Table 1.2 provides a brief outline of the information contained in each.

Table 1.2: Descriptions of Strategic Plan Sections

#	Title	Brief Description
1.0	Introduction	As above.
2.0	ITS Vision, Goals, and Objectives	Outlines the vision of ITS deployment in the Region as defined by the ITS TAC.
3.0	Regional User Needs	Summarizes transportation problems/needs identified by stakeholders in the San Joaquin Valley. Includes priority user services.
4.0	Market Packages and Functional Requirements	Summarizes the priority market packages and functional requirements identified for the Region
5.0	System Architecture	Defines an open architecture based on communication technologies and the national architecture that supports exchange of data between significant management systems.
6.0	Program Areas and Projects	Describes specific ITS systems, and project deployment phases for ITS projects identified and developed by the ITS Subcommittee for the Region
7.0	Implementation and Deployment Element	Provides an overall deployment vision, deployment time line, and annual budget estimates. Also defines operational strategies for ITS components. This Section ties together the projects identified in Section 6.0.
8.0	Funding Element	Outlines opportunities and strategies for obtaining funds for ITS deployment in the Region. Also meant to serve as a stand-alone document as needed.
9.0	Management Element	Outlines suggested policies and processes for managing deployment of ITS in the Region.

1.10 Project Consultants

A consultant team was contracted by SJCOG in order to assist the San Joaquin Valley ITS Technical Advisory Committee in the development of the SDP. This consultant team included:

- URS/BRW, Inc. (project team prime consultant)
- Meyer, Mohaddes Associates (MMA)
- National Engineering Technology (NET) Corporation
- CCS Planning and Engineering, Inc.

2.0 Vision Statement

"The ITS vision for the San Joaquin Valley Strategic Deployment Plan is to enhance quality of life, mobility, and the environment through coordination, communication and the integration of ITS technologies into the Valley's transportation systems."

Figure 2.1 displays the ITS vision developed for the Valley.

2.1 Purpose Of The Its Vision

Intelligent Transportation Systems (ITS) represent a relatively new area of transportation applications for many of the stakeholders in the transportation system. The ITS vision statement serves to provide a basic statement of the capabilities of ITS applications, as well as to focus the application of ITS within the Region.

The vision statement combines a high-level description of the intended results of ITS deployment with a summary of how those results will be achieved. The vision statement represents the highest, most encapsulated description of the purpose, objectives and strategies for ITS in the San Joaquin Valley, and is supported and expanded through the goals, objectives and user service objectives presented later in this section

2.2 Vision Elements

2.2.1 Freeway Management

Caltrans has deployed multi-faceted freeway management systems in several major metropolitan areas within the San Joaquin Valley, including the metropolitan areas of Fresno, Modesto, Stockton and Bakersfield. These systems provide the ability to quickly identify traffic accidents and other incidents, and adverse weather and pavement conditions, and convey this information to travelers and other transportation agencies. The vision for freeway management is to expand the geographic coverage of the Caltrans traffic operations systems (TOS), enhance the Caltrans TOS by adding and upgrading equipment and capabilities, and promote closer coordination between Caltrans and local traffic management staff. This vision must include more effective utilization of equipment currently deployed. Ultimately, this vision includes deployment of an integrated corridor system, which makes more efficient utilization of the transportation network.

2.2.2 Traffic Signal Systems

The urban areas of Stockton, Fresno, Modesto and Bakersfield have led the way in local agency traffic management ITS deployment in the Region. Previous efforts have focused on signal system improvements and traffic surveillance. This focus is expected to continue, but with a growing emphasis on other local traffic management technologies as well. The overall vision for traffic

management in urbanized areas of the valley focus on continued integration and coordination between key agencies in the metro areas combined with the carry-over of key ITS components to the smaller more rural cities.

2.2.3 Incident Management

The incident management vision for the Valley is to enhance interagency incident response and coordination through the application of ITS technologies, and formation of on-going Traffic Safety Committees by geographic region. This vision also includes the promotion of real-time data sharing to improve all aspects of incident management. Quick and accurate verification followed by rapid dissemination of incident information to motorists by ITS will prevent secondary collisions, improve traffic flow, and reduce emissions.

2.2.4 Public Transportation

The transit ITS vision for the Region focuses around increasing the capabilities and scope of the existing technology deployments at SMART, Fresno Area Express and Golden Empire Transit while building a simple, effective system for smaller fixed route and paratransit properties. The concept is to avoid duplication of agency effort by maximizing compatibility between urban and rural systems throughout the valley. This vision also incorporates enhanced cooperation and coordination between local transit agencies, which includes the potential for consolidated transit services.

2.2.5 Traveler Information

The vision for traveler information in the Region is to provide some enhanced information based on the expanding capabilities of the transportation management systems. At the same time, we prepare for any proposed statewide and possibly valleywide transportation information deployment efforts. Traveler information must be timely and useful, providing traffic and weather conditions for commuters, commercial vehicles and visitors to the region. It should focus on incident and tourist information and expand on previous efforts.

2.2.6 Agency Coordination And Systems Integration

The systems integration vision for the Region is based on previous successes. The concept is to utilize the national and statewide architectures as a basis, and then provide for coordinated deployments and standards within the Region. This concept is being followed in other parts of the state and is widely referred to as “build once, deploy many.” Statewide architecture alternatives were defined need to in the Statewide Deployment Initiatives Project and is discussed in Section 5.0.

Figure 2.1: Valleywide ITS Vision

2.2.7 Commercial Operations

In coordination with future national and regional initiatives, commercial carriers will be able to drive from one end of the I-5/SR-99 corridor to the other with minimal delays at weigh and inspection stations. Systems will electronically collect tolls, weigh, and inspect commercial vehicles. Other systems will enable the electronic issuance and monitoring of permits from regulatory agencies. Commercial carriers will have access to traveler information systems that can assist with routing, scheduling and dispatching optimization, as well as guidance to available parking areas.

2.2.8 Travel Demand

Users who wish to rideshare can immediately determine potential candidates and dynamically create carpools. Devices such as smart cards, public kiosks and personal digital assistants will allow users to communicate with each other and work together to reduce the number of vehicles on the roadway. ITS technologies will allow for detailed traffic data collection and analysis. This information can support demand management techniques.

2.2.9 Emergency Management

Devices will notify authorities of the need for dispatching emergency vehicles to the site of collisions or incidents. Systems will coordinate the response from fire, police and medical agencies for fast response in the most appropriate manner. There is an inherent overlap between incident management and emergency management related to responding to accidents involving personal injury. However, other systems will coordinate the removal of incidents to promote the timely return of the travel network to optimal performance.

2.2.10 Air Quality

Air quality will be improved through the increased efficiency and use of transportation systems including demand management strategies. Dynamic ride sharing systems will encourage the use of high occupancy vehicles. Traveler information systems will decrease the amount of vehicle miles traveled through better planning. Public transportation systems will improve the information available to users and enhance the visibility and flexibility of transit, thereby increasing the use of transit. Traffic management systems will smooth the flow of vehicles and reduce the level of pollution. Detection systems will monitor vehicle emissions and support inspection/maintenance efforts.

2.2.11 Intermodal And Multi-Modal Cooperation

The future of the San Joaquin Valley region starts with the mutual cooperation between transportation agencies within the Valley. All agencies and transportation providers will work together to promote

and encourage safe and efficient operation of the transportation network.

2.2.12 Configuration Management/Systems Integration

The systems integration vision for the Region is based on making productive use of past efforts. The concept is to utilize the national and proposed statewide architectures as a basis, and then provide for coordinated deployments and standards within the Region.

2.3 San Joaquin Valley ITS Principles

Valleywide ITS Principles:

- **Support goals and objectives of RTP's**
- **Address regional needs**
- **Support and integrate into Fresno and Kern County ITS Plans**
- **Promote solutions across jurisdictional boundaries**
- **Promote efficient use of existing transportation systems**
- **Provide a living document**

This section identifies a number of over-arching principles that guided the development of the San Joaquin Valley ITS Strategic Deployment Plan and that in the future will guide subsequent ITS activities. Whereas the vision statement, goals, objectives, user services and user service objectives focus on what is to be accomplished relative to specific user needs, transportation problems and issues, and ITS applications, the ITS principles more generally describe how the SDP will be used and the overall role for ITS.

The following principles have been developed to guide the development of the SDP and subsequent ITS activities in the San Joaquin Valley.

The San Joaquin Valley ITS Strategic Deployment Plan, and the ITS activities that follow it, shall:

- RTP Enhancement/Support – Support and advance the goals and objectives of existing Regional Transportation Plans. Intelligent Transportation Systems should be viewed as another set of tools to address transportation problems. Generally, ITS should not be viewed as a separate area of activity with a separate agenda. The SDP acknowledges Regional Transportation Plans, and the other elements of the traditional transportation planning and programming process as the primary instruments for identifying and addressing transportation problems and issues. The SDP should be viewed as a supplemental element of an overall transportation improvement strategy. It should also support and advance Caltrans goals and objectives including Caltrans Interregional Transportation Strategic Plan and the State Transportation Improvement Plan.

- Specific Problem Solutions – Address the specific problems and issues identified as part of the development of the SDP. In addition to supporting the previously identified transportation problems and strategies identified through Regional Transportation Plans and the traditional transportation planning and programming process, the SDP should provide

strategies to address the specific problems identified as part of the SDP effort.

- Augmentation of Existing ITS Plans In the Region – Support and advance the goals and objectives of existing ITS plans within the San Joaquin Valley, and to the extent that mutually beneficial outcomes can be achieved, also support the goals and objectives of the ITS plans prepared for neighboring regions. The SDP should support, enhance and extend the ITS direction that has been established through the Fresno and Kern County ITS plans. Also, as appropriate given the unique circumstances and conditions of the San Joaquin Valley, the SDP and subsequent ITS activities should seek to build upon, reinforce and extend the successes of ITS activities in bordering regions. These regions include the Central Coast (Monterey, San Benito, San Luis Obispo, Santa Barbara and Santa Cruz Counties), the San Francisco Bay Area, Sierra Nevada, the Tahoe gateways and Los Angeles-Ventura Counties regions.

- Interjurisdictional ITS Enhancements – Promote overall transportation problem solving across jurisdictions, both within the San Joaquin Valley and with bordering regions. In that much of ITS deals with operational issues that span jurisdictions, inter-agency coordination is essential to the success of many ITS efforts. Further, ITS planning and implementation represents a new and important opportunity to promote inter-jurisdictional cooperation and coordination. The ITS planning and implementation process constitutes a forum and mechanism to strengthen and extend existing cooperative problem solving efforts, and to encourage new ones. An important part of the overall benefit of preparing the SDP, in addition to the specific ITS projects and activities it will precipitate, is that it helps organizations and individuals who may not normally coordinate with one another to appreciate their shared concerns and the advantages for cooperative solutions.

- Optimization of Existing Infrastructure – Promote problem solving through maximization of the efficiency and effectiveness of existing transportation infrastructure and services, rather than through extensive new capital investments (e.g., new roads). Although most ITS applications do require supporting capital investment, overall, the intent of the SDP is to promote improve the management and operations of existing transportation systems, as opposed to physical expansion of the transportation system.

- Ongoing Maintenance of Document – Serve as a living document, to be revised as necessary into the future. The SDP identifies a recommended course of action given an analysis of

past and current conditions, and expectations for the future. However, changes in technology, experience gained in the actual implementation of recommended ITS projects, and other considerations will warrant updates to plan.

- The ITS Vision should be forward thinking but at the same time realistic.

2.4 San Joaquin Valley ITS Goals and Objectives

Table 2.1 presents the ITS goals and objectives for the San Joaquin Valley. A total of 34 objectives have been identified, reflecting the 38 identified problems, organized under seven goals.

These goals and objectives are integral to the development of the ITS Vision, Vision Elements, and ITS Principles. They directly correlate with the results of our User Service Analysis formed in Working Paper No. 2.

Table 2.1: San Joaquin Valley ITS Goals and Objectives

Goal	Objectives
1.0 Reduce Traffic Congestion	1.1 Reduce the number and duration of accidents and incidents
	1.2 Minimize the congestion and delays imposed by trucks on other traffic, including those related to the differences between truck and auto speeds, and designation and compliance with truck routes
	1.3 Reduce the delays at traffic signals by improving signal coordination, especially across jurisdictions
	1.4 Provide local and long-distance travelers with the traffic and weather information they need to avoid congestion, or to anticipate it
	1.5 Reduce the delays and congestion at railroad crossings, especially for emergency vehicles
	1.6 Improve the management of traffic at incident scenes, and in incident-related traffic diversions
	1.7 Minimize the congestion concerns associated with outdated roadway designs
	1.8 Reduce the congestion and delays associated with agricultural vehicles
	1.9 Minimize the congestion caused by gaps in the roadway system (i.e., lack of connecting segments that displaces traffic to other congested areas)
2.0 Reduce the number and severity of accidents and incidents	2.1 Reduce the number and severity of accidents and incidents: due to weather conditions, between trucks and autos, involving agricultural vehicles, and involving pedestrians and bicycles
	2.2 Improve monitoring and enforcement of speed limits
	2.3 Improve red light running monitoring and enforcement
	2.4 Provide local and long-distance travelers with the information they need to avoid adverse weather conditions, or to anticipate them
	2.5 Improve the ability to quickly locate incident scenes, especially in rural areas
	2.6 Minimize the safety concerns associated with outdated roadway design
	2.7 Improve coordination among emergency responders, including getting the right equipment to incident scenes quickly
	2.8 Improve the ability of travelers to find help quickly in highway emergencies
3.0 Improve transportation planning and operations	3.1 Promote coordination of transit services among providers
	3.2 Promote coordination of traffic management among jurisdictions, including traffic signals, construction management and incident management
	3.3 Increase the amount, accessibility and quality of data for planning and analysis, and improve planning and analysis tools
	3.4 Promote long-term coordination among agencies in solving transportation problems, beyond just the planning phase
	3.5 Improve the operation of existing traveler information systems, including greater responsiveness and consistency
4.0 Minimize the environmental impacts of transportation	4.1 Reduce air pollution associated with transportation
5.0 Promote the efficiency, safety, convenience and use of alternative travel modes	5.1 Facilitate trips requiring transfers between transit services, including local and intercity or regional, and between fixed-route and demand-responsive
	5.2 Improve the quality, availability and utilization of fixed-route and demand-responsive transit service, and pedestrian, bicycle and carpooling facilities and services
	5.3 Improve the safety and security on transit vehicles and at stations and stops, and on pedestrian, bicycle and carpooling facilities

Table 2.1: San Joaquin Valley ITS Goals and Objectives

Goal	Objectives
	5.4 Increase the availability, quality and ease-of-use of transit route and schedule information, and information regarding bicycle, pedestrian and carpooling facilities and services
	5.5 Improve transit on-time performance
	5.6 Support the provision of the transit amenities that are necessary to attract riders who have other options
6.0 Promote funding of needed, cost-effective ITS investments	6.1 Inform the public, policy makers and transportation planners, designers and operators of the need and benefits of funding appropriate ITS investments
7.0 Improve the safety and efficiency of goods movement and reduce the impacts of commercial vehicles on other traffic and roadways	7.1 Improve truck routing and enforcement to minimize damage to roadways
	7.2 Improve the availability and awareness of truck parking
	7.3 Improve the availability and promote the awareness and use of information for truckers on traffic and weather conditions, truck routes, and other services
	7.4 Reduce delays at commercial vehicle facilities, such as weigh stations

XXXXXX	= An objective that reflects at least one Priority 1 problem
XXXXXX	= An objective that reflects at least one Priority 2 problem
XXXXXX	= An objective that reflects at least one Priority 3 problem

2.5 Interregional Relationships

ITS applications will be considered as part of a comprehensive set of initiatives that may involve traditional improvements as well as technological ones.

Deployment of ITS is occurring throughout the San Joaquin Valley, as well as the State. There are numerous neighboring regions that have strong transportation relationships with the San Joaquin Valley Region. These include Central Coast, Los Angeles, Bay Area, Sierra Nevada, and the Sacramento regions. It is important that ITS deployments within the Region consider the implications of deployments in neighboring regions. This consideration begins with a review of the ITS visions of these neighboring regions:

- **Central Coast Region** – The following represents the ITS vision statement for the Central Coast Region:

  "ITS will be integrated into the transportation system on a strategic basis to address congestion and safety problems, to enhance emergency preparedness, to provide trip planning and en-route information to all travelers, to improve the efficiency and effectiveness of operational and maintenance functions of all transportation modes and to support transportation planning and system management functions."

- **Los Angeles Region** – The Los Angeles region defines it ITS vision in a somewhat more complex manner than central counties. The Los Angeles/Ventura Region ITS Strategic Deployment Plan describes that region's vision as:

  - To use intelligent and advanced transportation technologies to:

    increase mobility and accessibility throughout the region, improve air quality, use the existing infrastructure more efficiently and effectively, and maximize the Federal, State, and local funding opportunities for transportation improvements -

  - By identifying, evaluating, and recommending a deployment plan:

    to advance available and emerging ITS technologies within a short, medium, and long term integration window, that satisfy local, region and intermodal transportation needs while fostering institutional partnerships, whether public/private or public/public, necessary to successfully implement, operate, and maintain technologies throughout the life cycle of the identified projects.

- **Priority Corridor Showcase** – Within the Southern California Priority Corridor (Los Angeles, Ventura, Orange, San Diego,

and parts of Riverside and San Bernardino Counties), a vision has been defined for the Showcase project. The Showcase project is basically a standardization and integration effort that encompasses all of the Priority Corridor. It is important in that it may provide resources upon which the Fresno Region can draw at some future point. As indicated in the Showcase Final Implementation Plan (March 1997), the vision for Showcase is, *"to demonstrate the feasibility and benefit of integrating all modes of transportation and all roads of travel into a system of systems."*

- **Sierra Nevada Region** – The Sierra Nevada region is moving forward with its ITS planning process. It will incorporate the information and findings of the ITS plans with new information from the rest of the regions. While a vision has yet to be defined for the entire Sierra Nevada, it is likely that it will hold much in common with the vision defined for San Joaquin Valley region.

It is clear from the three ITS visions outlined above that the Los Angeles region has defined the most complex vision for ITS deployment. This is not surprising given the complexities and extent of transportation problems within the Los Angeles region.

It is important to consider the vision statements of neighboring regions for two reasons: 1) the vision provides insight into the direction ITS deployment is likely to take within the region; and (2) it allows the region to consider what opportunities exist for cooperation with neighboring regions.

The Region should seek to maximize the effectiveness of its deployment dollars. In terms of the Los Angeles region and Showcase ITS efforts, this means that the Region may choose to draw upon certain architecture and system efforts that support the Region's goals.

3.0 Regional User Needs and Related User Services

This section describes the process followed to identify and synthesize transportation deficiencies and issues throughout the San Joaquin Valley and to preliminarily consider ITS strategies that can help address those needs.

3.1 Overview

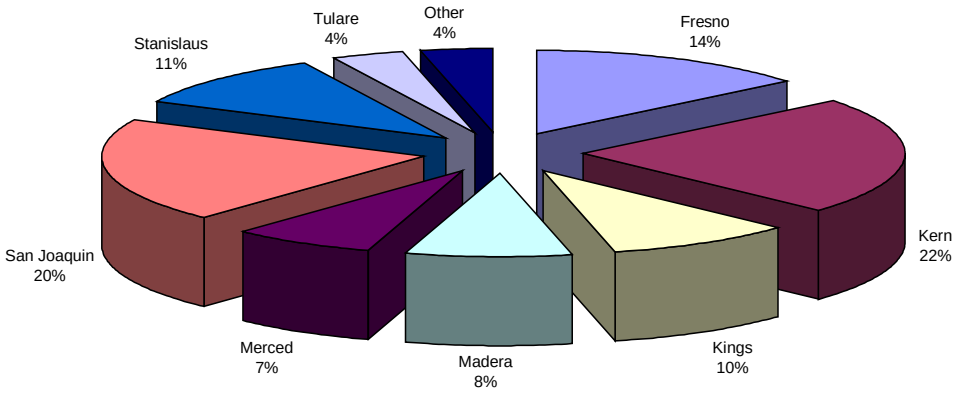
The deficiencies assessment process included two major components: a quantitative analysis of transportation operations, including analysis of traffic congestion and accidents; and a qualitative assessment composed of stakeholder outreach (surveys, interviews and workshops) and project Technical Advisory Committee (TAC) input. The focus of TAC input was a day-long Prioritization Workshop, where all of the deficiency assessment results were reviewed and the committee ranked transportation problems and preliminarily identified ITS solutions that may be applicable. The deficiency assessment is summarized graphically in Figure 3.1.

Based on all of the deficiency assessment work, an overall list of problems was developed, along with a map that associates issues with specific portions of the study area. The problems list and map guided the subsequent identification of user services and market packages and the development of specific ITS projects. The "straw poll" identification of candidate ITS strategies performed by the TAC at the Prioritization Workshop constituted a non-binding starting point for the formal consideration of ITS strategies, which occurred through the system architecture development process and in the development of project recommendations.

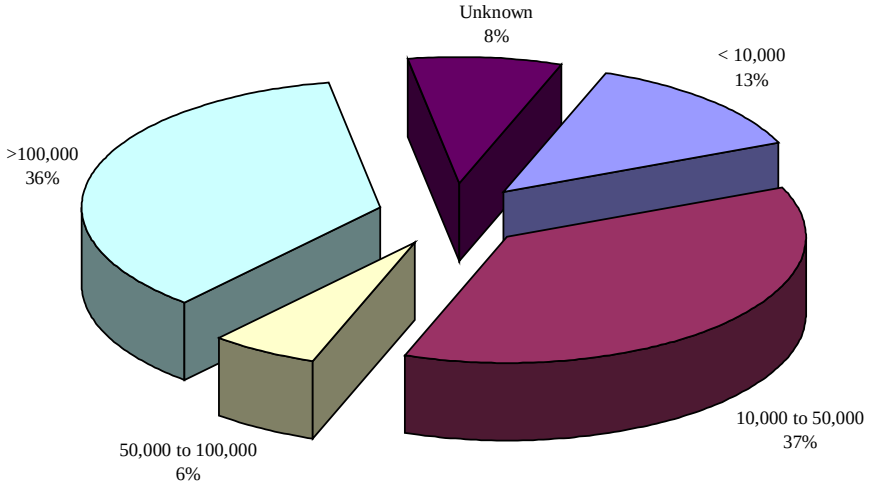
The five major deficiency assessment activities (operations analysis, survey, interviews, outreach workshop and Prioritization Workshop), along with the overall summary of deficiencies, are presented in the sections that follow.

Figure 3.1: Deficiencies Assessment Process

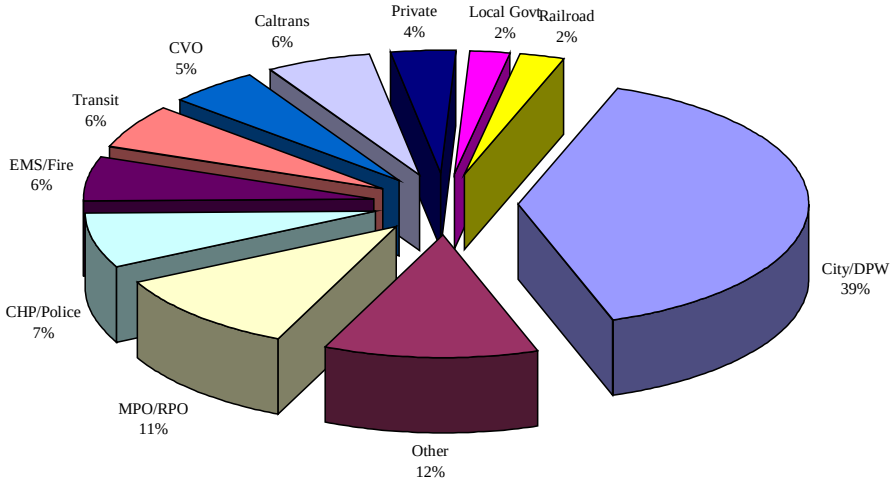
Figure 3.2: Survey Response Percentages by County, Population and Organization



Survey Response Percentages by County



Population Percentage Distribution of Survey Responses



Organization Category Percentage Distribution of Survey Responses

Table 3.1: Summary List of Problem Priorities

Priority Level	Problem
Priority 1	* Traffic congestion, especially due to incidents
	* Incidents and delay due to weather conditions (including fog, blowing sand and flooding)
	* Conflicts between trucks and other traffic, including congestion and accidents
	* Truck routing, including failure to specify routes, enforcement, and the impact of trucks on roadway surfaces
	* Traffic signal coordination, especially across jurisdictions
	* Speeding and red-light running
	* Connections between transit services, including between local and inter-city or regional, and between fixed-route and demand-responsive service.
	Interjurisdictional coordination of traffic strategies, including construction and maintenance, traffic management and compatibility of equipment
	Information for travelers, including traffic and weather/pavement, and including both local and long-distance travelers
	Air quality impacts of travel
	Delays and congestion at railroad crossings, especially to emergency vehicles
	Funding for transportation, including maintenance, road-building and ITS
	Inadequate planning data and analysis tools (e.g., GIS), especially across agencies
	Under-appreciation of the need for and benefits of ITS
Priority 2	Mechanisms and structures to promote long-term agency coordination (i.e., beyond the strategic planning stage)
	Managing traffic at incident scenes, especially interjurisdictional coordination of incident-related traffic diversions
	Lack of truck parking
	Insufficient fixed-route transit service, including no service or excessively long travel times
	Safety and security on fixed-route transit vehicles and at facilities
	Substandard roadway design
	Accidents and delay associated with agricultural vehicles
	Gaps in the roadway system
	Coordination among emergency responders, including getting the right equipment on site quickly

Table 3.1: Summary List of Problem Priorities

Priority Level	Problem
	Specific traveler information for truckers, including traffic, weather, truck routes and parking and services
	Inadequate transit schedule and route information
	Inadequate parking for motorists, including park 'n rides
	Improved operation of existing public traveler information systems, including more responsiveness and greater consistency
	Locating accident scenes, especially in rural areas
Priority 3	Accidents involving pedestrians or bicycles
	Delays at commercial vehicle facilities
	Finding help in highway emergencies
	Inadequate pedestrian or bicycle facilities
	Transit schedule adherence
	Lack of transit amenities to attract riders who have other options
	Land use policies in conflict with transportation objectives
	Insufficient demand-responsive transit service, including no service or excessively long travel times
	Emergency vehicle delays at railroad crossings
	Safety and security on demand-responsive transit vehicles and facilities

Notes:
* = Especially high priority problem, based on triangulation of deficiency assessment results

Source: URS/BRW, Inc. June 2000

The development of the final problems list began with the TAC problems rankings shown in Table 3.1. That list was then adjusted as follows:

- Some related problems, or problems that logically would be addressed together, were combined, in order to simplify and focus the listing.
- Priorities were checked against the results of the operations analysis.
- Some of consulting team's higher priority problems was moved up relative to their place on the TAC list, in cases where the stakeholder input supported it (see discussion in Section 3.4).

- Some of the higher priority problems identified through the survey, interviews and outreach workshops were moved up relative to their place on the original TAC list.

3.3 General Opportunities

These opportunities reflect critical considerations for selection including:

- **The availability of proven ITS applications that can help address identified San Joaquin Valley transportation problems and issues.**
- **Existing ITS and related resources that can be expanded upon, including infrastructure, expertise, stakeholder awareness and coalition building, existing partnerships and institutional momentum.**
- **Programmed and planned investments, both traditional and ITS-related, that can be expanded upon or used to address problems identified in this document.**

This section highlights some of the opportunities for deployment of ITS in the Region. It draws upon the deficiency assessment results, including the inventory of existing, planned and programmed ITS investments, stakeholder input and TAC direction, this section highlights some of the opportunities for San Joaquin Valley ITS efforts.

The following opportunities served as benchmarks that were consulted as the system architecture and specific project recommendations were developed, insuring that opportunities will not be overlooked and that the architecture and projects remained responsive to identified problems and opportunities.

Benchmark ITS Opportunities:

- **YATI**
- **Leverage Caltrans Expertise**
- **Leverage Caltrans ITS R & D Program**
- **Leverage Existing Transit Management System Experience**
- **Expand on Caltrans CHP Coordination Experience**
- **Build Upon Existing Efforts in Region**
- **Respond to New CVO Regulation**
- **Improve East-West Travel**
- **Build Upon This Efforts Momentum**

- Geographically expand the Yosemite Area Traveler Information (YATI) system and either develop additional systems for other major recreation areas, or combine with YATI.
- Build upon the existing extensive Caltrans District 6 and District 10 Traffic Management Systems to fill gaps and complete coverage on major facilities, including expansion of their highway closures and restrictions database to include other agencies.
- Capitalize upon the extensive ITS technology testing and standards development conducted by Caltrans by, where appropriate, utilizing Caltrans approaches for local traffic management systems.
- Build upon lessons learned from past and current transit ITS deployment experience (Fresno Area Express, Golden Empire Transit District, San Joaquin Regional Transit).
- Build upon Caltrans District 6 and District 10 experience with co-location and coordination between traffic management and Highway Patrol staff.
- Build upon the momentum and stakeholder coalition generated through the San Joaquin Valley Goods Movement Study to pursue ITS commercial vehicle projects.
- Traveler information for commercial vehicle operators at truck rest stop locations. As new laws require longer off-duty periods, demand for rest areas and for access to services will increase.
- Investigate how ITS can support other efforts to improve east-west travel between the Valley and the coast.

- Improve the visibility of and access to existing Caltrans valley-wide alternate route plans.
- Utilize momentum from the valley-wide ITS planning effort in conjunction with proposed federal rules (ITS architecture and standards conformity and statewide and metropolitan planning).

In addition to general opportunities for the region, each county in the Valley has specific opportunities for ITS deployment as noted below:

3.3.1 Fresno County Opportunities

- Maintain momentum generated by recent ITS strategic deployment planning process, taking advantage of the level of awareness and precedent for joint action established through the previous planning efforts.
- Continue efforts to improve coordination between the Caltrans District 6 and Fresno metro area traffic management centers, taking advantage of the current District 6 and Fresno fiber optic implementation projects. Utilize the Fresno-District 6 coordination efforts as a demonstration of the benefits of improved coordination between Caltrans and local traffic management centers.
- Other local entities (in addition to City of Fresno) investigate opportunities to coordinate with Caltrans District 6 fiber optic system with City of Clovis and County of Fresno.
- Support and expand upon the projects identified in the Fresno County ITS Strategic Deployment Plan that are intended to develop a regional transportation user information system (project 4.1), connections to a valley-wide or statewide information system (project 4.2), and development of common or standard electronic maps to support applications such as automatic vehicle location.

3.3.2 Kern County Opportunities

- Coordinate Bakersfield area TMC with Caltrans' District 6 (the D-6 satellite TMC in Bakersfield).
- Look for ways to integrate the ITS capabilities being implemented at Golden Empire Transit (GET) with the developing Bakersfield traffic management system, including of sharing of information between the two centers during emergencies.
- Facilitate the transfer of lessons learned from the Golden Empire Transit ITS deployment, now beginning, to other area transit operators, and look for opportunities for those

agencies to better coordinate with GET using GET's new ITS capabilities.

- Expand upon the accident-reduction successes of the Route 46 Safety Coalition Program and the South Kern Corridor Safety Program.

3.3.3 Kings County Opportunities

- Provide improved safety and mobility along east-west highways such as SR-198 using CMS and other ITS applications.
- Build on City of Hanford's traffic management capabilities, including coordination with Caltrans.
- Evaluate opportunities for developing an AVL system for Kings Area Rural Transit (KART).
- Potential to improve safety at rural railroad crossings using ITS applications.
- Provide commercial vehicles with improved information in the I-5 corridor related to routes, facilities and parking within the County.
- Enhance the safety and capacity of Highway 43 as an alternate route to SR-99/I-5 using ITS applications.

3.3.4 Madera County Opportunities

- Evaluation of surveillance and automated red-light running at high accident locations is needed in Madera
- Enhancements to emergency vehicle dispatching systems for rural areas, including improved evacuation plans for Yosemite Park that build on the additional roadway connections that are being constructed (i.e., elimination of "dead ends").
- Traveler information and/or other ITS applications that would support needed park and ride lots along Highway 99.
- Develop transit traveler information strategies to support the relocated Amtrak station.
- Investigate options for utilizing ITS in support of upcoming restructuring/optimization of rural demand-responsive transit service.
- Develop analysis tools for traffic accidents, such as a geographic information system, for the City of Madera.

3.3.5 Merced County Opportunities

- ITS traveler information and traffic management in support of the future University of California facility, red-light running enforcement and train warning and information system applications in Merced.

- Consideration of ITS traffic signal applications in support of Merced's major interchange improvements.
- Develop transit information and other transit management strategies to improve coordination of the regional bus service ("the Bus") with the intermodal transportation center in downtown Merced.
- Investigate options for supplemental railroad crossing warning and information systems at high-volume train crossings where delays are frequent and long.
- Investigate potential ITS enhancements to the planned weigh station on SR 99 at PM 2.1.

3.3.6 San Joaquin County Opportunities

- Build upon lessons learned from the integration of the Caltrans District 10 and Fresno metro area traffic management centers, and utilize the system as a test bed for Caltrans-local TMC coordination strategies that may be expanded region wide.
- Examine long-distance commuter-oriented traveler information and traffic management strategies oriented toward Bay Area commuters
- Utilize ITS to support the coordination of local transit services with the new commuter rail service to the Bay Area.
- Investigate methods to further improve coordination between San Joaquin Regional Transit and Stockton and/or Caltrans District 10 Traffic Management Centers.
- Build upon next bus arrival signs and automated phone system traveler information strategies at San Joaquin Regional Transit, possibly to include kiosks and Internet information.

3.3.7 Stanislaus County Opportunities

- Expand on the City of Modesto/Ceres TMS to develop an integrated Urban ATMS for the County.
- Improve interjurisdictional signal coordination.
- Build upon ITS transit applications in Stockton, Fresno and Bakersfield to provide MAX and local transit services with a means to improve operations and management.
- Improve safety and mobility on the Counties east-west rural highways including Highway 132 between the I-5 and SR-99 corridors using ITS applications such as Road Weather Information Systems (RWIS).

- Utilize intermodal freight facilities to provide improved information to commercial vehicles by using these facilities as information dissemination centers.
- Improve mobility, coordination and information between the urbanized areas of Stockton and Modesto along the SR-99 corridor.

3.3.8 Tulare County Opportunities

- Desire to implement red-light running enforcement in Visalia.
- Build upon the current traffic signal system efforts to develop an urban ATMS in the areas of Visalia, Tulare and Goshen.
- Provide safe areas along rural routes to the National Parks system including improved traveler information.
- Development of an improved communication link between the Visalia/Tulare urbanized area and Caltrans – District 6 to address coordination efforts along the SR-99 and SR-198 corridors.

3.4 User Services

This section explains the concept of ITS "user services", their role in the San Joaquin Valley ITS Strategic Deployment Plan and how they will be identified. "User Services" are the first in a series of concepts from the "National ITS Architecture" that will be used in the development of the San Joaquin Valley ITS Strategic Deployment Plan. The National ITS Architecture is a series of documents prepared by the United States Department of Transportation that collectively are intended to provide a common framework for planning, defining, and integrating ITS. Such a common framework promotes consistency and compatibility in ITS systems deployed by different organizations.

3.4.1 What are User Services?

"User Services" are services that can be provided to transportation system users and operators to address those users' problems or needs, for example, "Pre-Trip Traveler Information". The user service concept was developed in the National ITS Program Plan (1995), and later became one of the fundamental concepts around which the National ITS Architecture (NA) was developed. The National ITS Program Plan identified 29 user services, organized into seven categories or "bundles". Since that time, two additional services have been added to the list. These services were identified to fit into the needs of the Valley and it's Regional System Architecture in compliance with the NA. Table 3.2 presents the current list of 31 national ITS user services. The services are described in the sections that follow, organized by bundle.

Table 3.2: User Service Bundles and User Services

User Services Bundle	User Services
Travel and Transportation Management	• En-Route Driver Information • Route Guidance • Traveler Services Information • Traffic Control • Incident Management • Emissions Testing and Mitigation • Demand Management and Operations • Pre-trip Travel Information • Ride Matching and Reservation • Highway-Rail Intersection
Public Transportation Operations	• Public Transportation Management • En-Route Transit Information • Personalized Public Transit • Public Travel Security
Electronic Payment	• Electronic Payment Services
Commercial Vehicle Operations	• Commercial Vehicle Electronic Clearance • Automated Roadside Safety Inspection • On-board Safety Monitoring • Commercial Vehicle Administration Processes • Hazardous Materials Incident Response • Freight Mobility
Emergency Management	• Emergency Notification and Personal Security • Emergency Vehicle Management
Advanced Vehicle Safety Systems	• Longitudinal Collision Avoidance • Lateral Collision Avoidance • Intersection Collision Avoidance • Vision Enhancement for Crash Avoidance • Safety Readiness • Pre-Crash Restraint Deployment • Automated Highway System
Information Management	• Archived Data Function

Source: Adapted from National ITS Architecture, Version 3.0; USDOT, 2000.

3.4.2 Why Follow National ITS Architecture Standards?

One of the most compelling reasons to follow the National ITS Architecture is that the Transportation Equity Act for the 21st Century (TEA-21) requires that any ITS project receiving funds from the highway trust fund "conform" to the National ITS Architecture and applicable standards. New federal published in the Federal Register in January 2001 significantly amplify that requirement. Other benefits of using the National ITS Architecture include: potential time savings (much of the work has been done and can be easily adapted to local contexts); minimization of the risk of omitting important components or connections or missing opportunities; facilitation of future ITS system expansions; allows participation in the national ITS equipment vendor market emerging around the National ITS Architecture and associated ITS

standards (i.e., benefit from more competitive pricing of non-proprietary equipment).

The development of the San Joaquin Valley ITS architecture, which is consistent with the National ITS Architecture, is explained in detail. In this document, discussion will be limited to user services, the most common entry into the process to develop a nationally compatible regional ITS architecture.

3.4.3 Travel and Transportation Management

The user services in the travel and transportation management bundle are designed to use advanced systems and technologies to improve safety and create more informed travelers. A secondary purpose (sometimes identified separately as Travel Demand Management) is to reduce the vehicle demands on the existing roadway infrastructure by encouraging the use of multiple or high occupancy vehicles (HOV), public transportation systems, ride-sharing programs and altering normal travel patterns to reduce the demand on the existing systems.

3.4.3.1 En-Route Driver Information

This user service provides travel-related information to drivers after their trips have begun. This information could include real-time traffic (roadway travel speeds, accident/ incident location), real-time transit (schedule, status) and roadway conditions (temperature, icy/snow covered roadways). By providing this information to travelers while en-route, it allows alternative routes to be chosen for their destination. Driver Information consists of two major functions, which are (1) Driver Advisory and (2) In-vehicle signing. The potential decrease in traffic may also provide benefits in highway safety, reduced air pollution, and decreased congestion.

3.4.3.2 Route Guidance

This user service provides travelers with instructions on turns and other maneuvers to reach their destinations. This information could be presented in real time to a driver as he/she progresses along a route or in a static form to an individual using a personal computer or traveler information kiosk. Four functions are provided which are (1) Provide Directions, (2) Static Mode, (3) Real-time Mode, and (4) User Interface.

3.4.3.3 Traveler Services Information

Most often referred to as “electronic yellow pages”, traveler services data includes local information (location, operational hours, phone numbers) such as hotel/motels, gas stations, restaurants, and other points of interest and is provided to assist the traveler prior to embarking on a trip or after the traveler is underway. The functions which are included in this capability are Information Receipt and Information Access.

3.4.3.4 Traffic Control

This user service provides information to manage the movement of traffic on streets and highways, which includes surface street controls such as adaptive signal systems and freeway controls such as ramp metering and lane control. Four functions are provided which are (1) Traffic Flow Optimization, (2) Traffic Surveillance, (3) Control Function, and (4) Provide Information. This service will also include control of network signal systems with eventual integration of freeway control.

3.4.3.5 Incident Management

This user service provides the necessary information to enhance existing capabilities for detecting incidents and taking the appropriate actions in response to them. Six major functions are provided which are (1) Scheduled Planned Incidents, (2) Identify Incidents, (3) Formulate Response Actions, (4) Support Coordinated Implementation of Response Actions, (5) Support Initialization of Response to Actions, and (6) Predict Hazardous Conditions.

3.4.3.6 Emissions Testing and Mitigation

This user service provides information on an area-wide and roadside basis to assist in improving air quality levels. This information can be used by state and local governments to enhance their air quality control strategies. Information gleaned from this service will be used by Traffic Demand Management in the Traffic Management Center to mitigate pollution and may be provided to enforcement agencies to compel offenders to comply with standards.

3.4.3.7 Demand Management and Operations

This user service provides information to allow implementation of programs, policies, and regulations designed to increase occupancy of vehicles (HOV lanes, commute options programs) and provide multi-modal options to allow individuals to travel more efficiently, at a different time or to a different location. It consists of two major functions, which are (1) Increase Efficiency of Transportation system and (2) Provide Wide Variety of Mobility Options.

3.4.3.8 Pre-Trip Travel Information

This user service provides travelers with information prior to their departure and before a mode selection must be made. By providing travelers with travel information before they leave their origin, this user service assists travelers in making mode choices, travel time estimates, and route decisions prior to trip departure. This service consists of four major functions, which are: (1) Available Services Information, (2) Current situation Information, (3) trip Planning Service, and (4) User Access. Information is integrated from various transportation modes and presented to the user for decision making.

3.4.3.9 Ride Matching and Reservation

This user service provides a key TDM strategy for reducing roadway and vehicle demand by developing and encouraging ride sharing as an alternative form of travel. This Ride Matching and Reservation will provide travel users with information on rideshare providers. Three major functions are provided which are (1) Rider Request, (2) Transportation Provider Services, and (3) Information Processing. This service will also include a billing service to the providers.

3.4.3.10 Highway-Rail Intersection

This user service provides information to improve control of train and highway traffic to avoid and reduce the severity of collisions on at-grade highway-rail intersections (HRI). Two sub-services are supported: Standard Speed Rail Subservice which is applicable to light rail transit, commuter rail and heavy rail trains with operational speeds up to 79 miles per hour; and High Speed Rail Subservice which is applicable to all passenger and freight trains with operational speeds from 80 to 125 miles per hour.

3.4.4 Public Transportation Operations

The services included in public transportation operations are designed to decrease reliance on the personal auto by enhancing the efficiency, convenience, cost effectiveness, safety, and security of public transportation.

3.4.4.1 Public Transportation Management

This user service provides information on the application of advanced vehicle electronic systems to various public transportation modes. In addition, this service uses the data generated by these electronic systems to improve the quality of service to the traveling public. Activities in this area are typically grouped into three categories: 1) Operation of vehicles and facilities, 2) Planning and scheduling, and 3) Personnel management.

3.4.4.2 En-Route Transit Information

This user service provides information to transit riders while they are on a public transportation system. The information typically includes real-time, accurate transit and high-occupancy vehicle information (such as the next scheduled arrival or departure for transit service) so travelers can select the most appropriate and convenient form of transportation. This information helps travelers plan and modify their trips while underway. It consists of three major functions, which are: (1) Information Distribution, (2) Information Receipt, and (3) Information Processing. This service integrates information from different transit modes and presents it to travelers for decision making.

3.4.4.3 Personalized Public Transit

This user service involves use of flexible routed transit vehicles offering more convenient/personalized service to transit customers. Personalized services include random-route (Dial-A-Ride) transit, fixed-route transit capable of deviating on call and resuming the fixed route, and specialized transportation for the transit dependent. This service consists of five major functions, which are: (1) Rider Request, (2) Vehicle Assignment, (3) Data Collection, (4) Information Processing and (5) Communications.

3.4.4.4 Public Travel Security

This user service provides data on the public transit environment to help make transit patrons feel more secure, comfortable, and safer without detracting from transit ridership. Typically, this service involves deploying technologies both at fixed locations (such as parking lots and transit stops/stations) and to mobile systems (in-vehicle) designed to provide safety and security for the transit riders and employees. It involves four major functions which are: (1) Secure Areas, (2) Security Sensors, (3) Personal Sensors Items, and (4) Security Management and Control.

3.4.5 Electronic Payment

This service involves the ability to provide travelers with a common electronic payment medium for travel-related services.

3.4.5.1 Electronic Payment Services

This user service provides travelers with the ability to make non-cash payments for transportation services using electronic cards or tags. Four functions are provided which are: (1) Electronic Toll Collection, (2) Electronic Fare Collection, (3) Electronic Parking Payment, and (4) Electronic Payment Services Integration.

3.4.6 Commercial Vehicle Operations

This bundle of user services deals primarily with freight movement and focuses on two specific areas: those, which improve private-sector fleet management and freight mobility, and those, which streamline government/regulatory functions.

3.4.6.1 Commercial Vehicle Electronic Clearance

This user service provides information on both domestic and international electronic clearance. Today's requirement for commercial trucks and buses to stop at checkpoints for inspection/weighing significantly impacts commercial vehicle operational utilization and productivity. This service focuses on technologies and services that can allow the vast majority of commercial vehicles (those operating within the local, State, and Federal regulatory requirements) to travel the nation's interstate system just as passenger vehicles do. The electronic clearance would allow only selected vehicles (those with identified problems,

or areas that need to be checked) to be stopped at checkpoints while the remainder of the vehicles pass undisturbed.

3.4.6.2 Automated Roadside Safety Inspection

This user service provides the ability to automate inspection capabilities that check commercial vehicle safety requirements. Technologies in this user service area will allow for quicker inspection of commercial vehicles either at stationary roadside checkpoints or at mobile stations. This service provides three primary functions, which are: (1) Automated Roadside Safety Inspection, (2) Roadside Facility, and (3) Vehicle System.

3.4.6.3 On-Board Safety Monitoring

This user service focuses on technologies that allow on-board monitoring of safety warnings to the driver; integration of real-time safety information about the vehicle, driver, or cargo with the electronic clearance user service; and pre- and post-trip inspections. The goal of the monitoring system is to first inform the driver, as soon as possible, of any problem that has been detected. Of secondary importance is notifying the carrier of detected safety problems. Last in importance is the notification of appropriate enforcement agencies.

3.4.6.4 Commercial Vehicle Administrative Processes

This service focuses on technologies in three areas: electronic purchase of credentials, automated mileage and fuel reporting and auditing, and International Border Electronic Clearance. Technologies in this area will allow a carrier to electronically apply for and purchase credentials for their home state, other states, and even internationally. In addition, automated mileage and fuel reporting would be available electronically, reducing the administrative and record keeping requirements on the carrier, the driver and the States. The international electronic clearance component will extend the electronic clearance concept to the Mexican and Canadian borders and support the North American Free Trade Agreement (NAFTA) by facilitating traffic flow of safe and legal carriers across international borders.

3.4.6.5 Hazardous Materials Incident Response

This user service focuses on providing information to emergency responders at the scene of an accident. It includes three primary functions, which are, (1) HAZMAT Incident Notification, (2) Operational Focal Point, and (3) Communications.

3.4.6.6 Commercial Fleet Management/Freight Mobility

This user service provides real-time communications between drivers of commercial vehicles and their dispatchers to facilitate vehicle location, intermodal transportation providers, and real-time

routing using congestion or incident information. This user service is oriented primarily towards commercial trucking.

3.4.7 Emergency Management

This bundle of services relates directly to the detection, notification and response to emergency and non-emergency incidents, which take, place on or adjacent to the roadway. Emergency management services focus mostly on improving the ability of police, fire and rescue operations to provide an appropriate response to emergency situations.

3.4.7.1 Emergency Notification and Personal Security

Often referred to as "mayday" capabilities, this user service focuses on either a driver-initiated distress signal for incidents such as mechanical breakdown or non-injury incidents or automated notification of collisions by automatically sending information regarding location, nature, and severity of the crash to an emergency medical service dispatcher. This service consists of two primary functions, Emergency Notification and Personal Security and Automated Collision Notification.

3.4.7.2 Emergency Vehicle Management

This user service provides information designed to reduce the time between notification of an emergency situation and the arrival at the scene of emergency vehicles. This consists of activities in three areas: 1) Emergency Vehicle Fleet Management, 2) Route Guidance, and 3) Signal Priority.

3.4.8 Advanced Vehicle Safety Systems

This bundle of user services relates directly to improving driver safety by reducing the number and severity of accidents and incidents.

3.4.8.1 Longitudinal Collision Avoidance

This user service provides information to reduce the number and severity of head-on, rear-end and backing accidents. This type of collision avoidance focuses on three areas: 1) Rear-end Collision Warning and Control through driver notification, vehicle control, and avoidance of either the rear-end or stationary object; 2) Head-On Collision Warning and Control that detects an impending head-on collision; and 3) Backing Collision Warning that detects slow-moving or stationary objects (livestock, humans, vehicles) in the path and warns the driver.

3.4.8.2 Lateral Collision Avoidance

This user service provides information to augment the driver's ability to notice and avoid collisions caused when a vehicle leaves its own lane of travel while moving forward. This vehicle control and safety system focuses mostly on two technology areas: 1) Lane

Change/Blind Spot Situation Display, Collision Warning, and Control; and 2) Lane/Road Departure Warning and Control.

3.4.8.3 Intersection Collision Avoidance

This user service provides vehicle operators with assistance in avoiding collisions at intersections when vehicles improperly violate the right-of-way of another vehicle, or when the right-of-way is not clear.

3.4.8.4 Vision Enhancement for Crash Avoidance

This user service provides information systems that can improve the ability of the driver to perceive the roadway itself and objects on and along the roadway, enabling the driver to avoid potential accidents.

3.4.8.5 Safety Readiness

This user service focuses on reducing the number of incidents caused by impaired drivers, vehicle component failures or degraded infrastructure conditions. Driver impairment warning systems provide indications that the driver may not be in a condition to continue operating the vehicle safely. Vehicle condition warning extends existing safety monitoring systems to include components such as tire pressure or brake temperature. In-vehicle infrastructure condition warning focuses on providing information to the vehicle from instruments or systems mounted in the roadway infrastructure that warn of deteriorating road conditions due to water, ice, or snow.

3.4.8.6 Pre-Crash Restraint Deployment

This user service provides information and technology to both anticipate imminent collisions and to deploy passenger safety systems prior to impact.

3.4.8.7 Automated Vehicle Operation

This user service focuses on improving the safety and efficiency of highway travel, enhancing driver comfort and helping to reduce air pollution by moving suitably equipped vehicles under fully automated control along dedicated highway lanes. Drivers enter an automated highway system lane through a check-in area where the system: 1) checks the worthiness of the vehicle and driver; 2) accepts or rejects vehicles for operation on the system; and 3) diverts disapproved vehicles back to the non-automated lanes.

3.4.9 Information Management

This user service bundle collects ITS and related data, archives it, and makes it available to other users.

3.4.9.1 Archived Data Function

This user service centers on the Archived Data Management Subsystem (ADMS). The ADMS collects, archives, manages, and

distributes data generated from ITS sources for use in transportation administration, policy evaluation, safety, planning, performance monitoring, program assessment, operations, and research applications. The data received is formatted, tagged with attributes that define the data source, conditions under which it was collected, data transformations, and other information necessary to interpret the data. The subsystem can fuse ITS generated data with data from non-ITS sources and other archives to generate information products utilizing data from multiple functional areas, modes, and jurisdictions. The subsystem prepares data products that can serve as inputs to Federal, State and local data reporting systems. This subsystem may be implemented in many different ways. It may reside within an operational center and provide focused access to a particular agency's data archives. Alternatively, it may operate as a distinct center that collects data from multiple agencies and sources and provides a general data warehouse service for a region.

3.5 Selecting and Prioritizing User Services for Local/Regional Application

3.5.1 Selecting User Services

The typical approach to selecting user services for local application, such as in the development of a regional ITS plan, is to select those user services that address, in whole or in part, the specific local transportation needs, problems or issues that have been identified. In this process, often referred to as "mapping needs to user services", the user services that address a given problem or need are flagged. This process is repeated for each problem. Any user service that addresses at least one locally identified problem or issue is considered selected. In most cases, multiple user services are needed to address any given need or problem, and any given user service will play a role in addressing a range of problems or needs.

After the initial flagging of applicable user services, the need for additional user services, or modifications to the nationally defined user services, are considered. In cases where a local need or problem is not adequately addressed by one of the nationally defined user services, a new service may be developed or the national service may be modified to better address local concerns. This practice is endorsed by the USDOT.

Most regional ITS strategic plans prepared throughout the country do not include new (i.e., locally defined) or substantially modified user services. There are several reasons why new user services are not created more frequently for local application. First, the national services are fairly comprehensive in their scope and cover most of the ITS projects that are likely to be considered. Second, user services are intended to be a fairly high-level and simple summarization of the scope of intended ITS efforts, unlike other architecture components that are much more detailed and

numerous, and therefore having a very long list of narrowly defined services somewhat diminishes their utility. Finally, not all problems are appropriately addressed through an ITS user service per se. In some cases the problem requires non-ITS solutions, or requires actions that are not literally "services" provided to travelers or system operators.

3.6 San Joaquin Valley ITS User Services

This section identifies ITS user services for application in the San Joaquin Valley.

3.6.1 Selection of San Joaquin Valley User Services

The process to select user services is described and the resulting list of user services is presented. The process to identify ITS user services for application in the San Joaquin Valley consisted of the following three steps:

- Development of a "master list" of candidate user services;
- Mapping of identified San Joaquin Valley problems to the candidate user services; and
- Assessment of the need to add or modify user services based on unaddressed problems.

3.6.1.1 Development of a "Master List" of Candidate User Services

In addition to the 31 nationally defined ITS user services, two other sources of potential user services were consulted. First, the status of several potential, or "emerging", user services was researched. Potential additions to the list of national ITS user services are continuously being considered by the USDOT in conjunction with ITS America as the National ITS Architecture evolves, now in its third version, and as experience with ITS continues across the country and the world. Two user services have been added since the original list of 29 was developed in 1995. Currently, there are six potential new national ITS user services that are being evaluated, as described in Table 3.4. The specificity of the summaries in Table 3.4 varies, reflecting the relative level of development and consideration received to date. The most fully developed user service, Operations and Maintenance, is being recommended by the USDOT for inclusion in the next version of the National ITS Architecture, expected in the winter or spring of 2001.

In addition to researching potential new national user services, numerous California ITS plans were reviewed in an effort to identify any substantially modified or locally defined user services that may be appropriate for consideration in the San Joaquin Valley. These plans included the Central Coast ITS Strategic Deployment Plan,

the Kern and Fresno County ITS plans, the California Intelligent Transportation Systems Deployment Initiatives Project (a state level initiative of the California Alliance for Advanced Transportation Systems) and the California/Oregon Advanced Transportation Systems (COATS) ITS plan. None of the plans that were reviewed included substantially modified or locally defined user services, therefore the master list of candidate San Joaquin Valley services consists of the 31 current national services plus the six potential new national services listed in Table 3.3.

Table 3.3: Potential New National ITS User Services Under Consideration by the USDOT

Potential New National ITS User Service	**Summary Description**
Maintenance and Construction Operations (MCO)	Describes the need for integrating key activities to insure that roadways, associated infrastructure, and available resources are managed in an optimal manner. Key activities included in this user service include monitoring, operating, maintaining, improving, and managing both the physical condition of and equipment on the roadway. The focus for this user service would be on the following six functional areas • Maintenance Vehicle Fleet Management – monitor/track vehicle locations • Infrastructure Management – automate the inventory process for both ITS and non-ITS roadside infrastructure • Roadway Management – detect road/weather conditions & optimize maintenance crew operations • Work Zone Management and Safety – manage work zone activities & communicate with travelers • Roadway Maintenance Conditions and Work Plans Dissemination – provide O&M information to agency staff and travelers • MCO Management - Tracking Out-sourced Contracting – monitor/track private sector O&M activity performance

Table 3.3: Potential New National ITS User Services Under Consideration by the USDOT

Potential New National ITS User Service	**Summary Description**
Disaster Response and Management (DRM)	Addresses the coordination and management of responses to large-scale natural and man-made disaster situations. This would include a wide range of disaster types, such as floods, hurricanes, earthquakes, tornadoes, fires, avalanches, chemical spills, nuclear incidents, etc. These are events that cause significant disruption to community services, could cause significant loss of life and/or property, create major disruption in transportation services, and/or require evacuation of large numbers of people. This user service does not repeat the same functionality already included in other user services such as coordination between Traffic Management and Emergency Management for routine events. Instead, the DRM user service expands it to effectively support the scale of resource coordination required to respond to disasters. The functional areas included in this user service are: • Traveler Disaster Information and Notification • Evacuation Management • Monitoring status of routes, services, facilities • Transportation Agency Response Coordination with Other Emergency Services • Civil Defense/National Guard • Red Cross • Public Safety
Safe Driving Enforcement (SDE)	Supports various mechanisms (e.g., systems, processes, procedures, etc.) to enforce roadway controls and policies in situations where violations pose particular safety risks to violators and/or other travelers. Generally, key SDE activities include monitoring roadway conditions and/or vehicle movements, comparing this collected data vs. "safe" operating parameters, providing information to the traveler regarding their current vehicle operations, and alerting the appropriate law enforcement agency when a violation occurs. The SDE user service may be considered applicable to both urban and rural environments. The SDE user service focuses on the following components: • Variable Speed Limit Management and Enforcement - Weather/Environmental Conditions-based - Roadway Geometry Based • Intersection Signal/Signage Enforcement • Highway-Rail Intersection Signal/Signage Enforcement

Table 3.3: Potential New National ITS User Services Under Consideration by the USDOT

Potential New National ITS User Service	**Summary Description**
Environmental/ Weather Information Management	Focuses on the development and dissemination of integrated weather and/or environmental products relevant to roadway transportation. The elements of this user service include: • Integrated Weather/Environmental Data Gathering - Weather - Road Surface Sensing - Pollution/Air Quality • Information Products Dissemination - To Agencies/Organizations - To Travelers - Weather Emergency Response
Intermodal Freight Logistics	Intermodal is the movement of goods that involve more than one mode of transportation. Virtually all air, waterborne and non-bulk rail shipments are categorized as intermodal. Motor carrier movements are apt to be part of almost all intermodal movements. The key stakeholders involved in intermodal freight are shippers, ocean carriers, rail carriers, drayage companies and marine terminal operators. The functional areas of importance to the intermodal community are: • Freight In-Transit Monitoring - Container and freight shipment tracking - Container monitoring (temperature, shock, vibration) - Information management • Freight Terminal Management - Terminal vehicular traffic control - Security - Customs interface • Container pickup/drop-off acknowledgment
Multi-Jurisdictional Emergency Management	The National ITS Program Plan includes only 2 User Services related to Emergency Management: Emergency Notification & Personal Security and Emergency Vehicle Management. These services may not fully address the needs related to Emergency Management as it relates to the transportation community and ITS technologies. One area in particular that could be improved upon through a new user service is the coordination of emergency or incident management data between the various agencies in a region. During most emergency calls more than one agency must be involved in the response. For instance, police are needed to respond to a fire to be able to direct traffic around streets that the fire & rescue departments have closed.

Source: Unpublished materials provided by the Joint Program Office of the Federal Highway Administration, June 2000. All information is preliminary and may change.

3.6.1.2 Mapping San Joaquin Valley Transportation Problems to Identified User Services

The second step in the process to select ITS user services for application in the San Joaquin Valley consisted of "mapping" user services to the transportation problems identified and prioritized. As explained in Section 3.5.1, the mapping process consists of flagging the user services that are needed to resolve, in whole or in part, each problem. Table 3.4 illustrates the user service mapping exercise.

In associating user services with problems, only services that directly and substantially contribute to the problem resolution were flagged. Therefore, user services related to transit, ride matching and other alternatives to single occupant vehicle travel were flagged only for problems that specifically targeted those areas, even though sufficient success in these areas can contribute to reductions in traffic congestion and accidents.

3.6.1.3 Assessment of the Need to Add or Modify User Services

After mapping the identified transportation problems to the candidate user services the results were reviewed to determine whether:

1. The selected services adequately addressed all of the problems and;

2. If user services should be modified or new services created.

As noted in Section 3.5.1, there are a number or reasons why there may be problems not fully addressed through ITS user services that do not necessarily warrant user service creation or modification. First, and most commonly, some problems cannot be entirely solved with ITS

Table 3.4: Candidate User Services Mapped to San Joaquin Valley ITS Problems

User Services	San Joaquin Valley Transportation Problems/Issues																																								
	Priority 1																	Priority 2															Priority 3								
	Traffic congestion, especially due to accidents	Incidents and delay due to weather conditions (including fog, blowing sand and flooding)	Conflicts between trucks and other traffic, including congestion and crashes	Truck routing, including failure to specify routes, enforcement, and the impacts of trucks on roadway surfaces	Traffic signal coordination, especially across jurisdictions	Speeding and red-light running	Connections between transit services, including between local and intercity or regional, and between fixed-route and demand-responsive service	Interjurisdictional coordination of traffic analysis, including construction and maintenance, traffic management and compatibility of equipment	Information for travelers, including traffic and weather/pavement, and including both local and long-distance travelers	Air quality impacts of travel	Delays and congestion at railroad crossings, especially to emergency vehicles	Funding for transportation, including maintenance, road-building and ITS	Inadequate planning data and analysis tools (e.g., GIS), especially across jurisdictions	Under appreciation of the need for and benefits of ITS	Mechanisms and structures to promote long-term agency coordination (i.e., beyond the strategic planning stage)	Managing traffic at incident scenes, especially interjurisdictional coordination of incident response	Lack of truck parking	Insufficient fixed-route transit service, including on service or excessively long travel times	Safety and security on fixed-route transit vehicles and at facilities	Submarginal Roadway Design	Crashes and delay involving agricultural vehicles	Gaps in the roadway system	Coordination among emergency responders, including getting the right equipment on site quickly	Specific traveler information for truckers, including traffic, weather, stop, route and parking and services	Inadequate transit schedule and route information	Inadequate parking for commuters, including park 'n rides	Improved operation of existing public traveler information systems, including more responsiveness and greater consistency	Locating crash scenes, especially in rural areas	Crashes involving pedestrians or bicycles	Delays at commercial vehicle facilities	Finding help in highway emergencies	Inadequate pedestrian or bicycle facilities	Transit schedule adherence	Lack of transit amenities (e.g. street lighting, shelters, benches)	Land use patterns in conflict with transportation objectives	Insufficient demand-responsive transit service, including no service or excessively long travel times	Emergency vehicle delays at railroad crossings	Safety and security on demand-responsive transit vehicles and facilities
National ITS Architecture Services																																									
Travel and Traffic Management																																									
Pre-Trip Travel Information	■	■		■			■		■	■	■						■	■				■		■	■	■															
En-Route Information	■	■		■					■	■	■						■	■				■		■		■															
Route Guidance	■	■		■					■	■	■						■	■				■		■		■															
Ride Matching & Reservation										■																															
Traveler Services Information									■																																
Traffic Control	■	■	■	■	■	■				■							■					■											■								
Incident Management	■	■							■	■							■							■																	
Travel Demand Management	■									■																															
Emissions Testing and Mitigation										■																															
Highway Rail Crossing Safety											■										■											■							■		
Transportation Management																																									
Public Transportation Management							■												■															■				■			
En-Route Transit Information							■		■																■																
Personalized Public Transit							■												■																■		■				
Public Travel Security																				■																				■
Electronic Payment																																									
Electronic Payment Services																																									
Commercial Vehicle Operations																																									
Commercial Vehicle Electronic Clearance										■																								■							
Automated Roadside Safety Inspection										■																								■							
On-Board Safety Monitoring																																		■							
Commercial Vehicle Administrative Processes																																		■							
Hazardous Material Incident Response	■																							■																	
Commercial Fleet Management																		■																■							
Emergency Management																																									
Emergency Notification & Personal Security																														■			■								
Emergency Vehicle Management	■										■						■					■								■										■	
Advanced Vehicle Safety Systems																																■									
Longitudinal Collision Avoidance	■		■																													■									
Lateral Collision Avoidance	■		■																													■									
Intersection Collision Avoidance	■		■																													■									
Vision Enhancement For Crash Avoidance	■		■																													■									
Safety Readiness	■		■																																						
Pre-Crash Restraint Deployment	■		■																																						
Automated Vehicle Operation	■		■																																						
Information Management																																									
Archived Data Function							■						■		■											■															
Emerging (Potential) National ITS Architecture Services																																									
Operations and Maintenance	■						■		■				■		■											■															
Environmental/Weather Information Management	■	■							■																																
Disaster Response and Management	■								■													■																			
Safe Driving Information	■		■		■																											■									
International Freight Logistics																																		■							
Multi-Jurisdictional Emergency Management	■										■				■	■						■																	■	

■ Indicates User Services which substantially address, in whole or in part, the problem/issue

Indicates a problem/issue not completely addressed through the listed ITS user services

For example, although the problem of "inadequate parking" can be in part addressed by providing travelers with convenient and accurate real-time information on parking availability, ITS cannot fully resolve the problem if in fact there is truly a significant shortage of parking. Typically, in order to illuminate the overall picture and to underscore the fact that ITS strategies are typically only part of the solution package, the problem identification process considers all problems, not just those that may have an ITS solution. Referring to Table 3.5, which includes problems such as "funding for transportation, including maintenance and road building", it is evident that the identified San Joaquin Valley transportation problems include many such issues that transcend ITS.

Second, there are some problems that require an ITS related effort that is not, strictly speaking, a user service. For example, "traffic signal coordination across jurisdictions" includes two important facets, the first, the signal coordination itself, is certainly addressed through the "traffic control" user service. However, the second, and arguably the more challenging facet relating to inter-jurisdictional coordination, may require substantial institutional efforts above and beyond the ITS technology.

3.6.1.4 Identification of Problems Not Fully Addressed Through Candidate User Services

The first part of the assessment for the need for new or modified user services—the identification of problems not fully addressed through the candidate user services—is shown in Table 3.5, where these problems are shaded. As indicated in Table 3.5, 20 of the 38 total problems are not fully addressed by the candidate user services. These problems consist primarily of those that cannot be solved through ITS, including lack of funding for road building and lack of roads or other major transportation infrastructure. There are also several problems that cannot be fully addressed by an ITS user service per se, even though the problem does pertain to ITS implementation. For example, "mechanisms and structures to promote long-term agency coordination (i.e., beyond the planning stage)" refers to ITS coordination, but requires institutional actions that are not strictly speaking ITS user services.

3.6.1.5 The Need for New User Services

After "unresolved" problems have been identified, the need to modify or create user services to address those problems is determined. For the San Joaquin Valley, no new or modified user services were recommended at this time, although the option is left open for reconsideration as the development of the system architecture continues and as projects are developed. No new services are recommended because the "unaddressed" problems either require non-ITS solutions (e.g., "land use policies in conflict with transportation"), or because the aspect of the problem that is

not fully addressed, although ITS related, does not warrant an ITS user service per se. Rather, the issue may require a specific project or program, such as a committee structure and policies to facilitate inter-jurisdictional signal coordination.

3.7 San Joaquin Valley ITS User Services

Table 3.6 summarizes the user services that have been selected for application in the San Joaquin Valley. The list includes 35 user services, including 29 of the 31 existing national user services (only ride matching and reservation, and electronic payment services were not selected) and all 6 of the potential new national user services.

Table 3.6 also shows the priority of the highest priority problem addressed by each selected user service, as well as the number of "priority 1" problems addressed, and the total number of problems addressed. The San Joaquin problem priorities are fairly clear, and provided that the user service priorities are viewed as merely a useful way to summarize the overall ITS program focus, viewing Table 3.6 as a prioritized list is recommended.

Table 3.5: San Joaquin Valley Transportation Problems/Issues Not Fully Addressed by User Services

User Services	San Joaquin Valley Transportation Problems/Issues																																						
	Priority 1															Priority 2															Priority 3								
	Traffic congestion, especially due to incidents	Incidents and delay due to weather conditions (including fog, blowing sand and flooding)	Conflicts between trucks and other traffic, including congestion and crashes	Truck routing, including failure to specify routes, enforcement, and the impacts of trucks on roadway surfaces	Traffic signal coordination, especially across jurisdictions	Speeding and red-light running	Connections between transit services, including between local and intercity or regional, and between fixed-route and demand-responsive service	Interjurisdictional coordination of traffic management, including coordination and maintenance, traffic management and compatibility of equipment	Information for travelers, including traffic and weather/pavement, and including both local and long-distance travelers	Air quality impacts of travel	Delays and congestion at railroad crossings, especially to emergency vehicles	Parking for transportation, including maintenance and trade-building and ITS	Inadequate planning data and analysis tools (e.g., GIS), especially across jurisdictions	Under appreciation of the need for and benefits of ITS	Mechanisms and structures to promote long-term agency coordination (i.e., beyond the strategic planning stage)	Managing traffic at incident scenes, especially emergency/multi-agency coordination of incident response	Lack of truck parking	Insufficient fixed-route transit service, including service or excessively long travel times	Safety and security on fixed-route transit vehicles and at facilities	Substandard Roadway Design	Crashes and delay associated with agricultural vehicles	Gaps in the roadway system	Coordination among emergency responders, including getting the right equipment on site quick	Specific traveler information for truckers, including traffic, weather, truck routes and parking and services	Inadequate transit schedule and route information	Inadequate parking for motorists, including park rides	Improved operation of existing public traveler information systems, including more responsiveness and greater consistency	Locating crash scenes, especially in rural areas	Crashes involving pedestrians or bicyclists	Delays at commercial vehicle facilities	Finding help in highway emergencies	Inadequate pedestrian or bicycle facilities	Transit vehicle adherence	Lack of transit amenities to attract riders who have other options	Conflicts pedestrian in conflict with transportation objectives	Insufficient demand-responsive transit service, including no service or excessively long travel times	Emergency vehicle delays at railroad crossings	Safety and security on demand-responsive transit vehicles and facilities
National ITS Architecture Services																																							
Travel and Traffic Management																																							
Pre-Trip Travel Information	●	●		●			●		●	●	●					●	●				●		●		●	●	●												
En Route Information	●	●		●					●	●	●					●	●				●		●				●												
Route Guidance	●	●		●					●	●	●					●	●				●		●				●												
Ride Matching & Reservation																																							
Traveler Services Information									●																														
Traffic Control	●	●	●	●	●	●				●						●					●									●									
Incident Management	●	●							●	●						●							●																
Travel Demand Management										●																													
Emissions Testing and Mitigation										●																													
Highway-Rail Crossing Safety											●										●									●								●	
Transportation Management																																							
Public Transportation Management							●											●																●		●			
En Route Transit Information							●		●																	●													
Personalized Public Transit							●											●														●		●					
Public Travel Security																			●																				●
Electronic Payment																																							
Electronic Payment Services																																							
Commercial Vehicle Operations																																							
Commercial Vehicle Electronic Clearance										●																					●								
Automated Roadside Safety Inspection										●																					●								
On-Board Safety Monitoring																															●								
Commercial Vehicle Administrative Processes																															●								
Hazardous Material Incident Response	●																						●																
Commercial Fleet Management																	●														●								
Emergency Management																																							
Emergency Notification & Personal Security																													●			●							
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Advanced Vehicle Safety Systems																																							
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Lateral Collision Avoidance	●		●																											●									
Intersection Collision Avoidance	●		●																											●									
Vision Enhancement for Crash Avoidance	●		●																											●									
Safety Readiness	●		●																																				
Pre-Crash Restraint Deployment	●		●																																				
Automated Vehicle Operation	●		●																																				
Information Management																																							
Archived Data Function								●					●		●											●													
Emerging (Potential) National ITS Architecture Services																																							
Operations and Maintenance	●							●	●				●		●											●													
Environmental/Weather Information Management	●	●							●																														
Incident Response and Management	●								●														●																
Safe Driving Enforcement	●		●			●																								●									
Intermodal Freight Logistics																															●								
Multi-Jurisdictional Emergency Management	●										●				●	●							●															●	

● Indicates User Services which substantially address, in whole or in part, the problem/issue

Indicates a problem/issue not completely addressed through the listed ITS user services

Table 3.6: San Joaquin Valley ITS User Services

User Service	Priority of Highest Priority Problem Addressed	Number of Priority 1 Problems Addressed	Total Number of Problems Addressed
Pre-Trip Travel Information	1	7	13
Traffic Control	1	7	10
En-Route Information	1	6	11
Route Guidance	1	6	11
Incident Management	1	4	6
Operations and Maintenance	1	4	6
Safe Driving Enforcement	1	3	4
Environmental/Weather Information Management	1	3	3
Multi-Jurisdictional Emergency Management	1	2	6
Archived Data Function	1	2	4
Lateral Collision Avoidance	1	2	3
Intersection Collision Avoidance	1	2	3
Vision Enhancement for Crash Avoidance	1	2	3
Disaster Response and Management	1	2	3
Safety Readiness	1	2	0
Pre-Crash Restraint Deployment	1	2	0
Automated Vehicle Operation	1	2	0
Emergency Vehicle Management	1	1	6
Highway-Rail Crossing Safety	1	1	4
Public Transportation Management	1	1	4
Personalized Public Transit	1	1	4
En-Route Transit Information	1	1	3
Hazardous Materials Incident Response	1	1	2
Travel Demand Management	1	1	1
Emissions Testing and Mitigation	1	1	1
Traveler Services Information	1	1	1
Longitudinal Collision Avoidance	2	0	2
Emergency Notification and Personal Security	2	0	2
Public Travel Security	2	0	2
Commercial Fleet Management	2	0	2
Commercial Vehicle Electronic Clearance	3	0	1
Automated Roadside Safety Inspection	3	0	1
On-Board Safety Monitoring	3	0	1
Commercial Vehicle Administrative Processes	3	0	1
Intermodal Freight Logistics	3	0	1

Market packages define ITS building blocks for meeting user needs within the guidelines defined by the National Architecture. A Market Package is a group of technologies that work together as an ITS application to address an identified, ITS related need or opportunity.

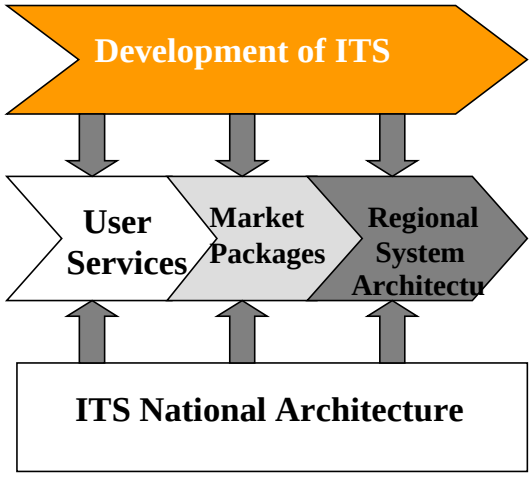


Figure 4.1: Market Package Process

4.0 Market Packages and Functional Requirements

This Section serves to define and identify the high priority or near term market packages for the San Joaquin Valley Intelligent Transportation System (ITS) Strategic Deployment Plan (SDP). As shown in Figure 4.1, market packages play an important role in linking the needs of transportation system managers and users with the regional and national system frameworks or architectures.

The San Joaquin Valley Region ITS TAC determined to take a course of action that paralleled the development of ITS projects with the identification and prioritization of user services and market packages. This document links previously defined high priority user services and preliminary project concepts with market packages as defined in the National Architecture, Version 3.0.

4.1 General Definition of Market Packages

Market Packages provide an accessible, deployment oriented perspective to the National ITS Architecture. They are tailored to fit, separately or in combination, real world transportation problems and needs. Market Packages bring together one or more Equipment Packages that must work together to deliver a given transportation service as well as the Architecture Flows that connect them to other important external systems. In other words, they identify the pieces of the Physical Architecture that are required to implement a particular transportation service. In short a market package is:

- A series of relatively detailed groupings of subsystems, equipment packages, and data flow definitions which can be logically and incrementally deployed over-time to provide increasing capabilities and levels of integration.

- A typical market package contains subsystems, equipment packages, architecture flows and supporting logical architecture elements. The equipment packages were assembled into 63 market packages that are models of what an agency or company might deploy to provide a given user service.

A series of relatively detailed groups of subsystems, equipment packages, and data flow definitions which can be logical and incrementally deployed overtime to provide increasing capabilities and levels of integration.

4.1.1 Additional Terminology Defined

The Market Package definition includes three concepts that require further definition for a complete understanding of Market Packages.

1. Subsystem – For purposes of this document, subsystems are not always "brick and mortar" entities. Each Subsystem is a cohesive set of functional definitions with required interfaces to other Subsystems. Subsystems are functionally, not physically, defined.

Example – A regional implementation may include a single physical "brick and mortar" center that collocates the capabilities from several Subsystems. For instance, a single Transportation Management Center (TMC) may include Traffic Management Subsystem, Transit Management Subsystem, Emergency Management Subsystem, and Information Service Provider Subsystem functionalities. On the other hand, a single Subsystem may be replicated in many different physical "brick and mortar" TMCs in a complex metropolitan area system. For instance, multiple traffic management Subsystems may be implemented in a region reflecting distinct State freeway and local arterial management centers.

2. Equipment Package – A Market Package is implemented with a combination of interrelated equipment. An Equipment Package represents a set of equipment/capabilities that are likely to be purchased by an end-user as a component to an overall system. This equipment often resides in several different Subsystems within the Architecture Framework and may be operated by different stakeholders. Since Equipment Packages are both the most detailed elements of the Physical Architecture and associated with specific Market Packages, there is clear traceability between the interface-oriented Architecture Framework and the deployment-oriented Market Packages.

Example – The Transit Vehicle Tracking Market Package includes vehicle location equipment in the Transit Vehicle Subsystem and a base station element in the Transit Management Subsystem. In this example, all Market Package elements are owned and operated by the same transit stakeholder. In other cases, the Market Package elements are owned and operated by different stakeholders. Many of the ATIS Market Packages require equipment in the Information Service Provider Subsystem that is owned and operated by a public or private information provider and equipment that is acquired and operated by the consumer as part of the Vehicle Subsystem or Personal Information Access Subsystem. Since equipment in different Subsystems may be purchased and operated by different end-users, these Subsystem-specific components may encounter varied deployment.

3. Architecture Flows – Architecture Flows are simply defined as the information and data exchange between and among various Equipment Packages and Subsystems. The Architecture Flows allow for a coordinated overall system operation by following pre-defined interfaces between equipment and subsystems, which may be deployed by different procuring and operating sectors.

To give a more visual understanding of a Market Package, Figure 4.2 shows a Market Package diagram, along with a legend to assist in understanding the diagram. In general, only the most salient elements from the Architecture definition (e.g., directly involved Subsystems, system terminators, and the highest level data flows) are depicted in each graphic to ensure clarity.

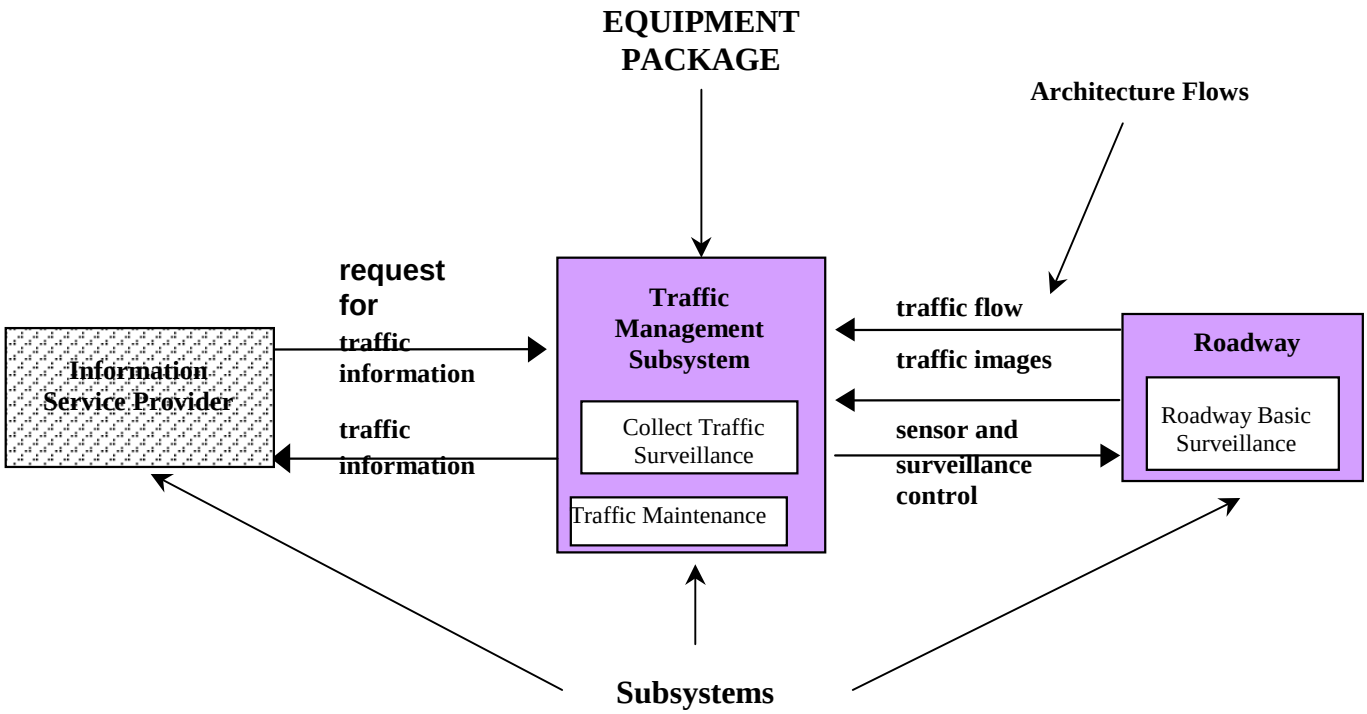
4.1.2 Market Packages Summary

Several different Market Packages are defined in each major area of ITS, which provide a palette of service options at various costs. Market Packages are also structured to segregate services that are likely to encounter technical or non-technical challenges from lower risk services. This approach allows the identification of a subset of the Market Packages that are likely early deployments, projects that make sense to develop in the near term. At the other end of the spectrum, several of the Market Packages represent advanced products or services that will not be available for some time. Many of the Market Packages are also incremental so that more advanced packages can be efficiently implemented by building on common elements that were deployed earlier with more basic packages. The complete list of market packages from The National ITS Architecture version 3.0 is identified in Table 4.1.

4.1.3 Market Package Descriptions

Because the complete list of Market Package descriptions is quite lengthy, only two Market Packages will be described in the body of this document, Figures 4.3 and 4.4. The complete list of Market Package descriptions is included as Appendix A of Working Paper No. 3. This information is also available in the National ITS Architecture Version 3.0; available on CD-ROM and on the Internet at http://www.odetics.com/itsarch/.

Figure 4.2: Example Market Package Diagram



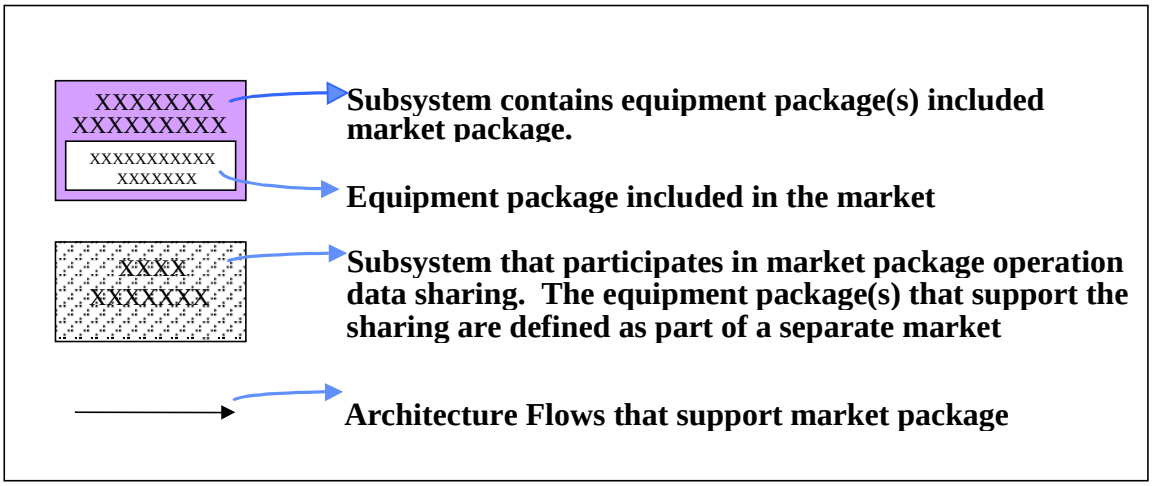
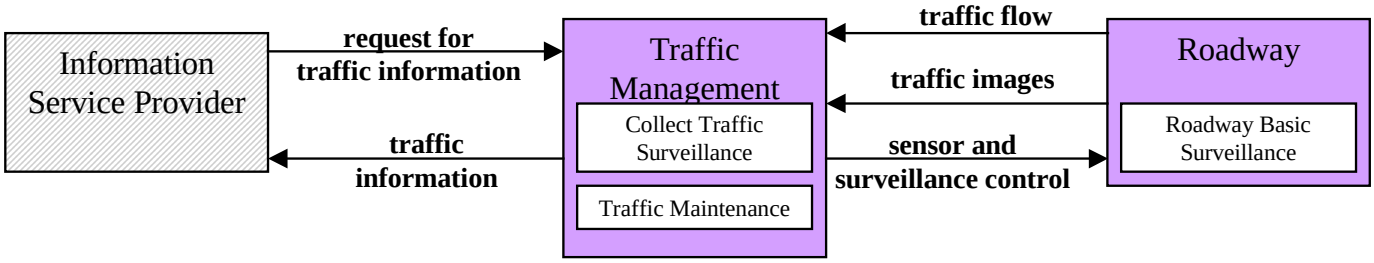


Table 4.1: List of National ITS Market Packages*

Traffic Management (ATMS)			
ATMS1	Network Surveillance	AVCSS1	Vehicle Safety Monitoring
ATMS2	Probe Surveillance	AVCSS2	Driver Safety Monitoring
ATMS3	Surface Street Control	AVCSS3	Longitudinal Safety Warning
ATMS4	Freeway Control	AVCSS4	Lateral Safety Warning
ATMS5	HOV Lane Management	AVCSS5	Intersection Safety Warning
ATMS6	Traffic Information Dissemination	AVCSS6	Pre-Crash Restraint Deployment
ATMS7	Regional Traffic Control	AVCSS7	Driver Visibility Improvement
ATMS8	Incident Management System	AVCSS8	Advanced Vehicle Longitudinal Control
ATMS9	Traffic Forecast and Demand Management	AVCSS9	Advanced Vehicle Lateral Control
ATMS10	Electronic Toll Collection	AVCSS10	Intersection Collision Avoidance
ATMS11	Emissions Monitoring and Management	AVCSS11	Automated Highway System
ATMS12	Virtual TMC and Smart Probe Data		
ATMS13	Standard Railroad Grade Crossing		
ATMS14		Advanced Railroad Grade Crossing	
Commercial Vehicles (CVO)			
ATMS15	Railroad Operations Coordination	CVO1	Fleet Administration
ATMS16	Parking Facility Management	CVO2	Freight Administration
ATMS17	Reversible Lane Management	CVO3	Electronic Clearance
ATMS18	Road Weather Information System	CVO4	CV Administrative Process
ATMS19	Regional Parking Management	CVO5	International Border Electronic Clearance
		CVO6	Weigh-In-Motion
		CVO7	Roadside CVO Safety
		CVO8	On-board CVO Safety
Transit Management (APTS)			
APTS1	Transit Vehicle Tracking	CVO9	CVO Fleet Maintenance
APTS2	Transit Fixed-Route Operations	CVO10	HAZMAT Management
APTS3	Demand Response Transit Operations		
APTS4	Transit Passenger and Fare Management		
APTS5		Transit Security	
Emergency Management (EM)			
APTS6	Transit Maintenance	EM1	Emergency Response
APTS7	Multi-modal Coordination	EM2	Emergency Routing
APTS8	Transit Traveler Information	EM3	Mayday Support
Traveler Information (ATIS)			**ITS Planning**
ATIS1	Broadcast Traveler Information	AD1	ITS Data Mart
ATIS2	Interactive Traveler Information	AD2	ITS Data Warehouse
ATIS3	Autonomous Route Guidance	AD3	ITS Virtual Data Warehouse
ATIS4	Dynamic Route Guidance		
ATIS5	ISP Based Route Guidance		
ATIS6	Integrated Transportation Management/Route Guidance		
ATIS7	Yellow Pages and Reservation		
ATIS8	Dynamic Ridesharing		*From National Architecture version 3.0
ATIS9	In Vehicle Signing		

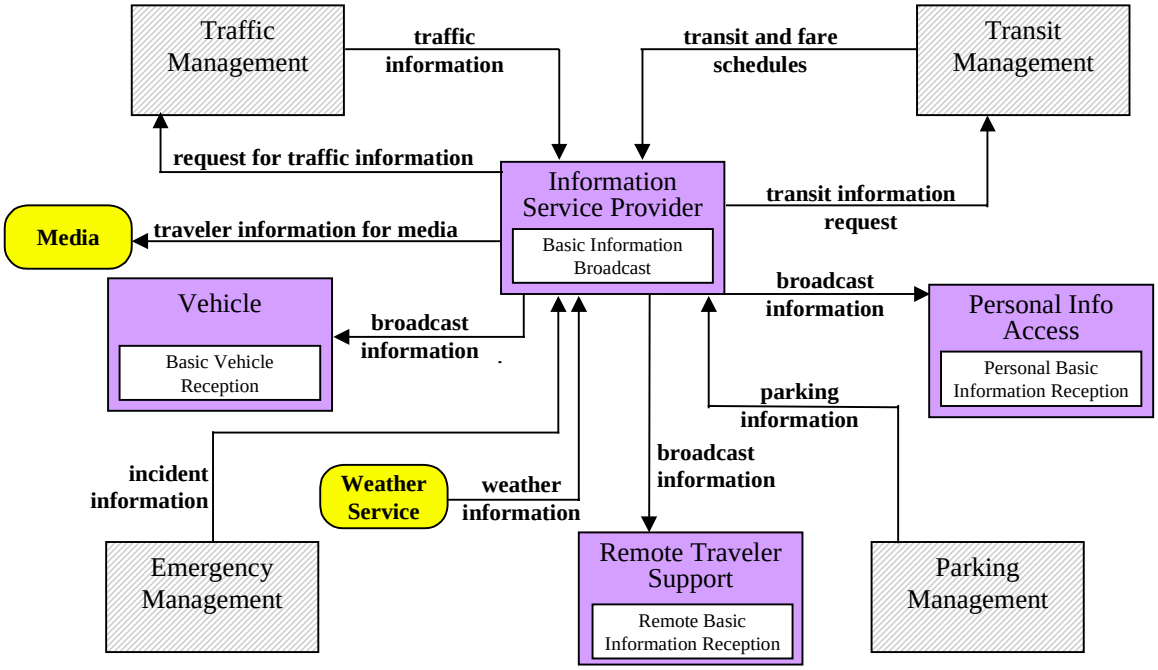
Figure 4.3: Network Surveillance (ATMS1)



*Note: Graphic shows key market package elements. Some elements are omitted for clarity

This Market Package includes traffic detectors, environmental sensors, other surveillance equipment, the supporting field equipment, and wireline communications to transmit the collected data back to the Traffic Management Subsystem. The derived data can be used locally such as when traffic detectors are connected directly to a signal control system or remotely (e.g., when a CCTV system sends data back to the Traffic Management Subsystem). The data generated by this Market Package enables traffic managers to monitor traffic and road conditions, identify and verify incidents, detect faults in indicator operations, and collect census data for traffic strategy development and long range planning. The collected data can also be analyzed and made available to users and the Information Service Provider Subsystem.

Figure 4.4: Broadcast Traveler Information (ATIS1)



*Note: Graphic shows key market package elements. Some elements are omitted for clarity

This market package provides the user with a basic set of ATIS services; its objective is early acceptance. It involves the collection of traffic conditions, advisories, general public transportation, toll and parking information, incident information, air quality and weather information, and the near real time dissemination of this information over a wide area through existing infrastructures and low cost user equipment (e.g., FM subcarrier, cellular data broadcast). Different from the market package ATMS6--Traffic Information Dissemination--which provides the more basic HAR and DMS information capabilities, ATIS1 provides the more sophisticated digital broadcast service. Successful deployment of this market package relies on availability of real-time traveler information from roadway instrumentation, probe vehicles or other sources.

4.2 Market Packages and User Services

The Market Packages are directly traceable to the User Services and often include capabilities that span more than one user service. Conversely, a single User Service sometimes includes a range of incremental capabilities that are segregated into separate Market Packages so that they may be considered separately from a deployment perspective. As a result, there is often a many-to-many relationship between the Market Packages and the User Services.

To illustrate these relationships, consider the following examples:

- Single User Services to Multiple Market Packages – The Traffic Control user service requires distinct surveillance, freeway and surface street traffic control, integrated area-wide traffic control, HOV lane control, and traffic information dissemination capabilities. Since each of these capabilities may be deployed individually by a local jurisdiction, they are allocated to distinct Market Packages. The Market Packages also distinguish between different traffic surveillance approaches. Roadside instrumentation (i.e., the Network Surveillance Market Package) and vehicle probes (i.e. the Probe Surveillance Market Package) are separated due to fundamentally different technical and institutional issues for the two approaches. In total, eleven separate Market Packages provide different mechanisms and levels of support for satisfying the Traffic Control User Service Requirements.

- Single Market Package to Multiple User Services – The HOV and Reversible Lane Management Market Package supports both the Traffic Control and Travel Demand Management User Services since both services could include HOV lane management capabilities. This single deployable package satisfies portions of the requirements associated with both of these user services.

The baseline relationships between User Services and Market Packages as identified in the National ITS Architecture version 3.0 is presented in Table 4.2. As shown in the table, the identified Market Packages support all required User Services.

Only one baseline relationship is identified between the Incident Management User Service and the ATIS Market Packages (ATIS4 – Dynamic Route Guidance). Emergency Services or Public Safety agencies involved in incident management often depend on the same traveler information outlets as the general public. However, those Emergency Services providers could subscribe to a Dynamic Route Guidance service provided by a private sector company to improve incident response times. Therefore, by analogy, implementation of any or all of the other ATIS Market Packages could create a relationship between the Incident Management User Service and the other ATIS Market Packages.

Table 4.2: National ITS Market Packages Versus National ITS User Services

	Market Packages	1.1 - Pre-Trip Travel Information	1.2 - En-Route Driver Information	1.3 - Route Guidance	1.4 - Ride Matching and Reservation	1.5 - Traveler Service Information	1.6 - Traffic Control	1.7 - Incident Management	1.8 - Travel Demand Management	1.9 Emissions Testing and Mitigation	1.10 - Highway - Rail Intersection	2.1 - Public Transportation Management	2.2 - En-Route Transit Information	2.3 - Personalized Public Transit	2.4 - Public Travel Security	3.1 - Electronic Payment Service	4.1 - Commercial Vehicle Electronic Clearance	4.2 - Automated Roadside Safety Inspection	4.3 - On-Board Safety Monitoring	4.4 - Commercial Vehicle Administrative Process	4.5 - Hazardous Material Incident Response	4.6 - Commercial Fleet Management	5.1 - Emergency Notification And Personal	5.2 - Emergency Vehicle Management	6.1 - Longitudinal Collision Avoidance	6.2 - Lateral Collision Avoidance	6.3 - Intersection Collision Avoidance	6.4 - Vision Enhancement For Crash Avoidance	6.5 - Safety Readiness	6.6 - Pre-Crash Restraint Deployment	6.7 - Automated Vehicle Operation	7.1 - Archived Data Function
ATMS	Network Surveillance						◆																										
	Probe Surveillance						◆																										
	Surface Street Control						◆	◆			◆																						
	Freeway Control						◆	◆	◆																								
	HOV Lane Management						◆		◆																								
	Traffic Information Dissemination						◆				◆																						
	Regional Traffic Control						◆																										
	Incident Management System							◆																									
	Traffic Forecast and Demand Management						◆		◆																								
	Electronic Toll Collection								◆							◆																	
	Emissions Monitoring and Management									◆																							
	Virtual TMC and Smart Probes		◆				◆	◆																									
	Standard Railroad Grade Crossing										◆																						
	Advanced Railroad Grade Crossing										◆																						
	Railroad Operations Coordination										◆																						
	Parking Facility Management								◆							◆																	
	Reversible Lane Management						◆	◆																									
	Road Weather Information System		◆				◆	◆																									
	Regional Parking Management								◆							◆																	
APTS	Transit Vehicle Tracking											◆	◆	◆	◆																		
	Transit Fixed-Route Operations											◆	◆																				
	Demand Response Transit Operations											◆	◆	◆																			
	Transit Passenger and Fare Management												◆			◆																	
	Transit Security											◆			◆																		
	Transit Maintenance											◆																					
	Multi-modal Coordination						◆		◆			◆																					
	Transit Traveler Information											◆	◆			◆																	
DIGLATIS	Broadcast Traveler Information	◆	◆										◆																				
	Interactive Traveler Information	◆	◆		◆	◆							◆	◆		◆																	
	Autonomous Route Guidance		◆	◆																													
	Dynamic Route Guidance		◆	◆		◆		◆					◆																				
	ISP Based Route Guidance	◆	◆	◆												◆																	
	Integrated Transp. Management/Route Guidance		◆	◆												◆																	
	Yellow Pages and Reservation	◆	◆		◆	◆							◆			◆																	
	Dynamic Ridesharing	◆	◆	◆	◆				◆				◆	◆		◆																	
	In Vehicle Signing		◆				◆				◆																						
AVCSS	Vehicle Safety Monitoring																												◆	◆			
	Driver Safety Monitoring																												◆				
	Longitudinal Safety Warning																									◆			◆				
	Lateral Safety Warning																										◆		◆				
	Intersection Safety Warning										◆																	◆	◆				
	Pre-Crash Restraint Deployment																												◆	◆			
	Driver Visibility Improvement																														◆		
	Advanced Vehicle Longitudinal Control																									◆							
	Advanced Vehicle Lateral Control																										◆					◆	
	Intersection Collision Avoidance										◆																	◆					
	Automated Highway System																															◆	
CVO	Fleet Administration			◆																		◆											
	Freight Administration																				◆												
	Electronic Clearance																◆			◆													
	CV Administrative Processes																◆			◆													
	International Border Electronic Clearance																◆			◆													
	Weigh-In-Motion																◆																
	Roadside CVO Safety																◆	◆															
	On-board CVO Safety																		◆														
	CVO Fleet Maintenance																	◆	◆			◆											
	HAZMAT Management							◆													◆	◆											
EM	Emergency Response																						◆	◆									
	Emergency Routing						◆																	◆									
	Mayday Support																						◆	◆									
AD	ITS Data Mart																																◆
	ITS Data Warehouse																																◆
	ITS Virtual Data Warehouse																																◆

Of all the market packages displayed in Table 4.2, those relating to freeway and surface street control are already being partially deployed in various portions of the San Joaquin Valley Region. Some emergency management services have deployed vehicle tracking and dispatch integration, but not yet at the regional level.

4.3 Market Package Selection

This section describes the process to identify and loosely prioritize Market Packages for the San Joaquin Valley.

Market Package Selection Process:

- **Identify Candidate Market Packages**
- **Initial Prioritization at Market Packages**
- **Development of Additional MP's**
- **Screening for Candidates**
- **Final Market Package Selection**

The process, as was the case with the selection of San Joaquin Valley User Services began with assemblage of a "master list" of candidate Market Packages. Next, an initial selection and loose prioritization of Market Packages was performed based on the relationship between the previously identified San Joaquin Valley ITS User Services and Market Packages (a relationship documented in the National ITS Architecture; see Section 3.0).

Then the need for development of additional Market Packages was considered; that is, it was determined whether or not the selected Market Packages were sufficient to fully implement the selected User Services. Finally, a screening analysis was performed on the candidate Market Packages, considering issues including the maturity of the technologies imbedded in the various packages, and the ability of the San Joaquin Valley ITS coalition to influence/control the deployment of the various packages. Based on the results of this screening, the initial Market Package selection and loose, relative prioritization was revisited and adjusted. As explained in the Introduction, the prioritization of Market Package merely acknowledges the relative obvious relationship between some packages and the identified high priority needs/problems and User Services. The Market Package priorities do not dictate ultimate project phasing, which considers many additional factors beyond the priority of the Market Packages involved in the projects.

It is at this same step in the process that Market Packages that are of special importance in rural areas are highlighted, a treatment that mirrors the approach currently taken to the urban/rural Market Package distinction in the current version (3.0) of the National ITS Architecture. The logic for such an approach is, generally, that Market Packages are flexible enough to accommodate both their rural and urban deployment, and that additional partitioning of the National ITS Architecture is therefore unnecessary, and to be avoided since it could to some extent impede the very integration that is at the heart of the National ITS Architecture. In the case of the San Joaquin Valley, which includes both heavily urbanized and very rural areas, both with distinct needs and circumstances, it does seem appropriate to highlight Market Packages that may be of particular importance to rural areas. Later, in the development and phasing of

specific projects, these distinctions may provide part of the basis for phasing distinctions for projects in urban and rural areas.

The product of the Market Package selection process is the identified list of San Joaquin Valley ITS Market Packages, loosely prioritized. As described in the Introduction, this list of Market Packages, combined with the identified San Joaquin Valley ITS User Services, become important components and building blocks of the San Joaquin Valley ITS System Architecture. Each of the steps in the Market Package process are described in the subsections which follow.

4.3.1 Development of the Candidate Market Package Master List

A total of 68 Market Packages are included in the Candidate Market Package Master List. These Market Packages represent the 63 National ITS Architecture standard packages, plus six "customized" packages arising from a review of other relevant California SDP Market Packages.

Nationally, and within California, very few custom Market Packages have been developed. In nearly all cases, the National ITS Market Packages are found to be sufficiently broad and flexible to implement identified User Services and address identified needs. However, the COATS project has developed five custom Market Packages that may have relevance to the San Joaquin Valley and which therefore were added to the 63 National ITS Market Packages for consideration:

- Animal-vehicle Collision Countermeasures
- Emergency Vehicle Maintenance
- Dynamic Warning System
- Safe Speed Advisory
- Mobile Traffic Management/Enforcement

The candidate list of Market Packages for the San Joaquin Valley therefore consisted of the 63 Market Packages from the National ITS Architecture shown in Table 4.2 plus five custom packages developed in the COATS project.

4.3.2 Initial Market Package Selection and Relative Prioritization

The initial selection and relative prioritization of San Joaquin Valley ITS Market Packages was made strictly based on the relationship between Market Packages and User Services, and the previously defined relative priorities of the San Joaquin Valley ITS User Services. Specifically, any Market Package that is needed to implement a San

Joaquin Valley User Service was selected, and the relative priority of that Market Package was determined based on the relative priority of the highest priority User Service that package supports. For example, a Market Package that supports two "priority 1" User Services and two "priority 2" User Services was identified as a "priority 1" Market Package.

Table 4.3 identifies the relationship between selected San Joaquin Valley ITS User Services and the candidate Market Packages. For those User Services and Market Packages from the National ITS Architecture, the relationship is taken from the National ITS Architecture (as shown Table 4.2). For the six User Services and five Market packages that did not come from the National ITS Architecture, the assumed relationships have been identified as part of this effort.

Based on the relationships and User Service Priorities shown in Table 4.3, the initial selection and prioritization of San Joaquin Valley Market Packages was determined, and is shown in Table 4.4

As has been the approach used in the National ITS Architecture, no urban/rural distinctions have been made in the selection of User Services for the San Joaquin Valley. The Market Package selection and relative priorities shown in Table 4.4, being based solely on Market Package relationships to San Joaquin Valley User Services, therefore also do not reflect urban/rural distinctions. Market Packages and their priority are only one consideration that will be taken into account in the identification of projects for implementation in the various portions of the San Joaquin Valley. The process to identify and prioritize specific projects in specific locations will be based on local considerations, including rural/urban distinctions.

Table 4.3: Market Package Relationships to User Services

	Market Packages	1.1- Pre-Trip Travel Information	1.2 - En-Route Driver Information	1.3 - Route Guidance	1.5 - Traveler Service Information	1.6 - Traffic Control	1.7 - Incident Management	1.8 - Travel Demand Management	1.9 Emissions Testing and Mitigation	1.10 - Highway – Rail Intersection	2.1 - Public Transportation Management	2.2 - En-Route Transit Information	2.3 - Personalized Public Transit	2.4 - Public Travel Security	4.1 - Commercial Vehicle Electronic Clearance	4.2 - Automated Roadside Safety Inspection	4.3 - On-Board Safety Monitoring	4.4 - Commercial Vehicle Administrative Process	4.5 - Hazardous Material Incident Response	4.6 - Commercial Fleet Management	5.1 - Emergency Notification And Personal Security	5.2 - Emergency Vehicle Management	6.1 - Longitudinal Collision Avoidance	6.2 - Lateral Collision Avoidance	6.3 - Intersection Collision Avoidance	6.4 - Vision Enhancement For Crash Avoidance	6.5 - Safety Readiness	6.6 - Pre-Crash Restraint Deployment	6.7 - Automated Vehicle Operation	7.1 - Archived Data Function	Operations and Maintenance	Environmental/Weather Information Management	Disaster Response and Management	Safe Driving Enforcement	Intermodal Freight Logistics	Multi-Jurisdictional Emergency Management
ATMS	Network Surveillance					◆																															
	Probe Surveillance					◆																															
	Surface Street Control					◆	◆			◆																											
	Freeway Control					◆	◆	◆																													
	HOV Lane Management					◆		◆																													
	Traffic Information Dissemination					◆				◆																											
	Regional Traffic Control					◆																															
	Incident Management System						◆																														
	Traffic Forecast and Demand Management					◆		◆																													
	Electronic Toll Collection							◆																													
	Emissions Monitoring and Management								◆																												
	Virtual TMC and Smart Probes		◆			◆	◆																														
	Standard Railroad Grade Crossing									◆																											
	Advanced Railroad Grade Crossing									◆																											
	Railroad Operations Coordination									◆																											
	Parking Facility Management							◆																													
	Reversible Lane Management					◆	◆																														
	Road Weather Information System		◆			◆	◆																														
	Regional Parking Management							◆																													
APTS	Transit Vehicle Tracking										◆	◆	◆	◆																							
	Transit Fixed-Route Operations										◆	◆																									
	Demand Response Transit Operations										◆	◆	◆																								
	Transit Passenger and Fare Management											◆																									
	Transit Security										◆			◆																							
	Transit Maintenance										◆																										
	Multi-modal Coordination					◆		◆			◆																										
	Transit Traveler Information										◆	◆																									
ATIS	Broadcast Traveler Information	◆	◆									◆																									
	Interactive Traveler Information	◆	◆		◆							◆	◆																								
	Autonomous Route Guidance		◆	◆																																	
	Dynamic Route Guidance		◆	◆	◆		◆					◆																									
	ISP Based Route Guidance	◆	◆	◆																																	
	Integrated Transp. Management/Route Guidance		◆	◆																																	
	Yellow Pages and Reservation	◆	◆		◆							◆																									
	Dynamic Ridesharing	◆	◆	◆				◆				◆	◆																								
	In Vehicle Signing		◆			◆				◆																											
AVCSS	Vehicle Safety Monitoring																										◆	◆									
	Driver Safety Monitoring																										◆										
	Longitudinal Safety Warning																							◆			◆										
	Lateral Safety Warning																								◆		◆										
	Intersection Safety Warning									◆																◆	◆										
	Pre-Crash Restraint Deployment																										◆	◆									
	Driver Visibility Improvement																												◆								
	Advanced Vehicle Longitudinal Control																							◆													
	Advanced Vehicle Lateral Control																								◆					◆							
	Intersection Collision Avoidance									◆																◆											
	Automated Highway System																													◆							
CVO	Fleet Administration			◆																	◆																
	Freight Administration																			◆																	
	Electronic Clearance														◆			◆																			
	CV Administrative Processes														◆			◆																			
	International Border Electronic Clearance														◆			◆																			
	Weigh-In-Motion														◆																						
	Roadside CVO Safety														◆	◆																					
	On-board CVO Safety																◆																				
	CVO Fleet Maintenance															◆	◆				◆																
	HAZMAT Management						◆													◆	◆																
EM	Emergency Response																					◆	◆														
	Emergency Routing					◆																	◆														
	Mayday Support																					◆	◆														

	Market Packages	1.1- Pre-Trip Travel Information	1.2 - En-Route Driver Information	1.3 - Route Guidance	1.5 - Traveler Service Information	1.6 - Traffic Control	1.7 - Incident Management	1.8 - Travel Demand Management	1.9 Emissions Testing and Mitigation	1.10 - Highway – Rail Intersection	2.1 - Public Transportation Management	2.2 - En-Route Transit Information	2.3 - Personalized Public Transit	2.4 - Public Travel Security	4.1 - Commercial Vehicle Electronic Clearance	4.2 - Automated Roadside Safety Inspection	4.3 - On-Board Safety Monitoring	4.4 - Commercial Vehicle Administrative Process	4.5 - Hazardous Material Incident Response	4.6 - Commercial Fleet Management	5.1 - Emergency Notification And Personal Security	5.2 - Emergency Vehicle Management	6.1 - Longitudinal Collision Avoidance	6.2 - Lateral Collision Avoidance	6.3 - Intersection Collision Avoidance	6.4 - Vision Enhancement For Crash Avoidance	6.5 - Safety Readiness	6.6 - Pre-Crash Restraint Deployment	6.7 - Automated Vehicle Operation	7.1 - Archived Data Function	Operations and Maintenance	Environmental/Weather Information Management	Disaster Response and Management	Safe Driving Enforcement	Intermodal Freight Logistics	Multi-Jurisdictional Emergency Management
AD	ITS Data Mart																													◆							
AD	ITS Data Warehouse																													◆							
AD	ITS Virtual Data Warehouse																													◆							
NEW	Animal-vehicle Collision Countermeasures																◆				◆		◆	◆		◆	◆	◆	◆								
NEW	Emergency Vehicle Maintenance																◆					◆															◆
NEW	Dynamic Warning System		◆	◆		◆	◆																											◆			
NEW	Safe Speed Advisory		◆			◆	◆																											◆			
NEW	Mobile Traffic Management/Enforcement																																◆				

	= Priority 1 San Joaquin Valley User Service
	= Priority 2 San Joaquin Valley User Service
	= Priority 3 San Joaquin Valley User Service

Table 4.4: Initial Prioritization of Market Packages

Priority 1 Market Packages		**Priority 1 Market Packages (cont'd)**	
ATMS1	Network Surveillance	AVSS11	Automated Highway System
ATMS2	Probe Surveillance	CVO1	Fleet Administration
ATMS3	Surface Street Control	CVO10	HAZMAT Management
ATMS4	Freeway Control	EM1	Emergency Response
ATMS5	HOV Lane Management	EM2	Emergency Routing
ATMS6	Traffic Information Dissemination	EM3	Mayday Support
ATMS7	Regional Traffic Control	AD1	ITS Data Mart
ATMS8	Incident Management System	AD2	ITS Data Warehouse
ATMS9	Traffic Forecast and Demand Management	AD3	ITS Virtual Data Warehouse
ATMS12	Virtual TMC and Smart Probe Data	New	Emergency Vehicle Maintenance
ATMS17	Reversible Lane Management	New	Dynamic Warning System
ATMS18	Road Weather Information System	New	Safe Speed Advisory
APTS1	Transit Vehicle Tracking	New	Mobile Traffic Management/Enformcement
APTS2	Transit Fixed-Route Operations	**Priority 2 Market Packages**	
APTS3	Demand Response Transit Operations	ATMS10	Electronic Toll Collection
APTS4	Transit Passenger and Fare Management	ATMS11	Emissions Monitoring and Management
APTS7	Multi-modal Coordination	ATMS13	Standard Railroad Grade Crossing
APTS8	Transit Traveler Information	ATMS14	Advanced Railroad Grade Crossing
ATIS1	Broadcast Traveler Information	ATMS15	Railroad Operations Coordination
ATIS2	Interactive Traveler Information	ATMS16	Parking Facility Management
ATIS3	Autonomous Route Guidance	ATMS19	Regional Parking Management
ATIS4	Dynamic Route Guidance	APTS5	Transit Security
ATIS5	ISP Based Route Guidance	APTS6	Transit Maintenance
ATIS6	Integrated Transportation Management/Route Guidance	CVO2	Freight Administration
ATIS7	Yellow Pages and Reservation	CVO3	Electronic Clearance
ATIS8	Dynamic Ridesharing	CVO4	CV Administrative Processes
ATIS9	In Vehicle Signing	CVO5	International Border Electronic Clearance
AVSS1	Vehicle Safety Monitoring	CVO6	Weigh-In-Motion
AVSS2	Driver Safety Monitoring	CVO7	Roadside CVO Safety
AVSS3	Longitudinal Safety Warning	CVO9	CVO Fleet Maintenance
AVSS4	Lateral Safety Warning	**Priority 3 Market Packages**	
AVSS5	Intersection Safety Warning	CVO8	On-board CVO Safety
AVSS6	Pre-Crash Restraint Deployment	New	Animal-vehicle Collision Countermeasures
AVSS7	Driver Visibility Improvement		
AVSS8	Advanced Vehicle Longitudinal Control		
AVSS9	Advanced Vehicle Lateral Control		
AVSS10	Intersection Collision Avoidance		

"New" = Custom (i.e., not included in the National ITS Architecture) Market Packages developed in the California/Oregon Advanced Transportation Systems (COATS) project.

4.3.3 Assessment of the Need for Additional Market Packages

The Market Packages that were initially selected and prioritized through the activity described in Section 4.2 were compared to the list of San Joaquin Valley User Services. The purpose of the comparison was to determine whether all of the User Services can be fully implemented using the selected Market Packages, or whether additional Market Packages are needed. It was determined that at this time, the development of additional Market Packages are not warranted, and that all of the selected User Services can be realized through development of the selected Market Packages.

4.3.4 Market Package Screening Evaluation

Although the relative priority of the User Services they support provides a logical basis for prioritization of Market Packages, other factors do impact prioritization within a given study area, such as the San Joaquin Valley. A screening-level evaluation of the candidate San Joaquin Valley ITS Market Packages was performed focusing on three of these study-area-specific factors: "deployability", "maturity of technology", and "opportunity".

"Deployability" relates to the ability of San Joaquin Valley public agencies to sufficiently influence or control the deployment of the Market Package. For example, the "Surface Street Control" Market Package would be considered highly deployable because it deals primarily with infrastructure owned and operated by public transportation agencies, principally traffic signal systems. On the other hand, the Market Package "In Vehicle Signing" would be considered not very deployable since it relies heavily on privately owned, in-vehicle equipment that is developed by private companies and purchased by private consumers.

"Maturity of technology" describes the extent to which the technology associated with a Market Package is commonly available and proven through real-world deployments. Since traffic signal technologies are relatively proven and widely available, the Market Package "Surface Street Control" would score high on this factor. The "In Vehicle Signing" Market Package, on the other hand, utilizes much less mature technology that, although functional, has not been proven through extensive deployment, and would therefore score lower on this factor.

"Opportunity" describes the extent to which the infrastructure and institutional components required to implement a given Market Package are currently present in the San Joaquin Valley. For example, there are a large number of traffic signals in the San Joaquin Valley, including many which could benefit from more sophisticated technology applications, and there exists a well-established institutional structure for implementing and operating traffic signals.

Therefore the "Surface Street Control" Market Package would score well on this factor. On the other hand, the "In Vehicle Signing" Market Package would score much lower, since practically none of the vehicles operated in the San Joaquin Valley are equipped with the devices necessary to support in-vehicle signing.

Each of the candidate San Joaquin Valley ITS Market Packages were scored on these three criteria on a scale of 1 to 5, with 5 being the best score in each case. A total score was calculated for each candidate package by summing the scores on the three evaluation criteria. Table 4.4 presents the results of the screening level evaluation, with Market Packages listed in descending order based on their total score.

Table 4.5: Market Package Screening Level Evaluation Results

Market Packages Screening Level Evaluation Scoring **Scale: 1 (Low) through 5 (High)**	**Evaluation Criteria**	Deployability	Maturity of Technology	Opportunity	**Total Score**
MARKET PACKAGES – scored					
ATMS3	Surface Street Control	5	5	5	**15**
New	Emergency Vehicle Maintenance	5	5	5	**15**
New	Dynamic Warning System	5	4	5	**14**
New	Safe Speed Advisory	4	4	5	**13**
ATMS1	Network Surveillance	4	5	4	**13**
ATMS4	Freeway Control	4	5	4	**13**
ATMS13	Standard Railroad Grade Crossing	4	4	4	**12**
APTS2	Transit Fixed-Route Operations	4	4	4	**12**
ATIS1	Broadcast Traveler Information	4	4	4	**12**
AD1	ITS Data Mart	4	4	4	**12**
ATMS6	Traffic Information Dissemination	3	4	4	**11**
ATMS18	Road Weather Information System	3	5	3	**11**
APTS4	Transit Passenger and Fare Management	4	4	3	**11**
APTS8	Transit Traveler Information	4	4	3	**11**
ATIS3	Autonomous Route Guidance	4	4	3	**11**
CVO1	Fleet Administration	4	4	3	**11**
CVO2	Freight Administration	3	5	3	**11**
CVO3	Electronic Clearance	3	4	4	**11**
EM2	Emergency Routing	3	4	4	**11**
ATMS5	HOV Lane Management	4	3	3	**10**
APTS1	Transit Vehicle Tracking	3	4	3	**10**
ATIS2	Interactive Traveler Information	3	3	4	**10**
ATIS7	Yellow Pages and Reservation	3	4	3	**10**
CVO6	Weigh-In-Motion	3	3	4	**10**
ATMS7	Regional Traffic Control	3	3	3	**9**
ATMS8	Incident Management System	3	3	3	**9**
ATMS10	Electronic Toll Collection	3	4	2	**9**
ATIS4	Dynamic Route Guidance	3	3	3	**9**
CVO9	CVO Fleet Maintenance	3	3	3	**9**
EM1	Emergency Response	3	3	3	**9**
EM3	Mayday Support	3	3	3	**9**
AD2	ITS Data Warehouse	3	3	3	**9**
AD3	ITS Virtual Data Warehouse	3	3	3	**9**
ATMS2	Probe Surveillance	2	3	3	**8**
ATMS9	Traffic Forecast and Demand Management	3	3	2	**8**
ATMS12	Virtual TMC and Smart Probe Data	3	2	3	**8**
ATMS14	Advanced Railroad Grade Crossing	3	2	3	**8**

	Market Packages Screening Level Evaluation Scoring **Scale: 1 (Low) through 5 (High)** **Evaluation Criteria**	Deployability	Maturity of Technology	Opportunity	**Total Score**
ATMS16	Parking Facility Management	3	3	2	**8**
APTS3	Demand Response Transit Operations	3	3	2	**8**
APTS5	Transit Security	3	3	2	**8**
APTS6	Transit Maintenance	3	3	2	**8**
AVSS1	Vehicle Safety Monitoring	2	5	1	**8**
AVSS7	Driver Visibility Improvement	2	4	2	**8**
CVO4	CV Administrative Processes	2	3	3	**8**
CVO5	International Border Electronic Clearance	2	3	3	**8**
APTS7	Multi-modal Coordination	3	2	2	**7**
ATIS5	ISP Based Route Guidance	2	2	3	**7**
ATIS8	Dynamic Ridesharing	2	3	2	**7**
CVO7	Roadside CVO Safety	2	3	2	**7**
CVO8	On-board CVO Safety	2	3	2	**7**
New	Mobile Traffic Management/Enforcement	3	2	1	**6**
ATMS11	Emissions Monitoring and Management	2	2	2	**6**
ATMS15	Railroad Operations Coordination	2	2	2	**6**
ATMS19	Regional Parking Management	2	2	2	**6**
ATIS6	Integrated Transportation Management/Route Guidance	2	2	2	**6**
ATIS9	In Vehicle Signing	1	3	2	**6**
AVSS4	Lateral Safety Warning	2	2	2	**6**
AVSS6	Pre-Crash Restraint Deployment	2	2	2	**6**
AVSS9	Advanced Vehicle Lateral Control	2	2	2	**6**
CVO10	HAZMAT Management	2	2	2	**6**
New	Animal-vehicle Collision Countermeasures	2	2	1	**5**
ATMS17	Reversible Lane Management	2	2	1	**5**
AVSS3	Longitudinal Safety Warning	2	2	1	**5**
AVSS8	Advanced Vehicle Longitudinal Control	2	2	1	**5**
AVSS11	Automated Highway System	1	2	1	**4**
AVSS2	Driver Safety Monitoring	1	1	1	**3**
AVSS5	Intersection Safety Warning	1	1	1	**3**
AVSS10	Intersection Collision Avoidance	1	1	1	**3**

4.3.5 Adjustments to Initial Market Package Prioritization

Table 4.6 compares the results of the Market Package screening evaluation with the initial prioritization based strictly on relationships between Market Packages and the relative priorities of the User Services they support (see Section 4.2). The Market Packages are listed according to the priorities established in the initial selection/prioritization process, with the relative priority of the each Market Package noted based on the screening level evaluation. For example, Market Packages that scored roughly in the upper third in the screening evaluation—those in Table 4.5 with a total score of 10 or higher—have been highlighted in black. Those that scored in the middle third—scores of 7, 8 or 9—are shown highlighted in gray. Those that scored in the lower third—scores of 6 or lower—have no shading.

In assessing the comparisons shown in Table 4.6, the focus was placed on discrepancies between priority 1 and priority 3 rankings. That is, on Market Packages that were priority 1 based on their relationship to priority 1 User Services, but which were priority 3 based on the screening level evaluation of their potential for deployment in the San Joaquin Valley, and vice versa. Distinctions between priority 1 and priority 2, and between priority 2 and priority 3 were dismissed, given that the priorities are loose, relative, and as described previously, do not determine the priority or ultimate phasing of specific projects.

Referring to Table 4.6, it can be seen that there are no examples of Market Packages that scored high in the screening evaluation, but which had been prioritized low (priority 3) based on the User Service relationships. Turning to the reverse case, it can be seen that 14 Market Packages prioritized high based on the User Service relationships scored low in the screening evaluation. In all cases, these 14 Market Packages, although necessary to implement User Services that can help address identified San Joaquin Valley ITS needs/problems, were found to either: be beyond the scope and control of the public agencies in the San Joaquin Valley, reliant on immature technologies, or based on infrastructure and/or institutional structures that are not present in the Valley. These 14 Market Packages were therefore down-graded in the final prioritization; 12 of them to priority 3 status and two of them ("HAZMAT Management" and "Mobile Traffic Management/Enforcement") were down-graded only to priority 2 status, given their strong relationship to identified San Joaquin Valley ITS needs/problems.

Table 4.6: Comparison of Market Package Screening Level Evaluation Results to Initial Prioritization

Priority 1 Market Packages		**Priority 1 Market Packages (cont'd)**	
ATMS1	Network Surveillance	AVSS11	Automated Highway System
ATMS2	Probe Surveillance	CVO1	Fleet Administration
ATMS3	Surface Street Control	CVO10	HAZMAT Management
ATMS4	Freeway Control	EM1	Emergency Response
ATMS5	HOV Lane Management	EM2	Emergency Routing
ATMS6	Traffic Information Dissemination	EM3	Mayday Support
ATMS7	Regional Traffic Control	AD1	ITS Data Mart
ATMS8	Incident Management System	AD2	ITS Data Warehouse
ATMS9	Traffic Forecast and Demand Management	AD3	ITS Virtual Data Warehouse
ATMS12	Virtual TMC and Smart Probe Data	New	Emergency Vehicle Maintenance
ATMS17	Reversible Lane Management	New	Dynamic Warning System
ATMS18	Road Weather Information System	New	Safe Speed Advisory
APTS1	Transit Vehicle Tracking	New	Mobile Traffic Management/Enformcement
APTS2	Transit Fixed-Route Operations	**Priority 2 Market Packages**	
APTS3	Demand Response Transit Operations	ATMS10	Electronic Toll Collection
APTS4	Transit Passenger and Fare Management	ATMS11	Emissions Monitoring and Management
APTS7	Multi-modal Coordination	ATMS13	Standard Railroad Grade Crossing
APTS8	Transit Traveler Information	ATMS14	Advanced Railroad Grade Crossing
ATIS1	Broadcast Traveler Information	ATMS15	Railroad Operations Coordination
ATIS2	Interactive Traveler Information	ATMS16	Parking Facility Management
ATIS3	Autonomous Route Guidance	ATMS19	Regional Parking Management
ATIS4	Dynamic Route Guidance	APTS5	Transit Security
ATIS5	ISP Based Route Guidance	APTS6	Transit Maintenance
ATIS6	Integrated Transportation Management/Route Guidance	CVO2	Freight Administration
ATIS7	Yellow Pages and Reservation	CVO3	Electronic Clearance
ATIS8	Dynamic Ridesharing	CVO4	CV Administrative Processes
ATIS9	In Vehicle Signing	CVO5	International Border Electronic Clearance
AVSS1	Vehicle Safety Monitoring	CVO6	Weigh-In-Motion
AVSS2	Driver Safety Monitoring	CVO7	Roadside CVO Safety
AVSS3	Longitudinal Safety Warning	CVO9	CVO Fleet Maintenance
AVSS4	Lateral Safety Warning	**Priority 3 Market Packages**	
AVSS5	Intersection Safety Warning	CVO8	On-board CVO Safety
AVSS6	Pre-Crash Restraint Deployment	New	Animal-vehicle Collision Countermeasures
AVSS7	Driver Visibility Improvement		
AVSS8	Advanced Vehicle Longitudinal Control		
AVSS9	Advanced Vehicle Lateral Control		
AVSS10	Intersection Collision Avoidance		

	= Scored high in Market Package Evaluation (e.g., score of 10 or higher)
	= Scored medium in Market Package Evaluation (e.g., score from 7 to 9)
	= Scored low in Market Package Evaluation (e.g., score less than 7)

4.3.6 Final San Joaquin Valley ITS Market Packages

Table 4.7 presents the San Joaquin Valley ITS Market Packages. The relative priorities reflect the adjustments made based on the screening level evaluation.

As noted in the introduction to this section, consistent with the approach taken to date in the National ITS Architecture, separate rural User Services or Market Packages are not being developed for the San Joaquin Valley. However, some Market Packages are particularly relevant to the rural environment and it is useful to identify them, as has been done in Table 4.7. This identification is not definitive, but represents a basis for possible future delineation of urban/rural distinctions in the San Joaquin Valley ITS system architecture and/or in program and project recommendations.

As noted in Table 4.7, the identification of Market Packages as particularly applicable to the rural environment is based on information in version 3.0 of the National ITS Architecture, specifically, pages 89 through 98 of the December 1999 "Market Packages" document. That document identifies 19 of the National ITS Market Packages as "highly applicable to rural user needs and suitable for the rural environment". These 19 packages are identified in Table 4.7 and additionally, two of the San Joaquin Valley Market Packages that were developed through the COATS effort have been identified as being particularly applicable to the rural environment.

Table 4.8 summarizes issues that should be considered for the prioritized Market Packages in terms of deployment of these priorities.

Table 4.7: Revised (Final) San Joaquin Valley ITS Market Packages

Priority 1 Market Packages		**Priority 2 Market Packages**	
ATMS1	Network Surveillance	ATMS10	Electronic Toll Collection
ATMS2	Probe Surveillance	ATMS11	Emissions Monitoring and Management
ATMS3	Surface Street Control	ATMS13	Standard Railroad Grade Crossing
ATMS4	Freeway Control	ATMS14	Advanced Railroad Grade Crossing
ATMS5	HOV Lane Management	ATMS15	Railroad Operations Coordination
ATMS6	Traffic Information Dissemination	ATMS16	Parking Facility Management
ATMS7	Regional Traffic Control	ATMS19	Regional Parking Management
ATMS8	Incident Management System	APTS5	Transit Security
ATMS9	Traffic Forecast and Demand Management	APTS6	Transit Maintenance
ATMS12	Virtual TMC and Smart Probe Data	CVO2	Freight Administration
ATMS18	Road Weather Information System	CVO3	Electronic Clearance
APTS1	Transit Vehicle Tracking	CVO4	CV Administrative Processes
APTS2	Transit Fixed-Route Operations	CVO5	International Border Electronic Clearance
APTS3	Demand Response Transit Operations	CVO6	Weigh-In-Motion
APTS4	Transit Passenger and Fare Management	CVO7	Roadside CVO Safety
APTS7	Multi-modal Coordination	CVO9	CVO Fleet Maintenance
APTS8	Transit Traveler Information	CVO10	HAZMAT Management
ATIS1	Broadcast Traveler Information	New	Mobile Traffic Management/Enforcement
ATIS2	Interactive Traveler Information	**Priority 3 Market Packages**	
ATIS3	Autonomous Route Guidance	CVO8	On-board CVO Safety
ATIS4	Dynamic Route Guidance	New	Animal-vehicle Collision Countermeasures
ATIS5	ISP Based Route Guidance	ATMS17	Reversible Lane Management
ATIS7	Yellow Pages and Reservation	ATIS6	Integrated Transportation Management/Route Guidance
ATIS8	Dynamic Ridesharing	ATIS9	In Vehicle Signing
AVSS1	Vehicle Safety Monitoring	AVSS2	Driver Safety Monitoring
AVSS7	Driver Visibility Improvement	AVSS3	Longitudinal Safety Warning
CVO1	Fleet Administration	AVSS4	Lateral Safety Warning
EM1	Emergency Response	AVSS5	Intersection Safety Warning
EM2	Emergency Routing	AVSS6	Pre-Crash Restraint Deployment
EM3	Mayday Support	AVSS8	Advanced Vehicle Longitudinal Control
AD1	ITS Data Mart	AVSS9	Advanced Vehicle Lateral Control
AD2	ITS Data Warehouse	AVSS10	Intersection Collision Avoidance
AD3	ITS Virtual Data Warehouse	AVSS11	Automated Highway System
New	Emergency Vehicle Maintenance		
New	Dynamic Warning System		
New	Safe Speed Advisory		

	= Particularly applicable to rural/intercity areas (identified as "highly applicable to rural needs and suitable for the rural environment) in the National ITS Architecture)

Table 4.8: Priority Market Package Considerations

ID	Market Packages	Regional Considerations	Other Considerations
ATMS	**Advanced Transportation Management Systems**		
ATMS01	Network Surveillance*	➢ Existing deployments by Caltrans & Large Cities ➢ Near-term expansion along new freeway and existing routes ➢ Previous lack of common standards	➢ Status of NTCIP Class B ➢ Caltrans standardization plans/specs ➢ Potential of 2070
ATMS03	Surface Street Control*	➢ Existing City of Fresno Implementation Plan ➢ Planned Cities of Fresno/Clovis & County coordination ➢ Some local cities have QN4 deployment	➢ Status of NTCIP Class B ➢ Potential of 2070
ATMS04	Freeway Control*	➢ Existing freeway surveillance/ramp metering deployments + RWIS deployments ➢ Current lack of integrated ATMS software for Caltrans ➢ Desire to share data/info. ➢ Need to coordinate surface streets w/freeways ➢ Expanding infrastructure	➢ Statuses of NTCIP Class B/E ➢ Caltrans standards ➢ Potential for 2070 ➢ Caltrans TMC Standardization Plan
ATMS06	Traffic Information Dissemination	➢ Co-location of CHP MIO & Caltrans TMC ➢ Extensive CMS deployment ➢ Problems w/mobile CMS ➢ Lack of communications ➢ Disconnect between collection & dissemination of traffic information	➢ Status of NTCIP Class B ➢ Relationships with neighboring regions
ATMS07	Regional Traffic Control	➢ Builds on surface street & freeway control ➢ Desire to create inter-jurisdictional links exist ➢ Institutional arrangements lacking ➢ Common standards lacking ➢ Likely to be longer term deployment	➢ Status of NTCIP Class B (Maybe something simpler) ➢ Caltrans TOPP Policies on information sharing ➢ Examples of shared control exist within the State ➢ Potentially follow another Region's architecture
ATMS08	Incident Management System	➢ Caltrans lack of complete ATMS software ➢ Creation of Incident Mgmt. Task Force ➢ May be slightly longer term deployment	➢ Caltrans TMC Standardization Plan ➢ Most of the basic functionality available in ATMS v2.0
APTS	**Advanced Public Transportation Systems**		
APTS01	Transit Vehicle Tracking*	➢ Some systems already deployed ➢ Need to expand existing deployment ➢ Radio system lacking for smaller transit agencies ➢ Possibility to deploy Regions on common system	➢ J1708 – Region is not compliant ➢ Instability of vendor market a concern
APTS02	Transit Fixed Route Operations*	➢ A few systems deployed	➢ Costs

Table 4.8: Priority Market Package Considerations

ID	Market Packages	Regional Considerations	Other Considerations
		➢ Small services operates separately ➢ Institutional considerations need to be resolved to allow better coordination ➢ Need to expand the system and add transit information linkage	➢ Market options somewhat limited
APTS03	Demand Responsive Transit Operations	➢ Paratransit radio systems inadequate/diverse ➢ Lack of AVL ➢ Need for equipment that matches regional standards	➢ Costs ➢ Several comprehensive packages on the market
APTS04	Transit Passenger & Fare Management	➢ Existing GFI systems in place ➢ Desire for upgrades ➢ Desire for commonality among various transit services ➢ Same standards/different equipment ➢ Institutional arrangements would require adjustment.	➢ Status of national payment instrument standards
APTS08	Transit Traveler Information	➢ Existing TrMS to serve as basis ➢ Focus on transit stations/en-route real-time information ➢ Lack of communications a consideration	➢ Many deployments to serve as examples (SmartTrek/TravelTIP/etc.) ➢ NTCIP should be considered ➢ Web interface (ala SmartTrek should be considered)
ATIS	**Advanced Traveler Information Services**		
ATIS01	Broadcast Traveler Information*	➢ Need to enhance traffic info., availability accuracy, timeliness ➢ CHP does current traffic spots (some) ➢ Potential lack of broad market for near-term ➢ Only existing dissemination method	➢ Comm. standards/ATMS deployment would assist ➢ RF Subcarrier possibilities should be reviewed ➢ Potential coordinated deployment with neighboring regions/State
ATIS02	Interactive Traveler Information	➢ Even greater need for accurate and complete traffic data ➢ Ability to promote intermodal options	➢ Possible coordination with neighboring regions/State
ATIS05	ISP Based Route Guidance	➢ Limited ability to attract private ISP ➢ Possibility to link with neighboring regions/State	➢ Potential use of TravelTIP/TravInfo architecture ➢ Ties to YATI ➢ Need linkage with the State
ATIS07	Yellow Pages and Reservations	➢ Market may be limited ➢ Location/extent of recreational travel a positive	
EM	**Emergency Services**		
EM01	Emergency Response*	➢ Incident Mgmt. Task Force a positive ➢ New/additional inter-agency agreements required. ➢ Improved integration of traffic/emergency response systems needed	➢ Framework for cooperation established by FHWA, ITE, and other orgs ➢ Proven in other regions that institutional issues can be overcome

Table 4.8: Priority Market Package Considerations

ID	Market Packages	Regional Considerations	Other Considerations
EM02	Emergency Routing	➢ Accurate/timely data critical ➢ May be appropriate to run as semi-manual system with human interface to traffic data ➢ Emergency services have expressed desire for traffic data	➢ Improved algorithms needed to enhance real-time response
ITS01	**ITS Planning**	➢ Need for data accurate for modeling & air quality purposes ➢ Gaps in freeway/street sensor infrastructure ➢ Linkage to planners needed	➢ Improvements are being made to many existing software titles to allow simplified report functions

5.0 Regional System Architecture

The purpose of this Section is to describe the recommended system architecture on which future ITS projects in the San Joaquin Valley will be based. This Section complies with the outline in the US DOT Final Rule 940.9 and 940.11 on Regional ITS Architecture development, dated Monday, January 8, 2001.

This Section contains the regional system architecture for the San Joaquin Valley Region. A system architecture is meant to act as a blueprint within which the regional deployment of ITS can occur. This architecture supports the National Architecture and the statewide architecture. It does not replace these two documents.

The Regional Architecture document (Appendix C) addresses the following requirements:

- Regional Description – A description of the region the architecture must serve.
- Regional Stakeholders – Who will participate in developing the system.
- Operational Concept – How the subsystems will be operated.
- Operations Agreements – Identification of agreements that exist or must be reached.
- Functional Descriptions – Description of how the systems will operate.
- Information Flows and Interface Requirements – Definition of how data will be shared in the system.
- Standards – Identification of what standards apply to the region.
- Project Phasing and Sequencing – A flow chart of how the projects depend on each other.

5.1 Architecture Overview

The San Joaquin Valley Region has the advantage of developing its system architecture following the development of several other system architectures in neighboring regions including the Bay Area, Sacramento, Kern County, Fresno County, Central Coast and Southern California. Where feasible, the San Joaquin Valley Region should maximize the effectiveness of its system integration efforts and minimize costs by drawing on integration efforts from these other regions. The California Alliance for Advanced Transportation Systems (CAATS) completed a proposed statewide ITS architecture, with an emphasis on the integration of statewide Advanced Traveler Information Systems. The recommended San Joaquin Valley architecture recognizes this effort and is flexible enough to fit within the guidelines of the statewide effort. In fact, the San Joaquin Valley Region will depend heavily upon statewide

ATIS integration for fulfillment of traveler information needs in this Plan.

The details contained in a system architecture vary from situation to situation. The architecture contained in this Section outlines potential paths/methods for the connection and integration of systems. It also provides guidelines on the relationships between the various ITS project elements discussed in Section 9.0 and national ITS standardization efforts currently underway. This architecture uses National Architecture Market Packages, suitably customized for the San Joaquin Valley Region, as a baseline for intermodal system connectivity. The San Joaquin Valley Region architecture also recognizes the US DOT Critical Standards currently in development as the key standards for regional project development. These standards are discussed in Section 5.8 and Appendix C.

5.1.1 Basic Architecture Overview

In its most basic form, an architecture is a set of rules that facilitate the building of systems and that allow these systems to communicate and interoperate after being built.

What is an architecture, and why is it important to know about architectures? An ITS architect is to an ITS system as a building architect is to a building. A building architect could not build a structure without a set of plans. Neither could an ITS architect build a complex regional ITS system without a set of plans. These plans are the system architecture. It is important to distinguish between an architecture built for planning and implementation guidance and an architecture used to build actual working systems. In our discussions regarding this Plan, the former context is most appropriate. We are using best practice in architecture development within California to fit the San Joaquin Valley Region operational and institutional environment.

To put the concept of an ITS architecture into the real world, consider the following. The San Joaquin Valley Region desires to build an integrated, regional ITS management systems consisting of integrated freeway and arterial traffic management elements. These elements include:

- One or more regional Transportation Management Centers that control a set of freeway management devices;
- One or more local Transportation Management Centers that control arterial traffic signals for a series of connected cities;
- The freeway management devices (ramp meters, Dynamic Message Signs (DMS), CCTVs and Highway Advisory Radio (HAR)) and arterial traffic signals;
- The vehicles that drive the freeways and arterials; and
- The communications systems that allow these elements to communicate.

The architecture describes how these elements will interoperate by detailing element locations, physical communications links, and most importantly what kinds of information must be transferred

among the different elements. The architecture also tells us what "functions" are performed by each of the "Smart Corridor" elements. Later in this Section we will see how an architecture can be gradually built up using the market packages.

An architecture is important in the development of complex systems because it provides detailed guidance on how to design the systems and because it provides a vehicle to decompose larger systems into more understandable subsystems. An architecture is particularly important if more than one system is to be built and these systems must talk to each other or if multiple systems will be expanded over a period of time. In the San Joaquin Valley Region both of these elements are clearly present.

A complex systems development process includes concept development, needs assessment, functional requirements definition and architecture development. To develop the architecture we first need to know about the system vision (concept) and what proposed system users need, in other words, what are their requirements? What do they want the system to do? At this point the details of physical elements such as communications links and traffic signals and TMC's are not important. The next step is to take the user needs and develop functional requirements. Here the emphasis is on what the proposed system must do to meet the users' needs. In the process of developing functional requirements, we determine what functions must be performed by the system and what data must flow between the functions. The final step in the system development process is to allocate the functional requirements to hardware, software or humans (operators). Part of this last process includes the development of an architecture for the system. This is referred to as High Level Design, or in some circles Preliminary Design. This essentially defines the system engineering process which is required by Part 940 Federal Regulations relating to National Architecture.

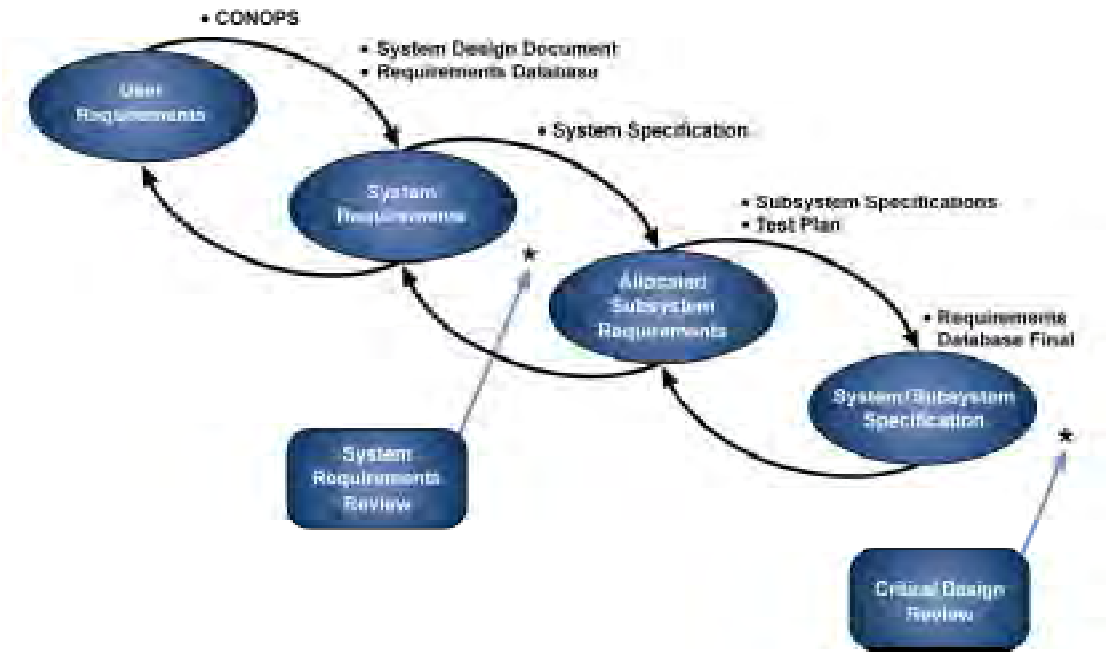


Figure 5.1: Presents the System Engineering Process for the Design of ITS Projects

5.1.2 Architecture Definitions

When we speak of an architecture, we mean the logical and physical relationship of certain defined subsystems within a system.

A system can be thought of in many ways: the Internet is a system. The highway network within the San Joaquin Valley Region is a system. The Caltrans Transportation Management Center in Fresno is a system. For purpose of our representation in this Plan, we define a system as the collection of subsystems including communications networks, operations centers, roadside devices and multimodal vehicles that control or operate on the region's transportation network in its broadest sense: roads, railroads and airports.

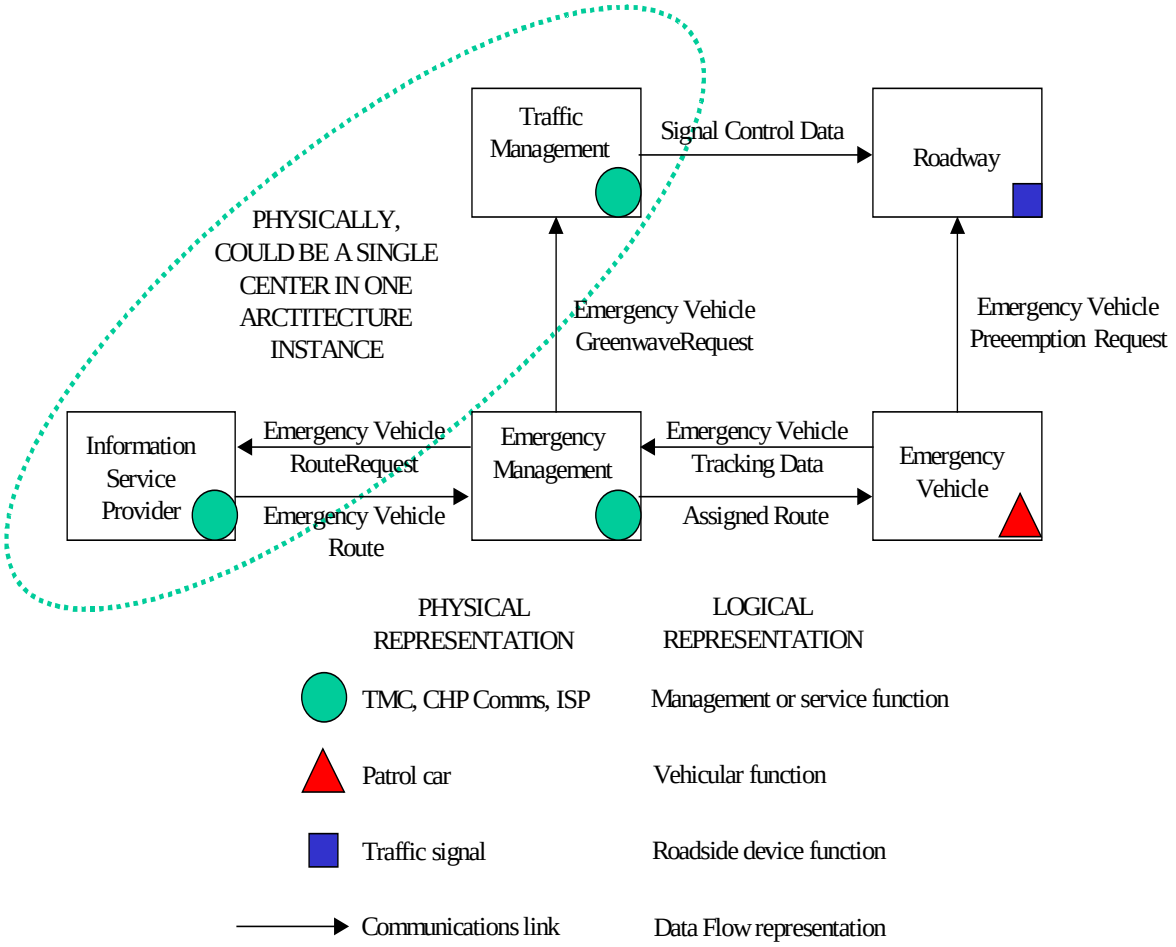
Subsystems can be directly related to the National ITS Architecture through what is commonly referred to as the "Sausage Diagram". Communications network subsystems range from underground fiber optic networks to commercial broadcast stations and paging networks. Operations Center subsystems are as diverse as the CHP communications center in Fresno, a local Traffic Management Center in the city of Bakersfield, a private information provider or a private truck dispatch facility desiring information about travel conditions in San Joaquin County. Roadside subsystems include railroad warning signals, motorist aid call boxes, traffic signals, changeable message signs, vehicle detection loops in the pavement and closed circuit TV monitors. Vehicle subsystems include cars, buses, commercial vehicles, emergency vehicles, trains (passenger and freight) and aircraft.

What is the difference between the physical and logical elements of an architecture? The physical architecture largely represents the communications links and the components that we can touch and feel that are connected by these links: operations centers, traffic lights, railroad crossing signals, loops in the pavement. The logical architecture is harder to define and to visualize, but it includes the functions (actions to be performed), and the flow of information between the functions that the system is supposed to accomplish.

For example, one of the Market Packages chosen for the transportation system in the San Joaquin Valley Region is Emergency Vehicle Routing. To perform this routing, the Emergency Management function needs to have real-time traffic conditions for the roadway links that emergency vehicles will travel to their destination. Conversely, the Information Service Provider function providing real-time traffic information needs to have the real-time location of the vehicle so it can intelligently select the routes for which traffic data is needed. If traffic signal preemption is required, additional functions and data flows are needed. These functions, and the data flows between them, represent a piece of the logical architecture of the transportation system. Figure 5.1 illustrates the separation of logical and physical architectures. The diagram shows the appropriate functions and data flows, therefore it represents a logical architecture needed to implement this Market Package. The physical architecture would include the CHP communications center, the Caltrans TMC (which we will assume includes the Information Service Provider function), the patrol car, and in the case illustrated, traffic signals along the route that will be preempted. The physical architecture would also include the communications links necessary to support these data flows. These would include leased lines or other wireline networks and short-range wireless radios.

Figure 5.2 also illustrates another important point about the separation of logical and physical architectures: a physical implementation may include any combination of logical functions. As shown, the functions of Traffic Management and Information Service Provider are combined in a single center, in this case, the Caltrans TMC. The architecture design process consists of developing a logical architecture based on user needs and functional requirements as previously discussed, and then allocating the logical functions to physical entities to build a physical architecture. Once the physical architecture is completed, the system design process can start, and specific centers or other system elements can be designed and developed. In the context of this Plan, the architectural design process will continue during development of the Plan. The system design process is an activity that occurs during individual project deployments. There will be, however, a continuous refinement process for the architecture as project requirements, technology options and institutional relationships change over time.

Figure 5.2: Example Of Logical And Physical Architecture For Emergency Vehicle Routing Market Package.



5.1.3 Logical Architecture for San Joaquin Valley

The logical architecture for the San Joaquin Valley Region is depicted in some detail by the consolidation and tailoring of those high priority Market Packages that were summarized in the Market Package Report, Working Paper #3. This amalgamation is provided in Section 4 of this report. The illustration in Figure 5.3 is used as an overview and introduction to the region's logical architecture. This illustration also serves to highlight some basic architectural design guidelines for the region as derived from Market Package priorities as discussed in Working Paper #3:

- There is an implied hierarchical relationship between the regional TMC's (Caltrans Districts 6 and 10) and local TMC's (examples: the Cities of Fresno, Stockton and Bakersfield TMC's) in the Figure. At least one level of local TMC's will be accommodated in the San Joaquin Valley Region's ITS architecture.
- The District 6 and 10 TMC's will be connected to the TMC's in Los Angeles, the Bay Area and Sacramento on the statewide Asynchronous Transfer Method (ATM) fiber optic network.
- Traveler information will be coordinated through a publicly or privately-operated Independent Service Provider which will generally follow the TravelTIP and TravInfo models being developed in Orange County and the Bay Area respectively. Multiple Independent Service Providers will be encouraged to participate in the region's Advanced Traveler Information System deployment;
- The Internet will be exploited to its full advantage for the dissemination of travel and incident information. The CHP is already accomplishing this for its communications centers' incident logs statewide;
- It may not be necessary to have centralized Transit Management Centers within subregions, but instead each major transit property could operate independent centers. These centers could also be remoted from a central database. In either case, the architecture goal is that these centers would be interoperable with each other and would send and receive information to other modal management centers (e.g. freeway, public safety) in the same manner;
- Private shuttle operators will be integrated into the ITS system as their business interests dictate;
- Although the Archive Data function was not specifically identified in the Project List, ITS provides a sufficient quantity and quality of data to support this process, therefore we show it in the logical architecture;

- The Emergency Management function should link all public safety centers in the region among themselves and with key traffic management centers. Several models exist around the U.S. that provide guidance on how to achieve this goal;
- Freeway Service Patrols (in the Stockton and Fresno area) and Cellular 9-1-1 will continue to be the primary sources of incident detection from the traveling public. Call boxes may be considered as another source of incident reporting. These systems will be considered complementary;
- Tailored traveler information services will be provided to commercial fleet operators through one or more Independent Service Providers as well as through the Internet; and
- Regional and local TMC's will be integrated into major "Smart Corridors" which will encompass State routes in the urban areas.

5.1.4 Physical Architecture for San Joaquin Valley

As previously noted, the physical architecture consists of recognizable subsystems such as communications links, traffic signal systems, vehicles, TMC's and emergency dispatch centers. Figure 5.3 is the generally accepted way to view the physical aspects of the region's architecture and has been tailored from the National ITS Architecture.

Figure 5.3 shows the major elements in the physical architecture: centers, roadside devices, vehicles, remote access and communications links. The San Joaquin Valley Region entities consist of the items listed below (not necessarily all-inclusive, with ITS National Architecture Subsystem abbreviated notation in parenthesis).

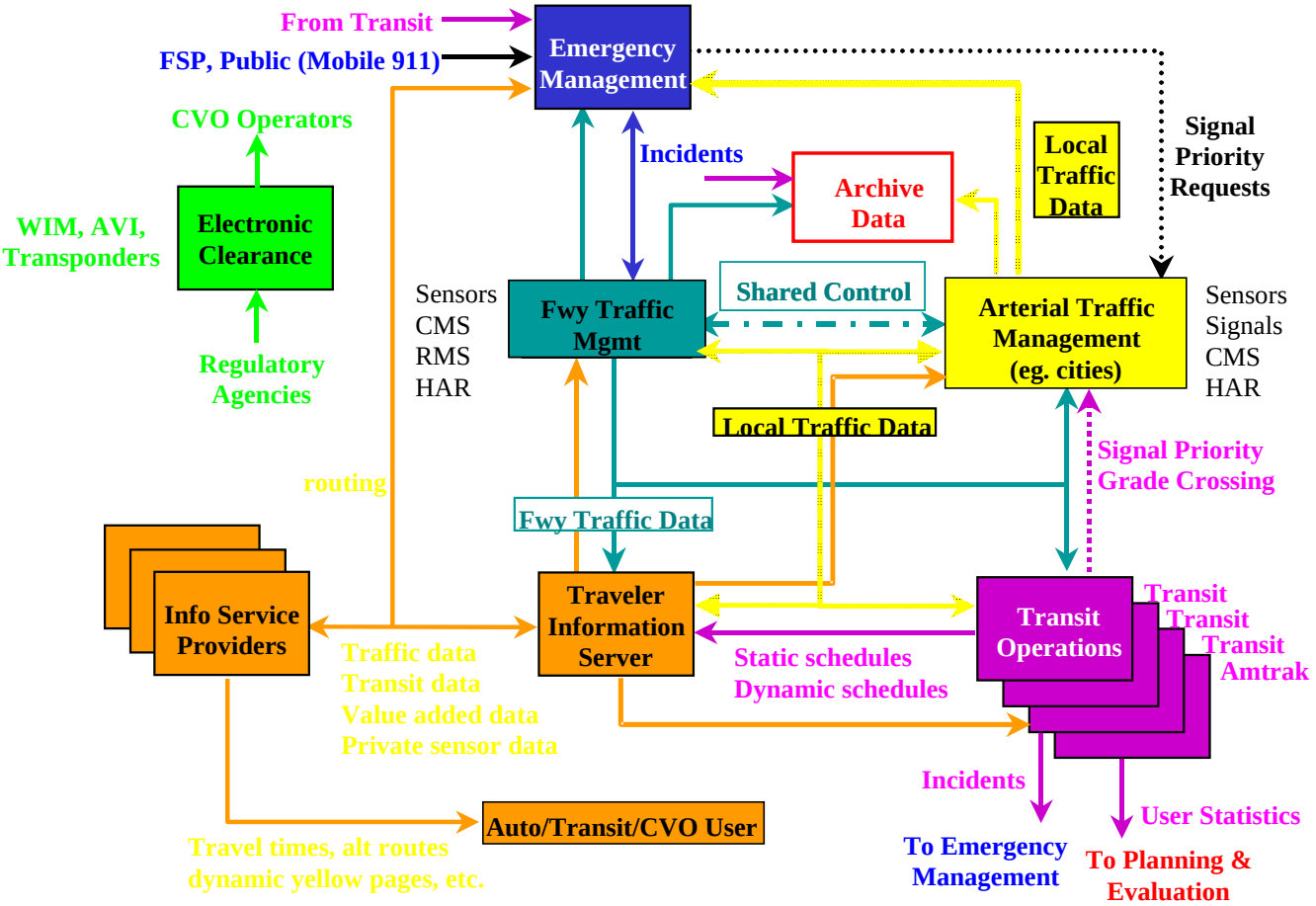
This section describes the process followed to identify and synthesize transportation deficiencies and issues throughout the San Joaquin Valley and to preliminarily consider ITS strategies that can help address those needs.

5.1.4.1 Centers

- District 6 and 10 TMC's (TOS)
- CHP Communications Centers in Stockton, Merced, Fresno and Bakersfield (EM)
- Local TMC's (cities with traffic signal control systems) (TMS)
- Independent Service Provider (dependent on ATIS business model) (ISP)
- Other Information Service Providers (none identified in projects) (ISP)
- Transit Management Centers (TrMS)

- Private freight company dispatch centers (external user of CVO ATIS data)
- Planning agencies (COG's, CAG's, Caltrans Districts 6 and 10) (PS)

Figure 5.3: Summary of San Joaquin Valley Region Logical Architecture



5.1.4.2 Roadway

- Arterial traffic systems (cities, Caltrans, counties)
- Arterial management system elements (CCTV, CMS, HAR)
- Freeway management system elements (CCTV, loop detectors, CMS, ramp meters, HAR)
- Motorist aid call boxes (existing and future)
- Smart Call Boxes (future)

- Environmental Sensing Units (Caltrans assets)
- Railroad grade crossings
- Commercial Vehicle Weigh Stations (CHP assets)

5.1.4.3 Vehicles

- Freeway Service Patrol
- Caltrans Traffic Management Team Vehicles
- Public Safety Units (CHP, Sheriff, PD, FD, EMS)
- Buses (including regional Amtrak service)
- Amtrak rail
- Commercial goods movement vehicles (trucks, rail, air)
- Autos (commuters, regional business travelers and visitors)

5.1.4.4 Communications Links

- Caltrans Fiber Optic plant (state-owned)
- Private Fiber Optic plants
- Common carrier leased services
- Cellular network (analog, digital, Cellular Data Packet Distribution - CDPD)
- Public and private fleet radio networks (public safety, transit, CVO, etc.)
- Personal Communications System (PCS) networks
- Nextel personal communications and fleet dispatch network

5.1.4.5 Remote Access

- Internet
- Public Switched Telephone Network
- Analog cellular

5.1.5 Communications

Wireline network options include the use of private networks, common carrier networks, or a mixture of the two. Examples of private network technologies are twisted pair cables, Fiber Data Distribution Interface (FDDI) over fiber optic rings, Synchronous Optical Network (SONET) fiber optic networks, and Asynchronous Transfer Method (ATM) over SONET networks. Examples of public shared network options are the leasing of telephone company-offered services such as leased analog lines, frame relay, Integrated Switched Digital Network (ISDN), Switched Multimegabit Data Service (SMDS), and Internet. A third wireline network option is that of a mixed network, where existing communications infrastructure can be utilized to the greatest extent possible, and possibly upgraded to carry any increased data load.

The addition of CCTV video exchange in particular can overload the backbone of an existing network.

The decision to specify a private network is probably not motivated by technological reasons because the desired data bandwidth can be supplied through the use of common carrier networks. Common carrier networks have many other advantages such as cost sharing and risk reduction. It is virtually certain that within the time frame of this Plan one or more local common carriers can provide network connectivity to fulfill the architecture communications requirements.

The reasons for building a private network have more to do with requirements/preference for a network built to the exact specifications of the user, and matching the available funding policies. If one-time capital funding is more easily obtained than monthly lease fees, then a private network appears as the best choice. In any case, there will still be an ongoing operation and maintenance cost.

The active participation of the owners of highway Right of Way (ROW) in partnership with one or more common carriers may be a means of having a private network built for the ITS infrastructure at little or no cost to the local agency. In exchange for the use of the rights of way, the carriers would provide a portion of the network capacity for ITS use, and much of the maintenance cost. Bartering of railroad right-of-way offers similarly attractive options to the railroad operator. At the current time, Caltrans has no highway ROW policy in force.

For the purposes of the communications analysis, the owner of the network is not an issue, nor is the exact carrier technology used on each link an issue. The major issues are the amount of bandwidth (capacity) needed and the standards that will be used to access the network and to exchange data in a meaningful way on the network. The ultimate choice of a network technology for the region's deployed network will be based on the specific details of the infrastructure assets deployed in the San Joaquin Valley.

5.2 Overview of Transportation/Facilities

A comprehensive overview of the general demographic characteristics and existing transportation system of the San Joaquin Valley, have been provided in previous sections and project deliverables which is important because it defines the environment into which ITS systems must be deployed and operated. No ITS architecture effort should be undertaken without a thorough knowledge of the region into which systems and projects will be deployed. Appendix C contains the associated Turbo Architecture Inventory Report and Regional System Architecture.

5.3 Operational Concept

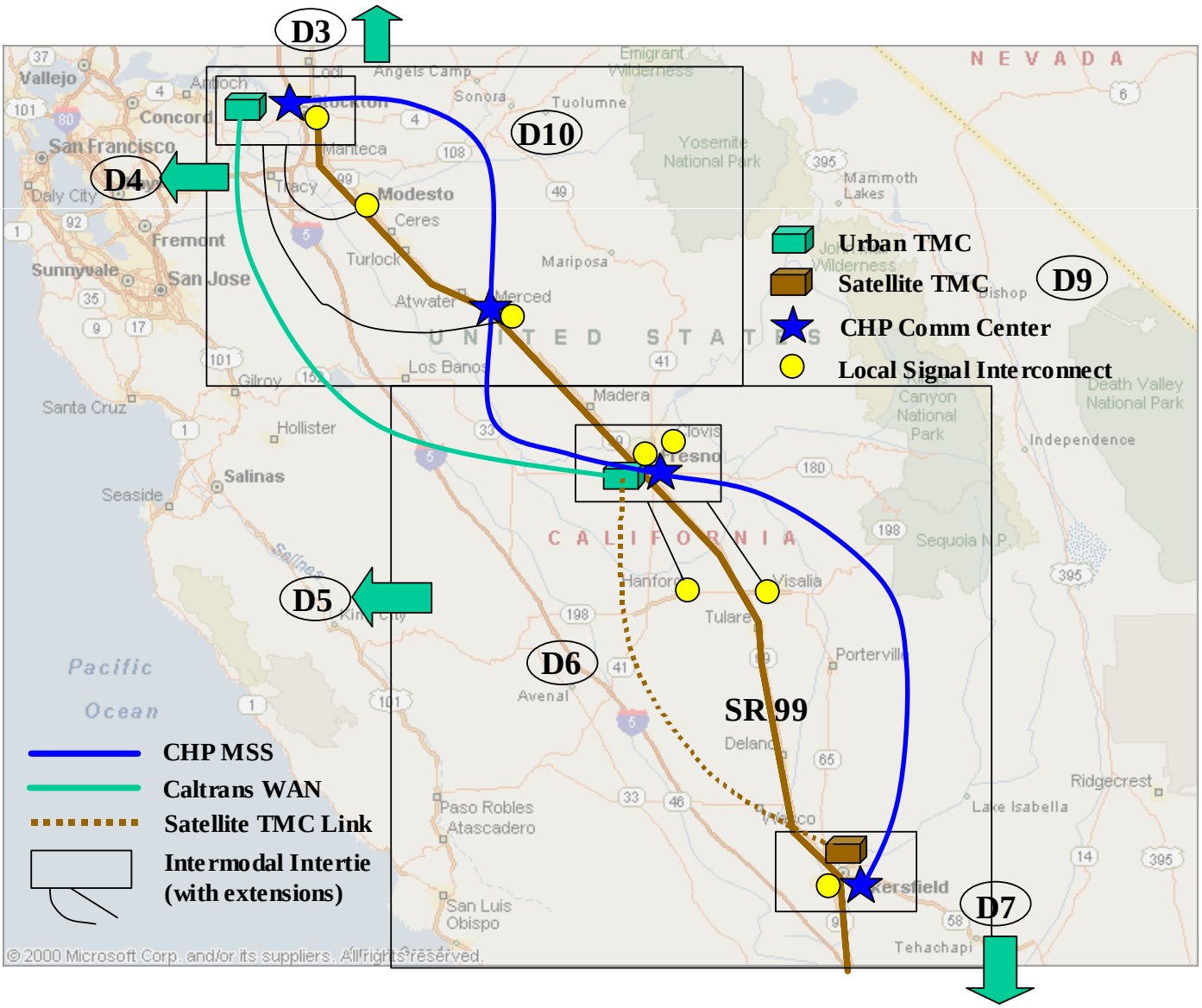
From an ITS systems perspective, the San Joaquin Valley is characterized by few major urbanized areas and two major North-

South arterials, I-5 and SR-99. These features lend themselves to a decentralized architecture, with regional nodes connected by a Valley-wide network and each regional node acting as a hub for local transportation system connectivity. Further, the San Joaquin Valley is largely rural in nature, so that ITS solutions must be economical and smaller scale than typically found in major metropolitan areas. This is not to say, however, that metropolitan-based solutions are not relevant to the Valley, but only that they must be applied with cost constraints in mind and with due regard for appropriate scaling.

In looking at current ITS deployment in the Valley region, the regional nodes suggested are Stockton, Modesto, Fresno and Bakersfield. A regional node is a communication center that acts as an intermediate point between local systems and larger systems. Only Fresno is scheduled for an Urban TMC installation in the Caltrans TMC Master Plan, but District 10 will have a small "TMC" in Stockton and Bakersfield is the home of a CHP Central Division Communications Center. It would also be feasible to remote a statewide ATMS Operator Workstation from Fresno to the Caltrans office in Bakersfield, or alternatively to the CHP Communications Center. A similar arrangement is being considered between the District 7 TMC in Los Angeles and the CHP Coastal Division Communications Center in Ventura.

Further discussion on the San Joaquin Valley Operational Concept will be focused in the areas of incident management, traffic management, transit management and advanced traveler information systems. Figure 5.4 illustrates the conceptual architecture.

Figure 5.4: San Joaquin Valley conceptual architecture



5.4 Functional Requirements

High-level Functional Requirements for the San Joaquin Valley Architecture are derived from the National ITS Architecture and its Equipment Packages, the building blocks of the Physical Architecture subsystems. Equipment Packages group like processes of a particular subsystem together into an "implementable" package. The grouping also takes into account the user services and the need to accommodate various levels of functionality. For purposes of the San Joaquin Valley architecture development, Equipment Packages will be considered equivalent to high-level functions. Since Equipment Packages (hereafter referred to as "functions") are both the most detailed elements of the physical architecture and tied to

specific market packages, they provide the common link between the interface-oriented architecture definition and the deployment-oriented Market Packages. Tailored Market Packages showing high-level data flows to support regional project development are shown in Section 4 of this report. "Functions" as described in this Section are associated with physical architecture entities in these Market Packages. In Appendix C, each Subsystem from the National ITS Architecture that will be implemented within the scope of the San Joaquin Valley ITS Strategic Deployment Plan is briefly described, followed by a listing of high-level functions that are most likely to be implemented.

5.5 Information Flows and Interface Requirements

In the context of the San Joaquin Valley ITS architecture, information flows will be interpreted as "architecture flows" as defined in the National ITS Architecture. These flows are high-level data exchange requirements between physical elements of the architecture, i.e. the architecture subsystems. As shown in the previous section, these subsystems include the major functional areas of Management Centers, Roadway Devices, Vehicles and Personal Access. The data in these flows is carried by the architecture interconnects, or communications networks supporting ITS. These have been established as:

- **Wireline networks** – networks supporting fixed elements of the architecture (centers and roadway devices). These networks include the Internet, public agency-owned fiber optic networks, signal interconnect networks, and the like.
- **Wide Area Wireless networks** – public and private networks that support both fixed and mobile elements of the architecture. These networks can support mobile access to the Internet. Wide area wireless networks also include "private" radio systems (as seen by the Federal Communications Commission) such as law enforcement trunked radio systems, transit fleet radio systems, etc.
- **Dedicated Short-Range** Communications networks – networks primarily serving communications between roadway devices and vehicles. These networks include, for example, emergency vehicle preemption and transit vehicle signal priority treatments through direct vehicle to signal controller communications.
- **Vehicle-to-Vehicle networks** – networks that support advanced vehicle control applications such as the Automated Highway System.

Other communications systems that support ITS applications include local area networks (LAN's) that are typically used within modal management centers, such as a freeway management system running in a Caltrans TMC. These internal networks typically support single systems like Advanced Traffic Management Systems

(ATMS) that include components such as applications servers, database servers and operator workstations.

Connectivity between physical architecture subsystems is greatly facilitated by the use of standard interfaces, or means of connecting to a network on one side, and to physical components on the other side. One of the best known interface standards is the RS-232C standard for connecting low data rate computing elements to communications devices such as modems. The RS-232C standard includes such mundane details as the electrical signal format (how "1's" and "0's" are formed), pin-out definitions for standard 9-pin and 25-pin connectors, and the meaning of signals on each pin (communications protocol). Other standard interfaces run the gamut from the means to encode analog video signals into a digital signal to the means to exchange high level data between dissimilar transportation management centers (e.g. a freeway management center and a transit management center). In Section 7, the subject of standards and their use in ITS applications is covered in detail.

5.6 Relationship to External Architectures

5.6.1 Background and Terminology

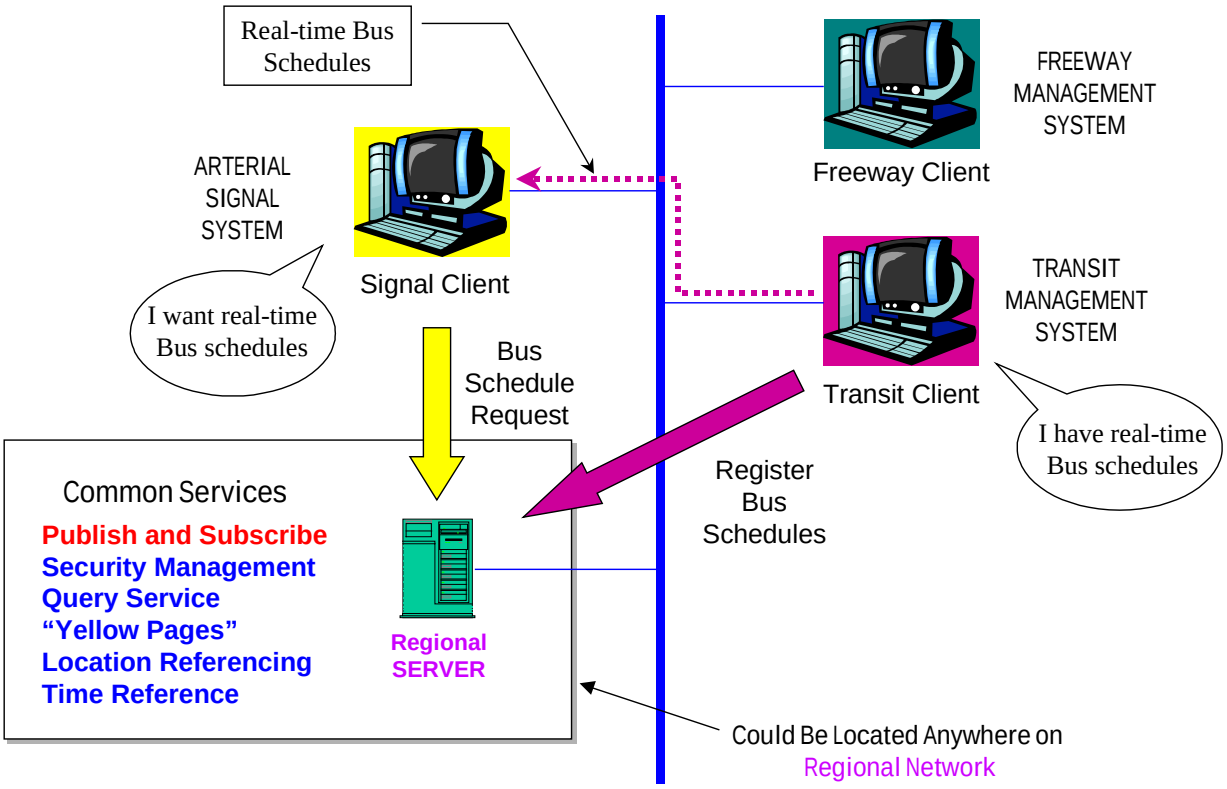
Although the Region is clearly not within the Southern California Priority Corridor, a discussion of that corridor's SHOWCASE program of projects would be useful for at least 4 reasons:

- There are useful lessons to be gained from this deployment
- This architecture is the first instance in the US of an architecture conforming to the National ITS Architecture
- Evolving Showcase standards are based on critical standards being developed by ITS America for the U.S. Department of Transportation
- Many Showcase elements such as the standards used to integrate dissimilar management systems and the concept of ATMS/ATIS integrated workstations for shared control of CMS and CCTV and traveler information data entry will have direct applicability to the Fresno region

SHOWCASE is a near-term effort to integrate deployed core components into an advanced traffic management and traveler information system over the next few years. The SHOWCASE program includes an architecture development project that culminated in a prototype TMC demonstration in March 1998. This prototype demonstrated that incidents could be exchanged between cooperating centers using a developmental standard called the Center-to-Center protocol. This protocol is one of the critical standards designated by the U.S. DOT. The SHOWCASE network will use a distributed, client-server network management concept that includes common region-wide services such as security management, location reference conversion, the sharing of information and control and a form of "yellow pages." These

common services and a standard way of connecting to the network will allow the integration of both existing ITS systems and planned ITS systems into a comprehensive, regional "system of systems". This concept is illustrated in Figure 5.5 for a transit data example.

Figure 5.5: Regional Network Management Architecture using National Architecture



5.7 Identification of Desired Standards

This section will provide a brief overview of the current ITS standards issues that are relevant to the San Joaquin Valley Regional Architecture. ITS standards are considered essential both for enhanced local, regional, and national interoperability and operational application. Led by the Federal Highway Administration (FHWA) in conjunction with the American Association of State Highway and Transportation Officials (AASHTO) and the Institute of Transportation Engineers (ITE), the National Electrical Manufacturers Association (NEMA) has been developing standards for the National Transportation Communications for ITS Protocol (NTCIP). NTCIP will provide a communications standard that ensures the interoperability and interchangeability of ITS devices and transportation centers. This spearheaded the development of a number of standards related to the identification, transfer, and dissemination of transportation

information. The various Standards Development Organizations (SDO's) including the International Standards Organization (ISO) are actively developing critical interfacing standards including data dictionaries, message sets, and communications protocol. These Standards Development Organizations (SDO's) are briefly described in Appendix C.

5.7.1 Standards Elements

A number of key elements make up a standard or set of standards. These include Data Dictionaries, Message Sets, Object Definitions and Communications Protocol. Each of these will be described below.

5.7.1.1 Data Dictionary

Data Dictionaries provide the definition and format of individual data elements that are then grouped into individual messages. In other words, messages are the sentences and data elements are the individual words.

Two good examples of data dictionaries are the Traffic Management Data Dictionary (TMDD) developed by the Institute of Transportation Engineers (ITE) and the Advanced Traveler Information Systems (ATIS) Data Dictionary developed by SAE.

5.7.1.2 Message Set

Message Sets (MS) are an essential component in the design and operation of modern computer based systems. They provide the basic information flows (generally described as messages) upon which communications between systems depend. Specifically, a message set provides the information definition (semantics) and format (syntax) to handle individual informational exchanges on specific topics. Thus, agreed upon message sets with unambiguous message definitions is one of the essential characteristics of standards required for information exchange between individual traffic management systems. Message sets are also important for communications between traffic management systems and other ITS users and/or suppliers of traffic related information. An example of a currently implemented Message Set is Location Reference Message Specification (LRMS). This specification standard was developed at Oak Ridge National Laboratory. The LRMS establishes standard formats for individual messages used within message sets to convey locations. The design of the LRMS is based on three fundamental concepts. First, the transfer of a location is a message in itself. Second, the use of multiple location message options (termed profiles) is used within an expandable framework. Finally, the use of a set of well-known ground control points (referred to as "datums") is used to permit registration of different map databases to one another so that locations transferred can be understood with minimal ambiguity. Message Sets work in hand-in-hand with Data Dictionaries and Communications Protocol.

5.7.1.3 Object Definitions

The analogy to message sets in the world of object oriented software is object definitions. Under the Common Object Request Broker Architecture (CORBA) protocol, object definitions are expressed as Interface Definition Language, or IDL. Objects are intuitive in nature – for example bus objects, traffic signal objects, vehicle detector objects, incident objects, etc. Each defined object has attributes, or characteristics and methods that act upon it. For example, a bus object contains attributes of <driver ID>, <bus number>, <passenger capacity>, <wheelchair compatible>, and so on. A bus object can be created, removed or stored – these are examples of its methods. Object definitions will gradually evolve as more and more object oriented systems are deployed. One major shortcoming of defining object-oriented architectures is that the National ITS Architecture is not yet object oriented. However, this does not necessarily lessen the value of the National Architecture in the definition of a regional architecture containing object-oriented systems.

5.7.1.4 Communications Protocol

Communications protocol is the set of data exchange rules that tie together the message set and data dictionary definitions. One could imagine having a word vocabulary and sentence structure but no grammar. This would be the situation if no communications protocol existed to allow interoperation between transportation management centers, for example. One of the more critical developments affecting a regional ITS architecture has been the evolving process of the NTCIP Application Profiles, formerly known as the NTCIP Class E or Center-to-Center standards. Currently, there are five NTCIP Application Profiles: 2301 (Simple Transportation Management Framework), 2302 (Trivial File Transfer Protocol), 2303 (File Transfer protocol), 2304 (Data Exchange ASN.1, also known as DATEX) and 2305 (Common Object Request broker Architecture – CORBA). We will concern ourselves with only the 2304 and 2305 standards at this point. Center-to-Center communications encompasses the exchange of information between domain-specific systems such as freeway management systems, transit management systems, emergency management systems, information service provider systems, traffic signal systems, and commercial vehicle systems. Because it is the fundamental standard used to interconnect management systems across modes, the C2C standard is crucial to the development of a regional architecture.

The Center-to-Center (C2C) Working Group of the NTCIP is developing the CORBA and DATEX-ASN protocols to provide optional paths for inter-system communications. These protocols complement each other and together provide a convenient means for any type of system to join a data exchange network. Through the proper use of these two protocols, the ITS industry will be able to more readily integrate disparate systems. Some specific details of

CORBA are provided as an example of how center-to-center protocol might be implemented in the real world. It should be noted that the California Alliance for Advanced Transportation Systems (CAATS) Statewide ITS Architecture recognizes the existence of both CORBA and DATEX and provides for their interconnection.

CORBA uses object-oriented technologies to provide advanced data exchange services. All of the data available for data exchange are registered with the local object request broker (ORB). Each center implements an ORB and related CORBA services software, comprising the CORBA system. This software is commercially available. At the simplest level, when a remote data item (such as an externally generated incident) is required to perform an action, the CORBA system is then responsible for negotiating the data exchange with the various brokers. As a result, from the programmer's perspective, all data on the network appear to be locally available. This simplifies computer code and allows a very modular design of software.

CORBA provides several features to support networks connecting object oriented systems, and assuming sufficient processing power and communications bandwidth are provided, it could be used for all applications between such systems. The DATEX protocol uses a mature message set with a less mature protocol and currently a lesser availability of commercial development tools. Conversely, CORBA uses less mature object models with a more mature protocol. Over time, as a standardized reference model emerges, new object-oriented systems come on line, and processing and communications resources are upgraded, more and more systems will use the CORBA protocol. Non-object-oriented “legacy” (pre-existing) systems may connect to a CORBA network through the Legacy Bridge function. The operation of this Legacy Bridge function in the case of transit data is illustrated in Figure 5.6 The proper operation of a Legacy Bridge assumes that a standard set of object definitions exists for a specific regional architecture.

Figure 5.6 shows how all of these standards inter-relate. For each system interface in the architecture, there must be a formal definition of (1) how the data will be exchanged (protocol), (2) the data message structure (message sets), and (3) data element definitions (data dictionary).

The IEEE Data Dictionary Standard (IEEE P1489, Box 1a in Figure 5.6) documents the basic building block used to define ITS data elements and other data concepts. The Message Set Template Standard (IEEE P1488, Box 2a) defines the format used to combine individual data elements together in order to form ITS messages. ITS messages provide a description of what to transfer, but not the details of how the information is transferred.

Functional area data dictionaries (Box 1b) and message sets (Box 2b) use the above formats to define their requirements. As mentioned previously, these standards include the Traffic

Management Data Dictionary (TMDD) for ATMS systems, the Transit Communications Interface Profiles (TCIP) for transit systems, and the SAE J-Series standards for ATIS and in-vehicle devices, among others. Local agencies should also use these formats when specifying project-specific data and messages. This will allow future integration efforts to readily understand the design of the local system and allow maximum reuse of computer code.

ITS messages can be readily transmitted using the DATEX-ASN protocol (Box 3a). Alternatively, the information and functionality contained within the ITS messages can be mapped to an object-oriented data model (Box 1c) and reference model (Box 2c) according to the rules defined by Object Management Group (OMG) standards (Box 2d). These object-oriented data and reference models, described in terms of a notation scheme called Unified Modeling Language (UML) and and a data specification called Interface Definition Language (IDL), can then be used as the basis for exchanging data using the Common Object Request Broker Architecture (CORBA) protocols (Box 3b). For the San Joaquin Valley architecture, the CORBA approach will be recommended since other areas in California have already invested in the development of CORBA software tools for transportation applications.

Regardless of the application-specific protocol used (e.g. transportation applications), the Internet protocols (Transmission Control Protocol-TCP, User Datagram Protocol-UDP, and Internet Protocol-IP (Box 4) are normally used for sending data over the network. This is consistent with the requirements of the NTCIP 2305 CORBA Application Profile.

Figure 5.6: Converting legacy data into standard CORBA-compatible object definitions.

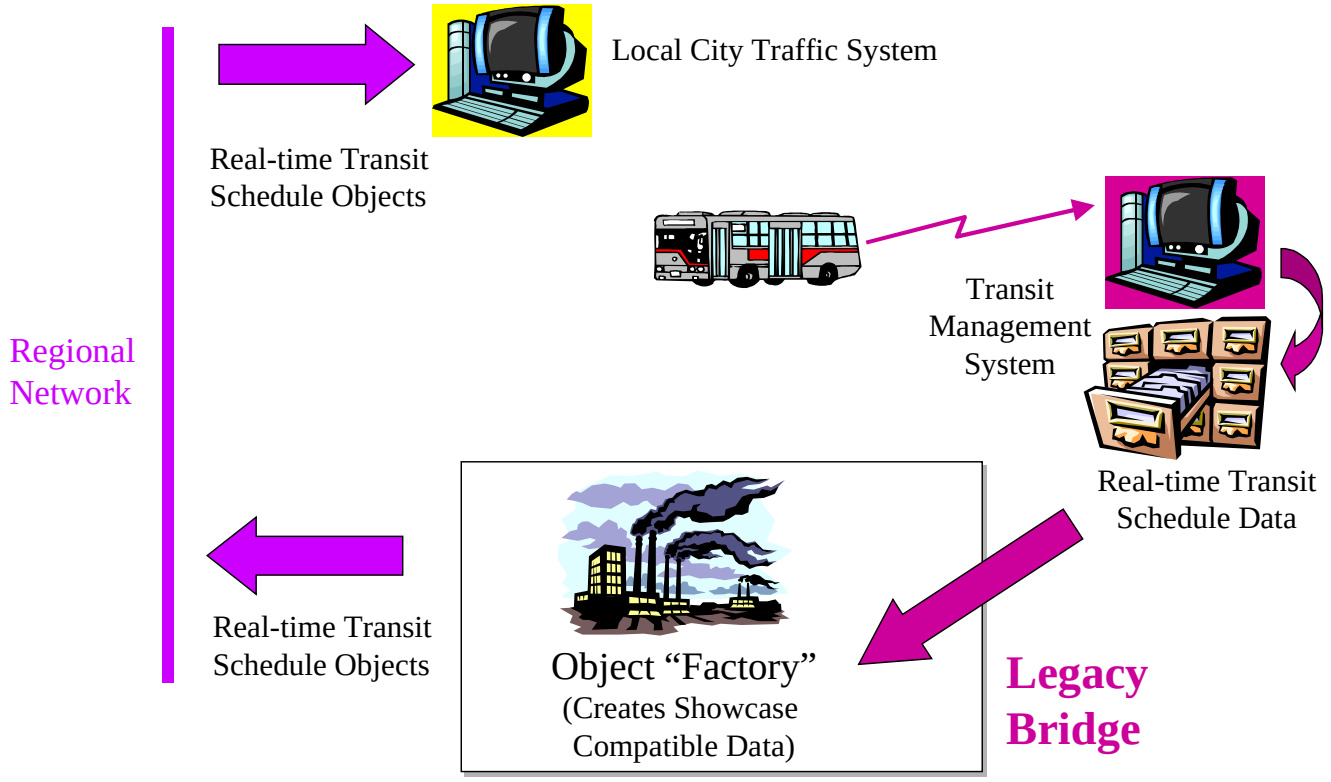
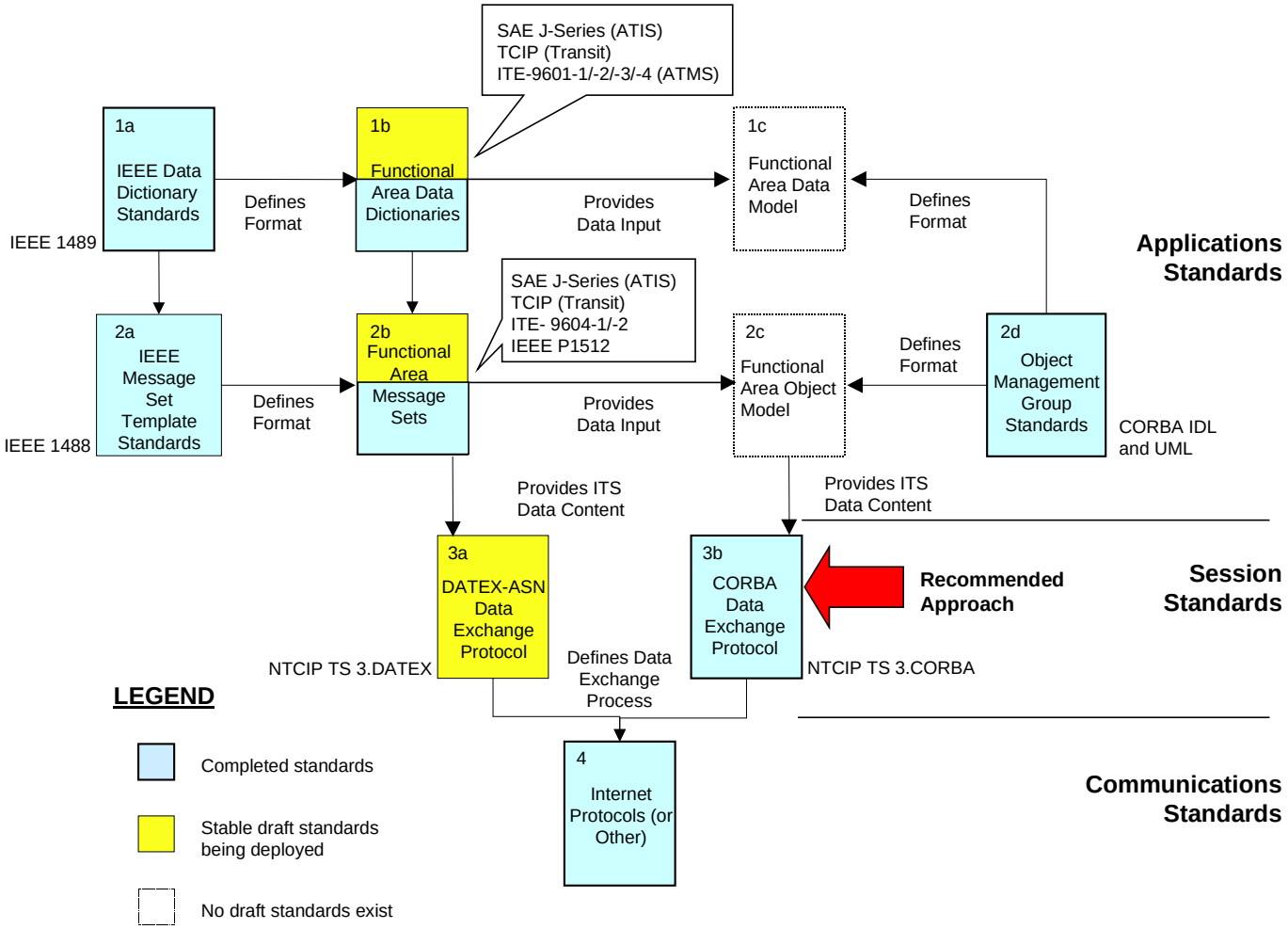


Figure 5.7: ITS standards architecture using currently defined standards.



In a more specific context, Figure 5.7 shows where certain standards fit into a typical transportation system ATIS architecture containing field elements, multiple transportation management centers and a traveler information system with numerous means of dissemination. Virtually all field device and data collection activity is covered by one of the many NTCIP standards. Center-to-center data exchanges are covered by the NTCIP 2305 CORBA or 2304 DATEX-ASN (Data Exchange – American Standard Notation). For the San Joaquin Valley architecture, the 2305 CORBA is recommended for use since current experience in Southern California provides a knowledge base and minimizes technical risk of future project implementation. Dissemination and location referencing to end users is covered by several of the SAE J-Series standards. A similar diagram could be constructed for transit management, substituting the TCIP standards for the SAE standards. The detailed application of these standards is specific to

individual projects and should be addressed in Requirements Definition and High Level Design as applicable for each project. For example, if a project required control sharing through an "Intertie" communications network, the standards application would look like Figure 5.8.

Figure 5.8: Operational use of standards in a transportation architecture.

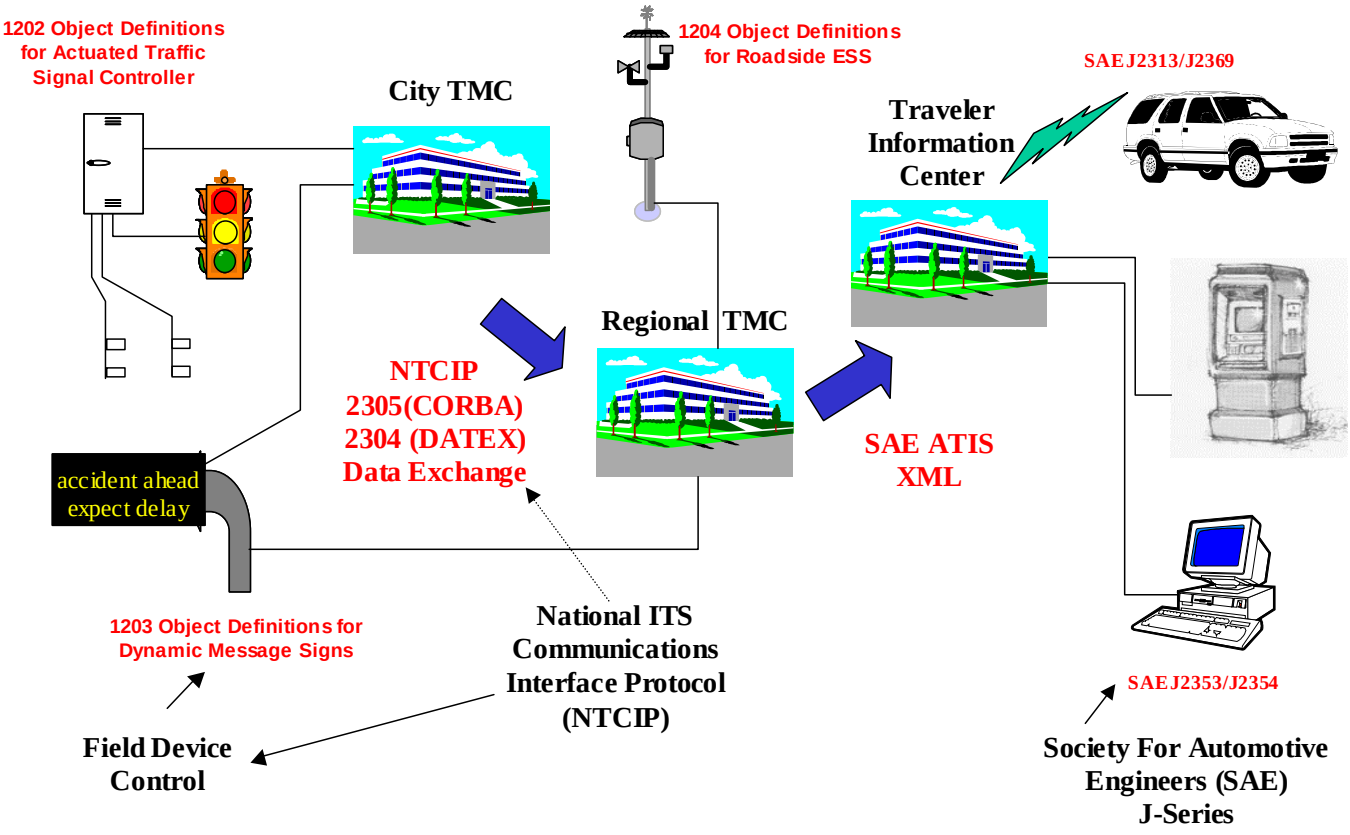


Figure 5.9: Use of standards in a shared field element control application

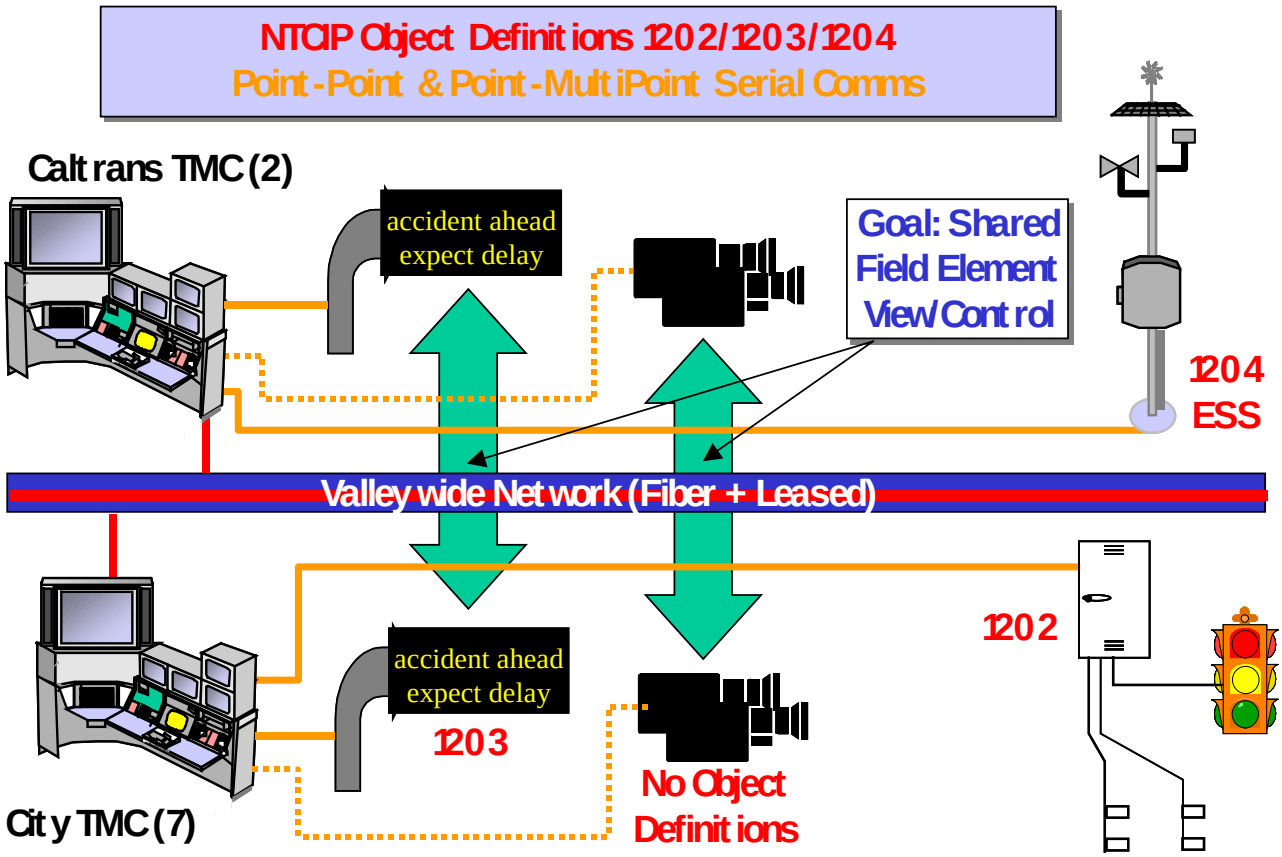


Figure 5.10 displays the overall tailored physical architecture for the Valley.

5.8 Project Sequencing

A project phasing chart has been developed for the prioritized Valleywide ITS projects featured in Section 6.0 of the SDP. This chart will define what projects are dependent on others to achieve success. Figure 5.11 illustrates the sequence of projects.

Figure 5.10: Physical Architecture for the San Joaquin Valley

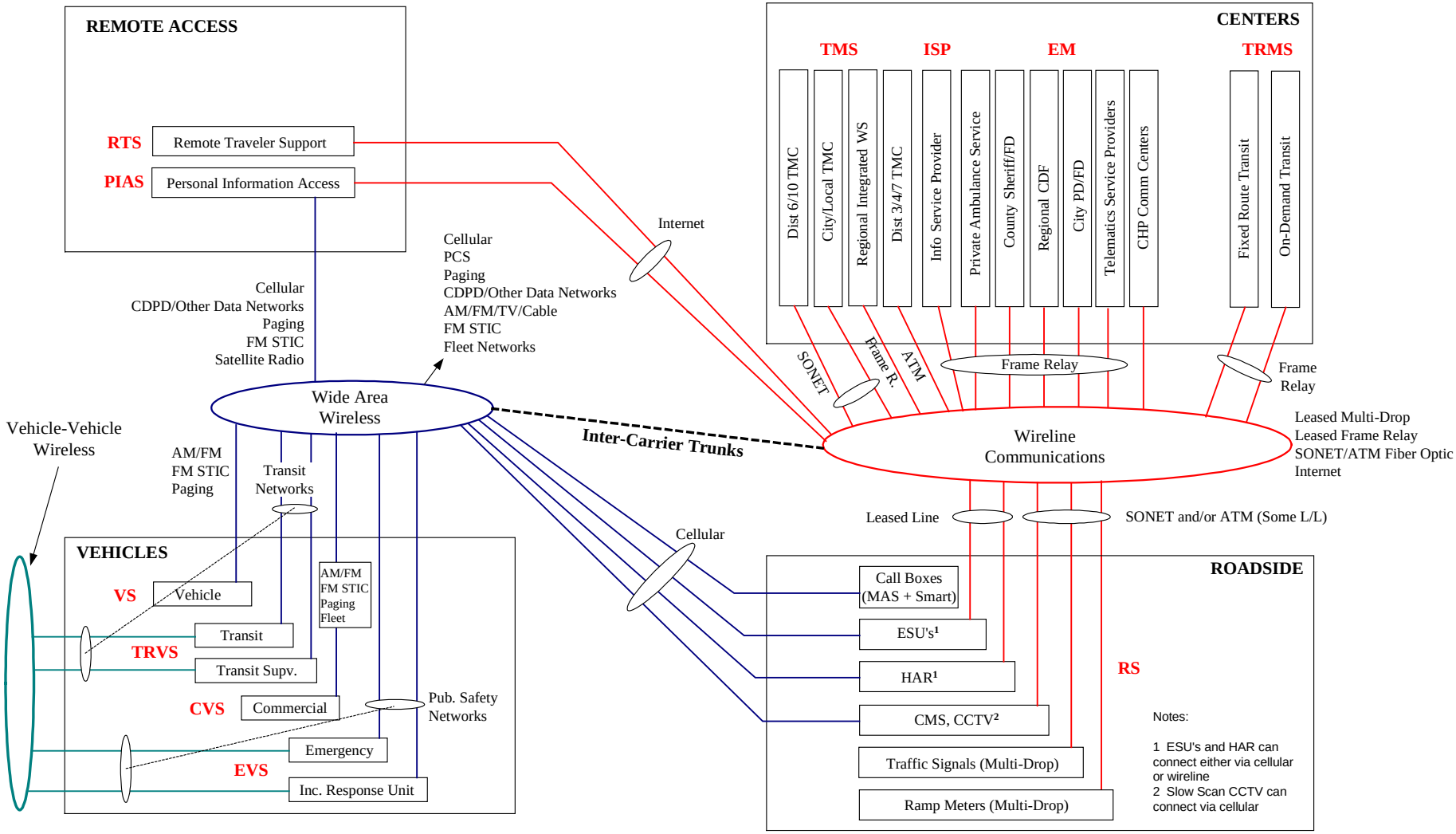
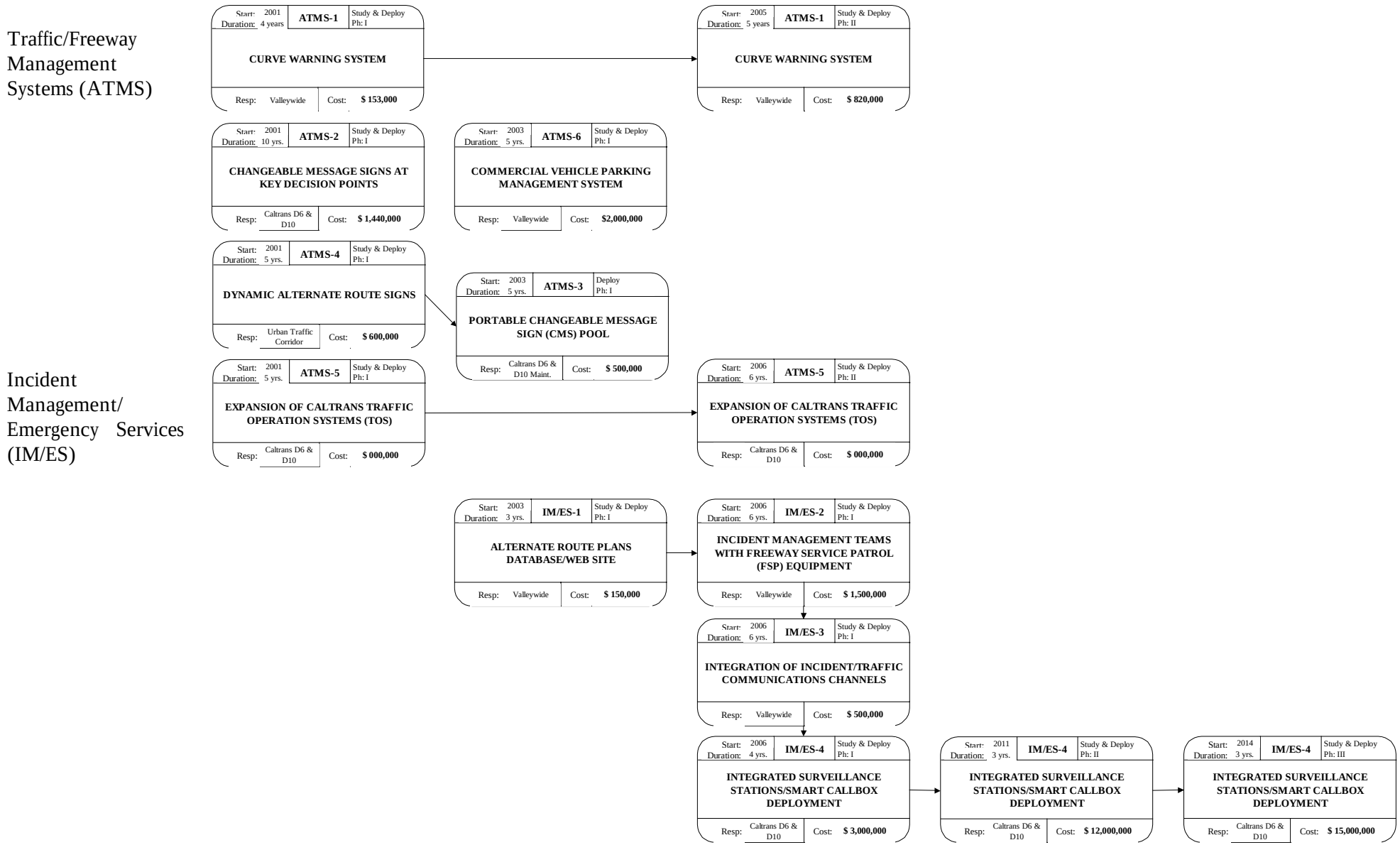


Figure 5.11: Sequence of Proposed ITS Implementation Activities for the San Joaquin Valley



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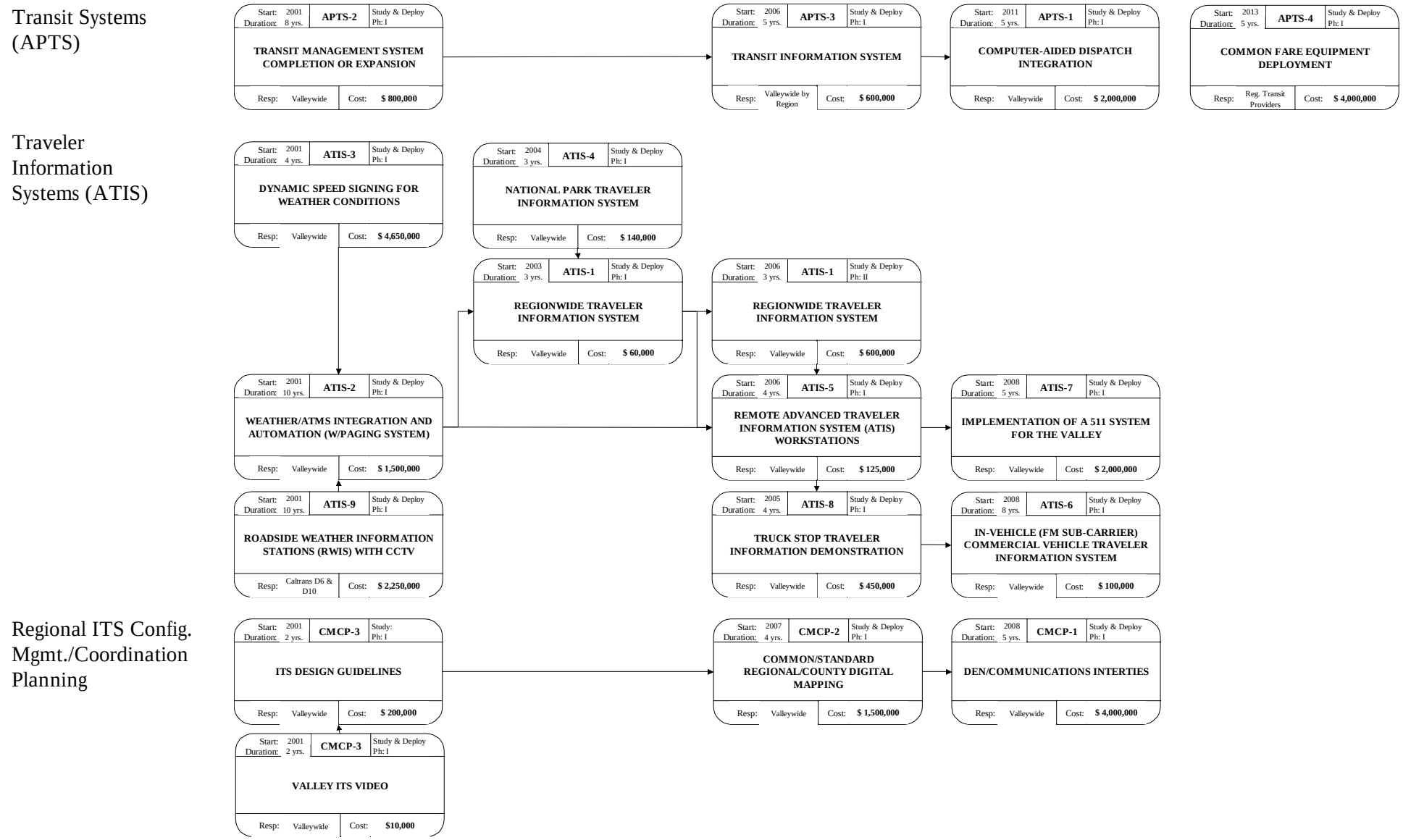

5.9 Summary

Why is the National ITS Architecture important and how does the San Joaquin Valley architecture fit in? The Region's architecture builds on the National Architecture and modifies it as necessary to fit regional conditions. As long as the Valley regional architecture adheres to evolving ITS standards, any system within this region can interoperate with any other system in the region or in the entire Valley. This will allow the Region to adopt a flexible architecture within the scope of the projects that support the consensus Market Package Plan.

6.0 Program Areas and Projects

6.1 Purpose of Program Areas and Project Descriptions

This Section describes the program areas and projects identified through the development of the San Joaquin ITS Strategic Deployment Plan. It outlines how the program areas and projects were developed, how they were organized, and provides specific information on each ITS project.

This Section is a crucial part of the SDP, as it contains the background project information for use in funding applications, project promotion, and further deployment efforts. Each project identified could be implemented as a stand-alone effort or in cooperation with other projects. Almost all of the projects call for cooperative efforts between multiple agencies within the San Joaquin Valley. Most of the projects are broken down into deployment phases and could be broken down into even smaller pieces if funding or other constraints require it.

The projects and program areas listed within this Plan represent the current ITS deployment concepts and priorities of the San Joaquin Valley. They are not meant to be inclusive of all the ITS projects which may be considered for deployment in the future. New projects may be identified that fit into program areas already defined in this Plan, or in rare cases, a totally new type of project may be introduced requiring a new program area. None of the project descriptions should be viewed as requirements. ITS deployment should be a cooperative effort between agencies within the Valley.

6.2 Project Development Process

The program areas and projects outlined in this Section were developed based on input from the ITS Technical Advisory Committee (TAC), composed of representatives of federal, state and local transportation organizations within the San Joaquin Valley. Throughout the development of the SDP, the TAC has met on a regular basis to address ITS related issues and to refine the project definitions. The basic process for developing the program areas and projects was as follows:

- Problem Definition – Through a series of surveys, interviews, and meetings with transportation stakeholders in the Valley, a listing of the priority transportation problems were developed. This process is discussed in Section 3.0 of this Plan. These problems served as the basis for identifying regional ITS user needs and preliminary project concepts.

- User Needs Definition – Supported by the surveys, interviews, and input from the TAC, priority user needs were identified. These needs are defined by the selection and prioritization of ITS user services. The initial selection of user services was utilized to identify gaps where ITS services were not meeting the

priority problems of the Valley. User services were discussed in greater detail in Section 4.0 of this Plan.

- Preliminary Project Concepts – Based on the priority transportation problems and user services identified by transportation stakeholders, ITS project concepts were developed. The advisory committee worked together to develop a series of project concepts that best matched the identified problems and needs. The ITS project concepts that were appropriate to the Valley for both short and long term were defined in this section of the SDP.

- Preliminary Program Areas and Organization of Projects – The preliminary project definitions were further refined to provide clarification and details to the project descriptions. The projects were grouped into five program areas initially:
  - Traffic/Freeway Management Systems (ATMS)
  - Incident Management/Emergency Services (IM/ES)
  - Transit Systems (APTS)
  - Traveler Information Systems (ATIS)
  - Regional ITS Configuration Management/Coordination/Planning (includes projects that touch on multiple transportation modes)

- Project Definitions – The project definitions within each program area were further detailed to provide the needed background information to move forward with regional ITS deployment.

The development of ITS program areas and project definitions for the San Joaquin Valley was a cooperative consensus based process. Open discussion and input was invited from regional transportation stakeholders at each technical advisory meeting.

6.3 Program Areas and Project Organization

Twenty-seven Valleywide projects and countywide projects from each of the eight counties were defined within five program areas during the development of the SDP. Table 6.1 and Table 6.2, at the end of this section, displays the overall organization of these program areas and projects for both Valleywide and Regional, respectively. The general character of the program areas, relationships between program areas, and the information provided for each of the project definitions is discussed below.

6.3.1 Program Areas

The general characteristics of the five program areas selected for deployment in the San Joaquin Valley are as follows:

- **Traffic/Freeway Management Systems (ATMS)** – Generally referred to as Advanced Transportation Management Systems (ATMS) throughout the nation and in the National Architecture, this program area is comprised of management systems and infrastructure deployments on the freeways, highways, and arterials of the urban and rural areas of the Valley. Sponsorship, operation, and ownership of these systems tend to reside with Caltrans, local cities, or the County. Systems in this program area are generally the greatest source of information on the transportation network, including: congestion, traffic delays, special events, road closure, and some forms of incident information.

- **Incident Management/Emergency Management Services (IM/ES) –** This program area is a combination of ATMS and Emergency Management Services (EMS) capabilities. The primary players in this program area include CHP, Caltrans, local fire services, local police services, CDF, County EMS, and other emergency service providers in the Valley. The projects proposed for this area focus on incident prevention, detection, response, and clearance. National Architecture information on this program area can be found in the ATMS and EMS portions of the Architecture. Incident management at a regional level is highly dependent on effective coordination between emergency service, law enforcement, and transportation management agencies. Through the development of this Plan, a Traffic Safety Task Force has been created to address interagency institutional and training issues. It is a primary component of this Plan that this task force would meet to enhance interagency incident management in the Valley. This group will handle coordinating multiple agency training, critiquing critical incidents, assisting in resolution of interagency concerns, and setting standards for incident management performance**.**

- **Transit Systems (TS)** – Known nationally as Advanced Public Transportation Systems (APTS), this program area focuses on the public transit components of the transportation network. Projects included in this Plan focus on enhancing cooperation and coordination of transit agencies in the Valley by building on previous efforts, as well as expanding on the established ITS capabilities.

- **Traveler Information Systems (TIS)** – Known nationally as Advanced Traveler Information Systems (ATIS), this program focuses on roadside information components of the transportation network. There are some basic forms of ATIS already operating in the Valley, including: CMS, HAR, and commute period radio and television broadcasts. Deployment of many of the proposed ATMS and IM/ES projects will enhance the timeliness, accuracy, and extent of transportation conditions information available for ATIS efforts. The planned level of ATIS deployment focuses on two primary areas: (1)

deployment of simple/expanded information dissemination capabilities within the Valley; (2) development of connections with traveler information deployment efforts throughout the State. There are generally no specific sponsors for ATIS projects, however it is expected that Caltrans, CHP, and regional COG's will take the lead in supporting this program area.

- **Regional ITS Configuration Management, Coordination, Planning** – This program area is a collection of projects that are important to ITS deployment, and cut across the boundaries of several of the other program areas. This program area focuses on continued planning, configuration management, and mapping efforts to support regional deployment. It is expected that regional COG's will provide leadership in this area in cooperation with ITS stakeholders.

The TAC determined that it was not necessary to have a separate commercial vehicle operations (CVO) program area. The general consensus was that specific CVO needs would be met by larger State, and federal efforts. The TAC chose to provide support to the CVO area by the provision of more accurate, timely, and comprehensive CVO traveler information related projects.

6.3.2 Relationships between Program Areas

Figure 6.2 shows the primary relationships between the five program areas identified in this Plan. The regional system architecture (Section 5.0), outlines more details on the specific data that may be exchanged between systems within each program area, as well as methods for moving this data from one system to another. It is important to consider the relationships between program areas and specific ITS projects early in the development process to ensure that the projects will support the appropriate exchange of data. These relationships are also the basis for improving the integration of modes and supporting intermodal operations.

The strongest relationship exists between the traffic/freeway management and incident management program areas. It is expected that these two areas will establish cooperative interoperations of systems with a single system possibly performing both traffic/freeway management and incident management functions. This relationship becomes quite clear when considering specific examples.

Figure 6.1: Basic Program Areas and Project Organization

Figure 6.2: Relationship between Program Areas

For example, Caltrans Traffic Operations staff is co-located with a CHP Media Information Officer (MIO) and has access to the CHP CAD system (an Incident Management system). An incident on the freeway system is generally first identified by CHP through the 911 system and then entered into the CAD. Caltrans then works with the MIO to take the appropriate actions which may include posting messages to a freeway CMS (controlled through an ATMS type system). This specific example does not include any direct automatic transfer of data from the CAD to the CMS systems, but the relationship established through the operators is clear. The eventual goal of ITS is to integrate many of these systems, simplifying the process for operators, and allowing them to focus on reacting to transportation conditions as opposed to repeating activities performed on multiple systems.

As the major collector of transportation conditions information, the Traffic/Freeway Management program area also has strong relationships with the Traveler Information Systems and Transit Systems program areas. Mostly data flows from the Traffic/Freeway Management systems to the ATIS and APTS program areas, however some regions have utilized their Transit Management Systems to measure traffic conditions on major arterials by tracking buses along their routes. Some regions have co-located ATMS, APTS, and/or APTS functions and operators to achieve better integrated operations.

The Incident Management/Emergency Services program area has the strongest relationships with the ATMS and ATIS program areas, and generally provides incident location, duration, and specific details to these two program areas. Incident information may also be exchanged between IM/ES and APTS program areas to provide conditions information to transit agencies and to report emergency situations on transit vehicles/vehicle locations to incident management services.

The Transportation User Information Systems program area can be viewed as sort of sponge that collects the pertinent information from the other program areas and distributes it to the public and/or certain agencies. Data exchange with the ATIS program area is generally one-way (input to the ATIS) only, however once broader ITS deployments take hold in the San Joaquin Valley and the State, projects in the ATIS area may become a tool for providing useful information to the regions in the Valley.

As displayed in Figure 6.2, the Regional Configuration Management/Coordination/Planning program area holds a central relationship with all of the other program areas. Decisions made or projects undertaken in this program area will support projects in each of the other program areas. Also, the Configuration Management/Coordination/Planning program area is a central resource for the enhanced planning data provided by the other program areas.

Once again, reviewing the potential relationships between program areas is a good idea during the early development of an ITS project. These relationships may open up funding opportunities, and could help to involve multiple stakeholders in a project that may otherwise seem to be of interest only to a single agency.

6.3.3 Project Definition Information

Sections 6.4 contains the specific Valleywide ITS project definitions organized by program areas (The countywide ITS project definitions ere described in Appendix A). Each project has a project identification number and name that relates it to its program area. In general, each specific project definition includes the following:

- **General Description** – A brief overview of key concepts and issues relating to the project.
- **Project Objectives** – A listing of the primary objectives that the project should try to achieve.
- **Sponsorship** – A listing of the agencies that should sponsor and/or support the deployment of the project.
- **Deployment Phasing** – Defines and describes the various phases the project could be broken down into. Project phasing may need to be changed based on funding availability or other issues that may arise over time.
- **Deployment Locations** – A description of the areas of the Valley in which the project should be deployed. Maps or descriptive text may appear under this item. Not all projects are specific to a geographic location, and this is noted where it applies.
- **Deployment Timeframes** – A summary table of anticipated project deployment timeframes based on input from the ITS Subcommittee. Project timelines are collectively summarized and displayed in Section 7.0.
- **Benefits** – A listing of the types of benefits that may be expected from project deployment. Where possible, examples from other ITS deployments have been provided for information purposes. Emissions reduction estimates are provided for some projects.
- **Budget Estimate** – A table summarizing estimated project costs/budgets by phase. The development of project budgets is discussed in Section 7.0, and the overall ITS deployment budget is summarized in this section.
- **Evaluation Criteria** – A listing of criteria by which the overall performance of the system may be judged. The criteria generally include:

- Measures of Effectiveness (MOE) – measure the extent to which the system meets its ultimate objectives (the reasons for which it was deployed). For example, deployment of a coordinated signal system is likely to include reductions in travel time as an MOE.
- Measures of Performance (MOP) – measure the actual performance of the system itself. Taking the signal system example, a MOP might measure the amount of time it takes to read the status of the signal controllers or maybe simply the number of controllers for which data can be simultaneously viewed.
- Measures of Suitability (MOS) – measure how suitable the overall system is to meeting its objectives while being sustained over time. MOSs tend to include measures such as mean time between failures or annual operating costs. A system may achieve solid MOEs and MOPs, but can be so expensive to maintain so staff intensive that it is not suitable to the needs of the system users.

➢ **Operations and Maintenance Considerations** – Any specific O&M issues are noted here.

➢ **Architecture Considerations** – Any specific system architecture issues are listed here.

The level of information provided in the descriptions is generally more detailed for near-term projects and less detailed for longer-term projects. Project definitions are based on the best information available and provided by the ITS Subcommittee. As each project nears deployment, the sponsoring agencies will need to provide further detail to the descriptions in order to support project specifics including detailed locations, involved agencies, institutional relationships, applicable standards, etc.

6.4 Valleywide Project Definitions

The remaining pages of this Section contain the specific ITS project definitions for the Fresno County Region. The program areas are divided into subsections as follows:

➢ 6.4.1 Program Area 1.0: Traffic/Freeway Management

➢ 6.4.2 Program Area 2.0: Incident Management/Emergency Services

➢ 6.4.3 Program Area 3.0: Transit Systems

➢ 6.4.4 Program Area 4.0: Traveler Information Systems

➢ 6.4.5 Program Area 5.0: Regional ITS Configuration Management/Coordination/Planning

Projects are identified by a unique identification number within each of these subsections. Readers may wish to reference the SDP Table of Contents to locate particular projects of interest or view the project summary table in the back of Section 6.0 of this document.

6.4.1 Program Area 1.0: Traffic/Freeway Management Systems

6.4.1.1 Curve Warning System

General Description:

Several truck rollover accidents have occurred along State Route 99. These accidents have been attributed to excessive speed and sharp curves that exist. While there is posted speed limits, many trucks do not slow down enough to safely negotiate curves. It is recommended that a more visible, "smart" warning system be deployed at the interchange.

The purpose of this project is to deploy a curve warning system at approach to the ramp. The curve warning system is primarily intended to increase the level of safety on this section of roadway, resulting in fewer rollovers and associated injuries.

The curve warning system will consist of a static warning sign located well in advance of the curve, which reads "CURVE AHEAD". A speed detection system will be installed to determine vehicle speed. If a vehicle's speed indicates that safe curve negotiation is not likely, an LED display, attached to the static sign and reading "REDUCE SPEED" would be illuminated.

Curve warning systems are available from a variety of manufacturers. Specifications, technologies and products will be detailed in the Technology Assessment and developed throughout the preliminary engineering process.

Project Objectives:

- Changeable Message Sign (CMS),
- A radar speed- measuring device,
- Control/communications equipment
- (Optional) Two cameras with video detection software for one of the cameras

Sponsorship: Valleywide including Caltrans District 6 and 10, Madera County, San Joaquin County.

Deployment Phasing: Three (3) locations have been identified within Caltrans District 10 for installation of TARWS: SR-4 WB off-ramp onto SB I-5, SR-99 SB off-ramp onto WB Mariposa Road/ SR-4, and I-5 NB off-ramp onto WB SR-152, considered Phase I of the project. Phase II will add an additional 16 locations listed in the San Joaquin Goods Movement study. This phase is considered a midterm project to be completed in the next 5 to 10 years.

	Phase Components
Phase 1	➢ 5 to 10 CWS locations to be deployed
Phase 2	➢ Same as above

Deployment Locations: Twelve to Twenty locations within the Valley along State and County Highways.

Deployment Timeframes: Phase I of this project has been identified for near term deployment and Phase II for mid term deployment.

	Phase Timelines
Phase 1	Near Term: Years 1-4
Phase 2	Mid Term: Years 5-9

Benefits:

- Reduced incidents and crashes
- Improved safety

Budget Estimate:

	Phase Budget Estimates	
	Capital Costs	Operations and Maintenance Per Year
Phase 1	$153 K	$3 K
Phase 2	$820 K	$18 K
Totals	$973 K	$21 K

The estimate of $40,000 assumes that a RADAR-based speed detection system will be mounted on the static warning sign. Capital costs will total an estimated $40,000 with an additional 15% contingency, and $5,000 for planning and design of the initial 3 locations, and a lump sum cost of $100,000 for contingency, planning, and design at an additional 18 locations.

Evaluation Criteria:

- Frequency of crashes/ erratic maneuvering
- Operating speeds
- Public acceptance and response
- Maintenance requirements

O&M Considerations: The annual operations and maintenance costs are estimated to equal $1,000 per unit.

Architecture Considerations: None applicable

6.4.1.2 Changeable Message Signs at Key Locations

General Description:

This project would expand the number of changeable message signs (CMS) located at key routing decision points within the San Joaquin Valley, such as in advance of interstate-to-interstate interchanges and interchanges between interstate routes and major state routes. This effort would supplement the CMS implementation efforts that are underway by Caltrans Districts 6 and 10, both of which operate numerous signs and will deploy additional signs in the future. Changeable message signs are a proven tool for conveying messages to travelers, providing travelers the ability to anticipate, and where alternate routes exist, to avoid congestion, incident scenes, and hazardous weather or pavement conditions. Changeable message signs can be used effectively in conjunction with highway advisory radio, with the sign providing a very brief message and a referral to tune to the advisory radio for more complete information. The specific locations for the CMS would most likely come directly from the District 10 and 6 long-range traffic management system plans.

Project Objectives:

- Provide advanced real-time traffic, weather, roadway, and safety advisory information on routes.
- Reduce congestion on highways due to incidents and peak season crowding within the project area by providing timely and accurate incident and route choice information (advisory, warning and diversion messages).
- Provide accurate and timely information about construction, maintenance, event activities, weather/road conditions, roadway closure information, etc.
- Encourage motorists to use HAR to obtain additional traffic information

Sponsorship: Caltrans District 10 and 6

Deployment Phasing: It is assumed that approximately 6 to 8 signs would be installed as part of this near to mid term project to be completed within the next 10 years.

	Phase Components
Phase 1	➢ Changeable Message Sign (CMS) ➢ Control/communications equipment

Deployment Locations: Key Points along Caltrans District 6 and 10 State Highways

Deployment Timeframes: This project is considered a near to mid term project to be completed within the next 10 years.

	Phase Timelines
Phase 1	Near to Mid Term: Years 1-10

Benefits:

- Reduce congestion and delay
- Provide traveler information to allow motorists to make more informed decisions

Budget Estimate:

	Phase Budget Estimates	
	Capital Costs	**Operations and Maintenance Per Year**
Phase 1	$1,440 K	$48 K
Totals	$1,440 K	$48 K

Capital costs will total an estimated $180,000 for each of the 8 CMS locations. Operational and maintenance costs were estimated at $6,000 per CMS location.

Evaluation Criteria:

- Technology considerations including: visibility, maintenance, and overall costs
- Physical considerations including: size and weight

O&M Considerations: The two primary sources of maintenance problems for all types of signs are poor technology and adverse operation conditions. Poor technology results from the use of inferior quality components. Adverse operating conditions Include exposure to extreme weather conditions, high atmospheric moisture content, and dust particles.

6.4.1.3 Portable Changeable Message Sign Pool

General Description:

This project will establish a pool of portable changeable message signs that would be made available to various public agencies for use in construction work zones, special event traffic control and other appropriate incident management applications. Currently, many agencies that could benefit from the signs cannot afford, or justify, purchase of the signs. Caltrans is the most likely candidate to purchase the signs and administer the lending program. For costing purposes, it has been assumed that 20 signs would be purchased. The signs could be made available at no cost or for a fee that would be less than that charged by commercial equipment rental companies. Agencies borrowing the signs may or may not financially contribute toward maintenance of the signs, depending on the funding source.

Project Objectives:

- Reduce congestion on highways due to incidents and expected congestion location in the Valley by providing timely and accurate incident and route choice information (advisory, warning and diversion messages).
- Provide accurate and timely information about construction, maintenance, event activities, weather/road conditions, roadway closure information, etc.

Sponsorship: Lead agency to be identified using MOU's to be decided by COG Director's Steering Committee.

Deployment Phasing: This project is considered a near term project to be completed within the next 5 years.

	Phase Components
Phase 1	➢ Procure Portable CMS ➢ Develop MOU's for O & M Procedures

Deployment Locations: Valleywide Implementation by District

Deployment Timeframes:

	Phase Timelines
Phase 1	Near Term: 0-5 years

Benefits:

- Provide improved motorist information
- Improved safety

Budget Estimate:

	Phase Budget Estimates	
	Capital Costs	**Operations and Maintenance Per Year**
Phase 1	$500 K	$40 K
Totals	$500 K	$40 K

Capital costs will total an estimated $25,000 for each of the 20 CMS locations.

Evaluation Criteria:

- Reduction in delay
- Reduction in accidents

O&M Considerations: Operational and maintenance costs were estimated at $2,000 per CMS location, annually.

6.4.1.4 Dynamic Alternate Route Signs

General Description:

This project would implement dynamic variable message signs (VMS) specifically sited, and primarily devoted, to detouring traffic onto alternate routes during incidents, including accidents and weather related road closures. These signs could differ from the large, permanent changeable message signs deployed by Caltrans at key decision points in several respects. First, they would be sited in conjunction with a specific alternate route/detour strategy developed for a particular route and alternate routes. Second, the signs could be smaller than the Caltrans signs. Third, the signs could include features, such as arrows or flashing beacons that are not included on the traditional CMS. Finally, the alternate routes signs could be deployed as trailblazers along the alternate route, rather than merely in advance of the main route/alternate route decision point. The objective of this project would be to improve compliance with detours and reduce driver uncertainty along detour routes. If successful in reducing the volume of vehicles entering hazardous or congested roadway segments, this project holds the potential to reduce congestion, delay and accidents. In order to be successful, it would be critical that this project include development of an alternate route plan and procedures to support the usage of the signs, and that this plan be effectively linked to an overall multi-agency coordinated incident management strategy. This project would also require a commitment on behalf of the operating agency to devote the time and attention necessary to utilize the signs effectively. Even more so than a single CMS, keeping the dynamic message signs current and accurate would be critical. This project assumes the installation of 30 dynamic alternate route signs for all the urban traffic corridors.

Project Objectives:

- To define alternate routes and direct motorist along these routes more efficiently.

Sponsorship: Caltrans District 10 and 6

Deployment Phasing:

	Phase Components
Phase 1	➢ Define Routes and Locations ➢ Design and Deploy Signs By Route in Phases 2-5

Deployment Locations: Key Points adjacent to State Highways in Caltrans, District 10 and 6 which follow the pre-planned alternate routes defined by the region.

Deployment Timeframes: This phase is considered a mid term project to be completed within the next 10 years.

	Phase Timelines
Phase 1	Mid Term: Years 5-10

Benefits:

- Improved traffic management
- Reduced delay time to major incidents
- Reduced impact on adjacent communities

Budget Estimate:

	Phase Budget Estimates	
	Capital Costs	**Operations and Maintenance Per Year**
Phase 1	$600 K	$40 K
Totals	$600 K	$40 K

Capital costs would total an estimated $30,000 for each of the 20 CMS locations.

Evaluation Criteria:

- Travel Time
- Delay
- Incident work zone safety

O&M Considerations: Operational and maintenance costs were estimated at $2,000 per CMS location

6.4.1.5 Expansion of Caltrans Traffic Operations Systems (TOS) Including Communications

General Description:

Caltrans considers most field elements that aid in traffic surveillance and management activities to be part of the TOS. The most common field elements deployed as a comprehensive TOS in urbanized areas include, but are not limited to: traffic detection (inductive loops, video, acoustic), closed circuit television (CCTV) cameras, changeable message signs (CMS), highway advisory radio (HAR), communications systems and centralized command and control systems/centers with expert systems to aid in incident detection and response as well as automated ramp metering operations. Additional elements that are typically added to rural settings include, but are not limited to: road weather information systems (RWIS) and other systems that aid in improved emergency response times and dissemination of travel advisory information.

There are three principle components to this project:

- Deployment of miles of fiber-optic cables along the major urban area highway, and to the Caltrans TMC's in each district.
- Deployment of TOS elements such as CCTV, HAR, CMS, DWIS, and ramp meters as growth in travel demands dictate.

- Installation and integration of the Caltrans Advanced Management System (ATMS) software to the District 6 and 10 TMC's. The Statewide TMC Standardization Plan has identified District 6 as receiving this software in the Year 2013. This timeline could adversely impact the ability of District to integrate with other on-going ITS deployment efforts in the Region, and an interim integration effort has been identified.

The most current version of the Caltrans ATMS software (version 2.0) is currently operational in District 7. This version contains a great deal of functionality, and would likely fulfill most of the functional requirements for Caltrans in the Region. Currently, the ATMS has somewhat simplified ramp metering management functions when compared with the special-purpose systems developed in some Districts, but the functions inherit in the ATMS are probably sufficient for the needs in the Region, so no specialized software is proposed. In any event, Caltrans, District 6 and 10 is likely to receive some future version of the ATMS (3.0+) with enhanced functionality.

The pressing need at this time for Caltrans, is to maximize the effectiveness of its field infrastructure through enhancing communications and management systems. Currently, most of the systems/field devices connected to the TMC must be operated independently. A simple spreadsheet/database has been adopted as an interim reporting tool, but the TMC lacks any substantial integration of its systems at this time.

The project proposes an interim solution to provide some level of systems integration prior to full deployment of the Caltrans ATMS system in the Districts. The specifics of this solution should be worked out by Caltrans in cooperation with the Region. Viable solutions include the interim adoption of an existing version of the ATMS with some funding assistance being provided by the Region.

Finally, as a part of this effort, Caltrans should determine its specific policies relating to the use of its communications infrastructure. Some basic options include:

- Exclusive Use – where Caltrans maintains exclusive use of its communications infrastructure. This option is not consistent with the spirit of the SDP and its stated vision, and if this option is selected it should be factored into the project programming and selection process.

- Service Provider – where Caltrans provides certain services over its communications backbone. These services may be oriented towards center to center communications between agencies or to field elements.

- Shared Conduit – where Caltrans allows other agencies to use its conduit to "pull" its own fiber.

Different Districts have differing policies on this issue.

Given the importance of communications to the Region, these options should be carefully considered. Depending on the communications resources available to the District, they may choose a combination of all three options.

Project Objectives:

- Design and deploy appropriate communications infrastructure along State facilities to eliminate existing gaps in the FCMA, and to provide a communications backbone for the Region.
- Design and deploy additional ramp meters along SR 41 to complete the planned system, and to manage travel demands on the freeway network.
- Develop an interim solution for systems integration at the Caltrans TMC.

Sponsorship: Caltrans, Districts 6 and 10

Deployment Phasing: Caltrans District 6 TOS plan includes the installation of 43 CCTV cameras, 21 CMS locations, 10 HAR locations, and 12 RWIS in the district. The plan also identifies an additional 43 CCTV locations, 1 CMS location, 10 HAR locations and 30 RWIS locations that have not yet been funded.

	Phase Components
Phase 1	➢ Miles of fiber communications ➢ Interim software integration solution for the TMC ➢ Deployment of TOS element sites (as determined by Caltrans)
Phase 2	➢ Miles of fiber communications ➢ Interim development/porting of ATMS software ➢ Deployment of TOS sites
Phase 3	➢ Development/installation of the Caltrans ATMS software into District 6 and 10.

All deployment efforts should be proceed by the appropriate studies and design documentation consistent with Caltrans standards.

Deployment Locations: State Highways within District 6 and 10.

Deployment Timeframes: This project is divided into 3 phases with Phase I being considered near term, Phase II as mid to long term, and Phase III as long term.

	Phase Timelines
Phase 1	Years 1-4
Phase 2	Years 5-8
Phase 3	Year 14

Benefits:

General Benefits:

- Ramp metering can reduce the number of accidents in merge areas reducing both bodily injuries and economic impacts.
  - In Denver, CO, in some areas where ramp meters were installed, the number of accidents decreased by up to 50%. Minneapolis/St. Paul has shown 38% reduction in accidents per vehicle mile traveled after the installation of ramp metering. Accidents in Seattle also decreased by 39% where ramp meters were installed.
  - Ramp meters show good results in reducing travel times on congested roadway segments. In Seattle, WA, area freeway traffic volumes grew by 10% to 100% along Interstate 5 over a six-year period. The speeds along 1_5 have remained steady or increased by as much as 20%.
- Closing the gaps in the communication systems will improve the flow transportation conditions information from roadway sensors, potentially reduce costs, and allow improved cooperation between various agencies within the Region.
- Improving the communications systems will improve roadway monitoring, as well as lower incident detection frequencies assuming appropriate sensors are in place (reference projects 1.3 & 1.6)

Emission Reductions:

- Emissions impacts of ramp metering are very controversial. On a site by site basis, it can be argued that ramp metering increases emissions as vehicles are forced to accelerate in a much more rapid fashion. The balancing factor is that emissions over the length of the freeway should be reduced as traffic congestion is eased and hours of travel fall. In general, emissions reductions are not a valid argument for the installation of ramp meters. Proponents of metering should work to identify issues specific to the proposed project.
- On the other hand, communications projects have traditionally been considered as supportive of emissions reductions as long as they provide the capability to install traffic management or signal coordination equipment. Once again, project proponents should work on a case by case basis. To support emissions reduction goals, it may be appropriate to require that communications projects clearly define what traffic management equipment will be connected and what benefits this equipment provides.

Budget Estimate:

	Phase Budget Estimates	
	Capital Costs	**Operations and Maintenance Per Year**
Phase 1	$26,000 K	$26 K
Phase 2	$30,000 K	$30 K
Phase 3	$20,000 K	$20 K
Totals	$76,000 K	$76 K

Fiber-optic deployment costs were based on a unit of $25/LF. Design costs were assumed to be %15 of capital costs, and contingencies were 15 % of capital costs for traditional project components.

Evaluation Criteria:

- MOE
  - Miles of congested freeway
  - Freeway travel times
  - Amount of transportation conditions information delivered to the public over the proposed fiber network
  - Reduction in freeway accidents near metered interchanges
  - Incident detection/response time (ATMS)
  - Time needed for traffic operations staff to monitor/control field devices (ATMS)
- MOP
  - Connection/data transfer times/rates from field devices to the TMC
  - Communications packet loss
  - Time to access data from the database (ATMS)
  - Screen refresh rates (ATMS)
- MOS
  - Mean-time between system failures
  - O & M costs

O&M Considerations: The operations and maintenance considerations of the TOS are significant and requires 10% of capital costs to cover resources such as staff and spare parts on an annual basis.

Architecture Considerations: The infrastructure items in this project are not a concern, however the ATMS deployment and the flexibility of the communications backbone are. Caltrans should discuss its standards with Regional stakeholders to assist in ensuring

that some common standards are utilized. Note that communications have many different standards or protocol "layers" that may impact the ability of systems to communicate over any given network. Many of these layers are not necessarily discussed in the National Architecture, but are commonly used in the computer networking world. For example, the Internet utilizes the TCP-IP standard, which is only one of many of the standards, which make the Internet work. Common fiber network standards include SONET and ATM. Additional discussion of this information can be found in the Technology Options Document (available under separate cover).

Reference should be made to Figures 5-2, 5-3, and 5-4 of the system architecture section to gain a better understanding of the relationship between this project and other regional ITS efforts. Within the National Architecture, it may prove helpful for readers to review market packages ATMS 1, 4, and 6.

6.4.1.6 Commercial Vehicle Parking Management System

General Description:

This project would deploy a system to monitor commercial vehicle parking availability at a number of locations in real-time, and utilize a variety of dissemination tools to make the information available to commercial vehicle operators. Detection systems at individual parking facilities would monitor parking availability. The real-time parking availability information would then be coupled with information on services available, prices, location/direction and other information. Information could be made available in various formats and at various levels of detail through a range of devices, including changeable message signs, the Internet, and highway advisory radio. Information could be collected for both rest stops and private operations. Potential partners in the project include Caltrans and private commercial vehicle facility operators.

Project Objectives:

- Improve information provided to commercial operators in order to better manage the truck parking available in the valley.

Sponsorship: Caltrans, Districts 6 and 10 along with the Valleywide Goods Movement Committee

Deployment Phasing: This would be a 2 Phase Project with an initial feasibility study and system design.

	Phase Components
Phase 1	➢ Study feasibility of the systems and develop HLD
Phase 2	➢ Design and deploy DMS

Deployment Locations: State Highways in District 6, State Highways in District 10

Deployment Timeframes: This project is considered a near to mid term deployment to be completed in years 6-10.

	Phase Timelines
Phase 1	Near to Mid Term: years 6-10

Benefits:

- Reduction in the amount of truck traffic driving and parking in restricted areas leading to reduction in congestion, added safety and reduced emissions.

Budget Estimate:

	Phase Budget Estimates	
	Capital Costs	**Operations and Maintenance Per Year**
Phase 1	$200 K	$0
Phase 2	$1,800K	$200 K
Totals	$2,000 K	$200 K

A total of $2,000,000 would be set aside for parking management throughout the Valley.

Evaluation Criteria:

- Truck related accidents and congestion
- Reduced CVO parking violations

O&M Considerations: Operational and maintenance costs were estimated at 10 percent of the capital costs

Architecture Considerations: Relationship to Caltrans TOS Expansion and Caltrans ATMS Upgrades along state highways.

6.4.2 Program Area 2.0: Incident Management/Emergency Services

A large percentage of TAC discussions on the Incident Management/Emergency Services (IM/ES) program area centered around large incidents caused by low visibility conditions, improving interagency incident response and management tools, and providing enhanced communications.

Low visibility conditions caused by seasonal fog and dust storms are a well-established problem throughout the San Joaquin Valley. The Valley is well know for having had numerous very large multiple car accidents along major freeways and highways. Improving interagency coordination and communications were also identified as very high-priority needs by the TAC.

These projects represent an opportunity to improve the tools available to emergency services so that they can further improve their response and clearance efforts, and they are not a reflection that anything is currently wrong with regional incident management efforts.

6.4.2.1 Alternate Route Plans Database/Web Site

General Description:

This project would aid in the dissemination and utilization of alternate route plans by providing access to the plans via the Internet. During the needs identification process, it was noted that in many cases alternate routes plans to facilitate traffic diversions during incidents, including accidents, construction and weather-related closures, do exist, but are not utilized to the extent they should be because some agencies are not aware of the plans and/or do not have convenient access to them. If successful, this project would make traffic diversions more coordinated and effective, including reducing the adverse impacts that detoured traffic imposes on alternate routes, and reducing the volume of traffic on roadway segments with hazardous conditions or heavy congestion. This project would focus on collecting and providing access to existing alternate route plans, although it would likely include some development of new plans to fill gaps, etc. In addition to the collection of plans and development of dissemination tools, this project should include agency discussions to stimulate understanding and use of the alternate route plans.

Project Objectives:

- To provide improved availability of information related to pre-determined alternate routes.

Sponsorship: Caltrans Districts 6 and 10 with individual counties RPTA's.

	Phase Components
Phase 1	➢ Finalize and approve alternate route plans for each County. ➢ Develop Web Site and provide approved information on the site.

Deployment Locations: Centralized in the District 6 and 10 TMC's on a website with links to the RPTS sites for access by local agencies.

Deployment Timeframes: This project is considered a mid term deployment to be completed in the next 3 to 5 years.

	Phase Timelines
Phase 1	Near Term: Years 3-5

Benefits:

- Improved incident management with better information.

Budget Estimate:

	Phase Budget Estimates	
	Capital Costs	**Operations and Maintenance Per Year**
Phase 1	$150 K	$15 K
Totals	$150 K	$15 K

A total of $150,0000 in capital costs is allocated for website construction.

Evaluation Criteria:

- Improved incident management
- Improved jurisdictional coordination

O&M Considerations: Operational and maintenance costs were estimated at $15,000 per year.

Architecture Considerations: Does not apply.

6.4.2.2 Integration of Incident/Traffic Communications Channels

General Description:

This project would integrate radio communications among agencies that respond to incidents, such as local police, state patrol, fire departments, Caltrans, and local traffic agencies. The objective of the project would be to improve communications and thereby improve the effectiveness of incident management, resulting in reduced response times, reduced incident duration and associated traffic delays. Currently, most agencies that must, or should, work together during incidents cannot easily communicate with one another over their respective radio systems. This project would identify a specific study area and set of agencies, then identify and implement a solution to provide integrated communications. Depending on the existing equipment and approaches, the potential strategies to provide for integrated communications include both heavily capital intensive solutions, such as those involving major changes in communications infrastructure, and less intensive solutions, such as those that could involve changes in procedures, reprogramming of existing equipment, etc.

Project Objectives:

- Enhance the ability of emergency service personnel to communicate with one another either at or in responding to an incident.
- Provide interagency communications for coordination activities.
- Enhance interoperations between emergency service agencies.
- Limit duplication or conflicting efforts through common inter-agency communications.

Sponsorship: CHP, Police Depts., Fire Depts., Sheriff, Others.

Deployment Phasing: This project consists of a single phase of deployment.

	Phase Components
Phase 1	➢ Procurement of either communications channel patching equipment; or ➢ Procurement of 2-way handheld communications for Caltrans Traffic Operations/Maintenance, CHP, Fire/PD, Sheriff, CDF, EMS, County Fire and other emergency service agencies (20 units to each agency). ➢ Communications support/leased communications.

Deployment Locations: No specific locations – agencies would be provided equipment as noted in Deployment Phasing.

Deployment Timeframes: This project has been identified for mid term deployment.

	Phase Timelines
Phase 1	Mid Term Years 6-11

Benefits:

- Reduced confusion, duplication of effort, danger at incident sites.
- Improved communications between inter-agency incident response agencies resulting ultimately in less delay to traveler.
- Possible reduction in incident duration due to enhanced communications between responding emergency agency resources.
- No direct emissions reduction can be associated with this project, however some emissions reduction could be expected from reduced incident duration at major incidents (see projects 2.1 and 2.2 as examples).

Budget Estimate:

	Phase Budget Estimates	
	Capital Costs	**Operations and Maintenance Per Year**
Phase 1	$500K	$0
Totals	$500K	$0

Unit costs assumed $20,000 for each involved agency, and $250,000 for enhanced communications patching.

Evaluation Criteria:

- *MOE*
  - Number of calls/incidents the system is utilized at
  - Incident clearance times
  - Collective incident response times to inter-agency situations
- *MOS*
  - O&M costs

O&M Considerations: Project costs include some overall management of the communications resources. Operational charges for communications (especially cell based) should be incorporated into agency budgets. An interagency agreement may be necessary to support long-term O&M costs.

Architecture Considerations: If enhanced inter-agency communications are to be provided through a communications patching solution, then a careful assessment of communications equipment and needs should be performed by a specialist in communications.

6.4.2.3 Integrated Surveillance Stations/Callbox Deployment

General Description:

The basic premise behind integrated surveillance stations/callbox deployments, also known as "Smart Call boxes" is the clustering of multiple capabilities at a single field location. Callbox locations can be equipped with traffic and weather surveillance devices, and utilize the communication capability of the call box to transmit the surveillance data back to a traffic management center or centralized database archive. The typical technology options that are attached to the call boxes include: traffic detection devices for operations (speed, volume) or planning (census, classification) purposes and road weather information systems (RWIS).

Traffic counts and classification data form the basis for transportation planning, engineering, and financial analysis. Counts are required when developing, designing, and updating traffic models, conducting corridor studies, developing traffic impact assessments, air quality impact assessments, level of service (LOS) monitoring, etc. Historically, regional count information has been available from Caltrans; however, Caltrans conducts traffic counts at designated control stations in each county (other than at permanent count stations) only once every three years. For the other two years, the actual control station count is increased considering application of an average growth rate (typically 2 percent). As a result, the accuracy of the count data is diminished in years when actual counts are not conducted. In addition, the counts are taken during one representative week in each quarter of the year. This count schedule may or may not account for average

and/or peak seasonal or average annual traffic conditions along specific routes in the region.

A Smart Call Traffic Monitoring Program can use the existing or planned call box system with integrated counter devices, existing Caltrans or other agency inductive loops, and various classification equipment to provide accurate, reliable, and timely traffic census and classification data throughout the Valley. The count/classification data collected through Smart Call Boxes is needed to calibrate and validate regional and local transportation models. The count/classification data will also enable agencies in the Valley, especially Caltrans; to monitor heavily traveled corridors to determine the appropriate application of improvements and funding priority. In addition, the Smart Call Box can remotely sense an incident considering average speed data compared to actual speeds of vehicles along a State Route or local highway.

The "Smart" Call Box is very similar to permanent traffic counter equipment except that downloading the data occurs through a modem call via the cellular network to the "Smart" Call Box. Caltrans and other agencies currently retrieve or download the data manually in the field at traffic control stations or sites to a laptop computer. Remote collection of traffic data allows the agency to reduce staff collection costs and collect year-round data.

There are three primary components to the project:

- **Remote Sensing Applications** – These sites would be remotely located at key locations within the Region to fill many of the gaps in the existing ITS sensing infrastructure. The remote stations would be capable of utilizing various CCTV, CMS, vehicle detection systems

- **VDS and weather sensors.** A strong emphasis should be the deployment of visibility sensors to support projects 2.1 and 2.2 in the IM/ES program area. Data would be communicated back to the Caltrans TMC through wireless means, most likely cellular. Information could then be passed on to other agencies through the regional network and RIW identified in project 1.5: Communications Interties.

- **Smart Callbox Applications** – Similar to the remote sensing stations, but with the added capability of a motorist aide callbox, Smart Callboxes have been deployed in various regions of the State including Sutter, Riverside, and San Bernardino Counties. Kern County has also identified the use of Smart Callboxes as a part of its ITS SDP. Smart Callboxes utilize a "smart card" placed within the Callbox to connect to various sensing devices. Data from the sensors would be transmitted via cellular communications to the Caltrans TMC, and would be made available to the wider Region over the regional network.

- **Callbox Applications** – The majority of devices contained in this project are simple motorist aide callboxes. Callbox systems have been deployed in the neighboring Counties of San Luis Obispo and Kern, as well as throughout many other regions of the State. Callbox calls can be handled either through a contracted answering service or through the CHP communications/call-taking center. In either case, funding support to the call answering party would be required. If the call taking center is private then emergency calls are passed to the CHP and simple motorist aide needs are dealt with through auto clubs and/or towing services. The deployment of a callbox system should include appropriate program management funding and functions to deal with contracting, servicing, and installation issues.

The deployment of a callbox system, as well as the installation of Smart Callboxes and other ITS components, can be supported through the development of a Service Authority for Freeway Emergencies (SAFE) within the Valley. State law allows the Regional agencies to collect a small fee on vehicle registrations within the County to support deployment of a motorist aide system. The creation of the SAFE would require political support from the Region and approval from the County Board of Supervisors.

A separate assessment is included as part of this project to site and further prioritize deployment of callboxes within the Region. Eventually, callbox deployment may seek to cover all feasible/major state facilities within the Region. The project also includes a handful of callbox deployments at Regional parks and along trails. While these deployment cannot be fully funded through the same mechanism, they can utilize the same system resulting in much reduced costs. Finally, it is important to note that the general concept that “everyone” will have cellular phones is far from valid. Even in many urban areas, cell phone market penetration is not expected to go too far beyond 35%. In most areas with callbox systems, the total number of calls has continued to climb over time as traffic levels have increased. Given the projected demographics, growth, and rural character of the Region, a motorist aide callbox system seems highly beneficial.

Project Objectives:

- Design and deploy remote surveillance stations with a common architecture, standards, and interface.
- Design and deploy a regional callbox system along applicable facilities.
- Provide for multi-jurisdictional access to the surveillance components of the system.
- Develop an institutional structure to provide continued support and maintenance of the overall system.

Sponsorship: Caltrans/Counties that have implemented SAFES including Fresno, San Joaquin, Kern (with support from local agencies)

Deployment Phasing: This project has been broken down into three basic phases.

	Phase Components
Phase 1	➢ Study for location of remote sensors, Smart Callboxes, and callboxes. ➢ Answering center start-up & support. ➢ Callbox program support. ➢ Deployment of 500 normal and 50 Smart callboxes/remote sensing stations along I-5 and SR-99, as well as in some regional routes parks/trails. ➢ Procurement of supporting software.
Phase 2	➢ Continued answering center support. ➢ Callbox program support. ➢ Deployment of 500 normal and 56 Smart callboxes/remote sensing stations along Phase 2 facilities identified in Figure 6-7.
Phase 3	➢ Continued answering center support. ➢ Callbox program support. ➢ Deployment of 126 normal and 15 Smart callboxes/remote sensing stations along Phase 3 facilities identified in Figure 6-7.

Call boxes and Smart Call boxes were assumed to be deployed two to a location (one on either side of the facility). Actual deployment should be based on the findings of the preliminary location study proposed in this project.

Deployment Locations: The Traffic Count Program in each County will be designed in cooperation with Caltrans District 6 and 10 personnel to maximize siting benefits. Specific locations identified include: State Highways in all counties that have a SAFE in place or plan to implement a Call Box Program.

Deployment Timeframes:

	Phase Timelines
Phase 1	Near Term: Years 6-8
Phase 2	Mid term: Years 9-10
Phase 3	Long Term: Years 10-15

Benefits:

The primary benefit to this clustering of capabilities is the ready availability of mounting infrastructure and electric and communication services. This technology could be utilized to fill-in gaps in traffic or weather surveillance or to add new surveillance in outlying areas where call boxes may be present but little or no traffic or weather surveillance

This project would provide several benefits to the valley including:

- Reduced incident detection times, especially in rural areas.
- Enhanced motorist aide services.
- Positive public perception of public services and support.
- Low-cost provision of remote transportation conditions information.
- Additional data to be obtained from other regions.

Emissions reductions from this project are likely to be somewhat limited due to the dispersed and rural character of the proposed deployment. Emissions reduction potential should not serve as a primary purpose for deploying this project type.

Budget Estimate:

	Phase Budget Estimates	
	Capital Costs	**Operations and Maintenance Per Year**
Phase 1	$3,000K	$450K
Phase 2	$12,000K	$1,800K
Phase 3	$10,000K	$1,500K
Totals	$25,000 K	$3,750K

Based on deployments in other regions, the basic costs were conservatively assumed to be $8,000 for a basic callbox installation and $12,000 (+ $10,000 for sensing devices) for Smart Call boxes installed.

Once the basic motorist aide and Smart Callbox systems are in place, funds obtained through the regional fee can be applied to maintenance, replacement, and deployment of additional motorist aide and transportation management devices.

Evaluation Criteria:

- *MOE*
  - Number of calls
  - Number of secondary incidents
  - Clearance time for disabled vehicles
  - Call answer/response times
  - Number of incidents
- *MOP*
  - Time to answer/respond to calls
  - Connect times to remote devices
  - Reliability of remote connections

- *MOS*
  - Mean-time between failures
  - O&M costs

O&M Considerations: This project involves a substantial operational program and funding requirements. It also provides a funding mechanism for continued operations. Many existing callbox deployments have displayed a lifespan in excess of that originally anticipated (approx. 15 years could now be assumed applicable with regular maintenance).

Architecture Considerations: Refer to market package ATMS 1 in the National Architecture.

6.4.3 Program Area 3.0: Transit Systems

Some regional agencies in the San Joaquin Valley have already begun deployment of key ITS transit components such as Transit Management Systems; whereas others have yet to develop their ITS capabilities. This project would develop key ITS transit components within the San Joaquin Valley, as well as identify several desirable activities that represent a combination of institutional and technical solutions to enhance the coordination of transit operations. The overall deployment concept for the Transit Systems program area is displayed and each project is discussed separately below.

6.4.3.1 Computer Aided Dispatch Integration

General Description:

This project would integrate the computer-aided dispatch systems of various emergency response and transportation agencies that jointly participate in traffic incident management, including local police, state patrol, HAZMAT response, Caltrans, and fire departments.

It is relatively common for State police and DOT centers to share CAD information. By adding the Fire and Police centers, cities, county, and state TMC's could improve traffic management considerably. The police concern about confidential information control can be overcome by using a separate database or part of a database for non-criminal incident data.

There are several CAD integration efforts on-going throughout the State. Two notable examples are the InterCAD project in San Diego and the FIRST program in Los Angeles.

- InterCAD – utilizes IBM's MQM series products to allow communication between a series of independent terminals, some of which are directly integrated into emergency service CAD systems. The original focus was on the integrating operations and exchanging information between law enforcement agencies, but this has recently shifted to more of a fire agency emphasis.

- FIRST – utilizes a separate system to extract information from the CHP CAD system in a non-intrusive manner, filter the information, and make it available for other transportation agencies.

Both projects have met with some difficulty in regards to the CHP CAD system, which is outdated and operating at capacity. The CHP has determined that in order to ensure the basic functions of the CAD, that extraneous interfaces should be limited until such time as a replacement CAD system can be put in place. The timeframe for replacement is currently unknown, but is likely to exceed five years.

Some regional agencies such as Fresno Fire and Police have recently implemented new CAD systems and other agencies in the Valley plan to undertake similar efforts in the near future. There is a national standard being developed for the exchange of information between CAD systems. As systems are replaced, integration between CAD systems should be simplified.

Given the status of the CHP CAD the Region has two basic deployment options in terms of this project:

- Integrate certain CAD functions into the Regional Integrated Workstation (RIW) project identified in project 5.1: Communications Interties – This may provide the necessary exchange of incident information between emergency services, but is likely to offer somewhat limited capabilities when compared with a true CAD integration effort.

- Deploy a separate series of CAD integration workstations similar to InterCAD - This provides simple CAD functions to an agency that either does not have a CAD or does not wish to directly integrate with its existing CAD system. This also offers the opportunity to integrate CAD systems if desired.

The focus of this project would be the communications linkages and software interfaces that would allow different agencies selected access to other agencies computer-aided dispatch systems. This access could including monitoring, in real-time, the dispatch activities of other agencies, sending and receiving messages, and under certain circumstances and according to mutually agreed upon procedures, providing input directly into other agencies systems. The extent of access to be provided to various agencies would be a critical consideration to be determined by the participating agencies.

The communications link for this project could utilize dedicated phone lines, or depending on distance and availability, fiber optic cable.

Project Objectives: The objective of the project would be to improve information exchange between agencies to improve the efficiency of their coordinated incident response activities, resulting in reduced response times, faster and more effective incident clean-

up, and ultimately, reduced secondary accidents and incident-related congestion and delay.

- Enhance communications and interoperations between dispatch centers within the Valley.
- Provide enhanced incident information for freeways and arterials.
- Integrate basic CAD functions throughout the Valley.

Sponsorship: Caltrans and CHP

Deployment Phasing: This project consists of a single phase of deployment.

	Phase Components
Phase 1	➢ Development of a common regional CAD integration software component either separately or within the RIW. ➢ Implementation of a FIRST or similar interface to the CHP CAD system. ➢ Deployment of appropriate workstations and associated equipment at 20 different locations throughout the Region including police, fire, CHP, Caltrans, and other emergency services. ➢ Leased communications for each agency.

Deployment Locations: Valleywide by TMC

Deployment Timeframes: This project is considered a long-term deployment to be completed in years 11-15.

	Phase Timelines
Phase 1	Long Term

Benefits:

General Benefits:

- Swifter interagency response to major incidents.
- Improved coordination capabilities between various emergency management services.
- Improved communications in emergency or disaster situations.

Emissions Reduction:

- No emissions reduction can be directly associated with this project. Some emissions reduction may occur through decreased incident duration and or response time in major incidents.

Budget Estimate:

	Phase Budget Estimates	
	Capital Costs	Operations and Maintenance Per Year
Phase 1	$2,000K	$300K
Totals	$2,000K	$300K

A total of $2,000,000 would be set aside for the integration of computer aided dispatch in the Valley.

Evaluation Criteria:

- *MOE*
  - Number of messages exchanged across the system
  - Number of incidents logged
  - Perception of CAD operators
- *MOP*
  - Communications rates
  - Message update/refresh rates
- *MOS*
  - O&M costs
  - Mean time between failures

O&M Considerations: The annual operation and maintenance costs were estimated at 15% of the capital costs of the project. Operational procedures should be developed/updated along with the CAD integration effort in order to maximize the benefits of the project. In addition, interagency cost-sharing agreements may be required depending on the specific CAD integration approach utilized.

Architecture Considerations: As noted above, the Region should follow development of the national standards regarding CAD integration and data definitions. In addition, readers may want to review Figure 5-4 of Section 5.0 of this Plan, as well as market package ATMS 8 in the National Architecture.

6.4.3.2 Transit Management System Completion/Expansion

General Description:

This project would provide additional funding assistance to a transit operator that has begun implementation of a transit management system but lacks the resources to complete the implementation in a timely manner, or to implement all of the desired functions. A transit management system typically includes automatic vehicle location (AVL), computer-aided scheduling and dispatch software, mobile data terminals, automated schedule adherence monitoring, computer report generation and data management, and

maintenance management software. Transit management systems may also include traveler information elements such as automated itinerary planning systems, station signs showing real-time vehicle arrival information, and Internet web sites.

The project would look at the most effective options for continuing TrMS deployment efforts in the Valley such as AVL. Additional countywide TrMS functions should be deployed with a view towards eventual valleywide deployment. Options for deploying compatible components across all vehicles should be sought. Different devices may be used, but they should operate across a common software/system with completely compatible standards.

Project Objectives:

- Develop TrMS deployment by using existing TrMS as a building block.
- Establish valleywide standards for the deployment of transit AVL equipment.
- Enhance the efficiency of transit services throughout the Valley by deployment of a compatible TrMS.
- Allow transit agencies to operate remotely of the core TrMS system with appropriate security features.
- Enhance the TrMS to effectively support demand based transit operations.

Sponsorship: Candidates for this project include those agencies that have begun implementation of transit management systems, including Fresno Area Express, Modesto Area Express, Golden Empire Transit and San Joaquin Regional Transit as well as some agencies who are just beginning to plan for these technologies such as Kings Area Regional Transit, Etc.

Deployment Phasing: This project has been broken down into two basic phases.

	Phase Components
Phase 1	➢ Perform a focused transit communications study to determine the specific communications needs of TrMS expansion. ➢ Deploy transit vehicles (including fixed route & paratransit) with standard AVL/GPS equipment. ➢ Deploy vehicles with enhanced equipment (passenger counting, etc.) ➢ Develop/procure software upgrades for TrMS to support regional needs and paratransit services. ➢ Install radio/communications system upgrades for rural transit services. ➢ Procure additional workstations.
Phase 2	➢ Deploy standard vehicles. ➢ Radio system upgrades for Local Transit. ➢ Procure additional workstations.

Deployment Locations: Valleywide deployment

Deployment Timeframes: This project is considered a near to mid term deployment to be completed within the next 8 years.

	Phase Timelines
Phase 1	Near to Mid Term: years 1-8

Benefits:

General Benefits:

- Enhanced information for transit managers.
- Provides enhanced potential for real-time transit operations integration.
- Improved coordination between various transit agencies.
- Expands core for the TrMS deployment to support other ITS transit deployment efforts.

Emissions Reductions:

- Transit management systems generally have a significant potential for positive impacts on emissions reductions resulting from more effective use of the transit fleet.
- This project focuses on demand responsive and urban transit services. Enhanced management and dispatching for these systems could reduce out-of-direction travel and increased service effectiveness.

Budget Estimate:

	Phase Budget Estimates	
	Capital Costs	**Operations and Maintenance Per Year**
Phase 1	$8,000K	$800K
Totals	$8,000K	$800K

A total of $8,000,000 would be allocated for the development and installation of multiple Transit Management System in the San Joaquin Valley.

Evaluation Criteria:

- *MOE*
  - Transit O&M
  - Ridership
  - On-time performance

- *MOS*
  - Mean-time between failures
  - O&M costs

O&M Considerations: Operational and maintenance costs were estimated at 10 percent of the capital costs per year.

Architecture Considerations: Valleywide standards for TrMS deployment should be established based on existing TrMS systems in the San Joaquin Valley, as well as existing/emerging national standards. Reference should be made to APTS 1 of the National Architecture.

6.4.3.3 Transit Information System

General Description:

This project would implement a system for collecting, processing and disseminating transit information, including "static" information such as routes and schedules, and in the cases of those operators with vehicle tracking systems, real-time information such as estimated vehicle arrival times at specific locations. The objective of the project would be to improve the availability and accessibility of transit information, thereby making transit more convenient and increasing transit utilization. Uncertainty about transit schedules, transit non-users as impediments often cite stops, fares and the timing of arrivals at specific stops. This project would establish a centralized transit information database, residing in a computer that would probably be housed at one of the San Joaquin Valley transit operations, or perhaps at a location, such as a Caltrans traffic management facility, where other traveler information is compiled. The project would include procedures and supporting communications infrastructure that would allow participating transit operators to submit information to the system. For static information, the communications system could be very minimal, such as via e-mail or Internet file transfer. The communications necessary to support real-time information would be more costly and elaborate and could include a dial-up or dedicated phone connection. The project would also include dissemination tools to make the information available to travelers. These tools could include an Internet web site, telephone information system, and kiosks.

Project Objectives:

- Provide real-time transit status information to transit patrons including delays, arrival times, and schedules.
- Promote transit ridership through enhanced information to the public.

Sponsorship: Valleywide by region including: Caltrans, COG's, and regional transit agencies.

Deployment Phasing: This project consists of a single phase of deployment.

	Phase Components
Phase 1	➢ Deploy real-time transit information displays at ten locations (2 displays each/secure casings). ➢ Procure or develop software to upgrade the TrMS to support the transit information displays. ➢ Provide communications for each of the locations. ➢ Provide monitoring/management workstations for the system.

Deployment Locations: Fifteen prominent transit centers/transfer locations within the Valley.

Deployment Timeframes: This effort is slated for mid-term deployment.

	Phase Timelines
Phase 1	Mid Term: Years 6-10

Benefits:

General Benefits:

- Provides simple, accurate, and timely transit information to transit patrons on the status of the next bus, delays, schedules, etc.
- Promotes transit ridership by improving the perception of the service.

Emissions Reduction:

- Improved information for transit patrons should help to enhance ridership. Short- and Long-Range transit plans should include this project, and the anticipated impacts on ridership. These estimates could be used to determine emissions reduction potential.

Budget Estimate:

	Phase Budget Estimates	
	Capital Costs	**Operations and Maintenance Per Year**
Phase 1	$1,000K	$100K
Totals	$1,000K	$100K

The total allocation cost is estimated at $1,000,000 for a Transit Information System.

Evaluation Criteria:

- *MOE*
  - Survey of transit patrons

- *MOS*
  - O&M costs
  - Mean time between failures

O&M Considerations: Operational and maintenance costs were estimated at 10 percent of the total capital costs

Architecture Considerations: Reference should be made to Figure 5-6 and 5-7 of the system architecture. In addition, reference should be made to market packages APTS 4 and 8 of the National Architecture.

6.4.3.4 Common Fare Equipment Deployment

General Description:

While certain fare transfer policies have been established between the region's transit agencies, there is difficulty in properly monitoring and managing fare transfers. Some agencies lack the more advanced fare equipment which is useful in terms of reporting ridership, patron types, travel patterns, etc. The potential for flexible fare media and smart cards should be reviewed. As with the expansion of the TrMS, the specific equipment needs of agencies may vary, but a common standard is important to inter-compatibility and economies of scale.

This project would coordinate the fare payment systems of one or more transit systems, allowing riders to use the same fare media, such as a magnetic strip swipe card, interchangeably on any of the participating systems. The project would include the deployment of appropriate fare equipment and software to participating agencies in the San Joaquin Valley. In addition to on-board fare collection equipment, this project would also include the computing and communications resources necessary to coordinate fare accounting among the participating agencies. This project could involve two or more agencies that do not have electronic fare payment systems (e.g., implement new equipment at all participating agencies), or expand upon a system already implemented by one or more agencies by equipping additional agencies.

Project Objectives:

- Establish a common regional transit fare system.
- Increase the convenience of fare payment for transit patrons.
- Promote transfers between systems
- Reduce fare handling costs for transit operators

Sponsorship: Regional Transit providers such as Tulare/Visalia Transit, KART, SMART, FAX, MAX, and GET

Deployment Phasing:

	Phase Components
Phase 1	➢ Perform a needs definition and installation plan. ➢ Deployment of new fare system on vehicles ➢ Procurement of fare management software, workstations, and interface equipment. ➢ Deployment of new fare system on regional transit vehicles ➢ Procurement of fare management software, workstations, and interface equipment.

Deployment Locations: Valleywide

Deployment Timeframes: This project has been identified for long term deployment.

	Phase Timelines
Phase 1	Long Term: Years 12-20

Benefits:

General Benefits:

- Improve regional integration of the transit fare system.
- Benefits patrons making transfers.
- Improves extent and quality of information available to transit managers.
- Allows for integration with the TrMS.

Emissions Reductions:

- No specific emissions reductions can be associated with this project.

Budget Estimate:

	Phase Budget Estimates	
	Capital Costs	**Operations and Maintenance Per Year**
Phase 1	$4,000K	$240K
Totals	$4,000K	$240K

A total of $4,000,000 would be set aside for the design and implementation of a common fare equipment deployment in the San Joaquin Valley.

Evaluation Criteria:

- Number of units deployed and mean time between failures.

O&M Considerations: The annual operational and maintenance costs were 6 percent of the capital costs of the project.

Architecture Considerations: Regional standards for fare systems would be established based on existing/emerging national standards. Reference market package APTS 4 of the National Architecture.

6.4.4 Program Area 4.0: Traveler Information Systems

There are three key portions of the overall ATIS program area for the San Joaquin Valley SDP:

- Improvement of existing data collection and transportation management systems through the deployment of projects defined in the other program areas,
- Enhancement of regional ATIS through the expanded deployment of ITS in the Valley, and
- Connecting with other Statewide and valleywide ATIS projects to provide a comprehensive picture of travel conditions within the San Joaquin Valley.

Figure 6.3 graphically displays the project concept flow diagram for traveler information systems.

6.4.4.1 Region-Wide Traveler Information System

General Description:

The objective of the regional traveler information system would be to provide travelers with a "one stop shopping" opportunity to collect traveler information for the entire valley. In this respect, the system would be especially useful for those traveling over large distances within the valley or traveling through the valley. The need for traveler information, including consolidated information for long-distance travelers was one of the high priority problems identified in the needs assessment.

The ultimate traveler information system would probably include information on both highway and transit, and possible information on other modes, including airports and pedestrian and bicycle facilities. The system would include a central database, or a series of linked databases acting as a virtual central database, containing information from a number of agencies, including Caltrans and city and county transportation agencies. The system would also include the procedures and communications infrastructure necessary for individual agencies to submit information to the system on an on-going basis. This communications infrastructure would most likely utilized dedicated phone lines, although fiber optic cable and wireless options are possible. The traveler information system would disseminate information through a variety of channels, including the various information tools operated by the agencies that contribute information to the system, such as changeable message signs, highway advisory radio and the Internet.

Figure 6.3: Traveler Information Systems

The first phase of this project would consist of, a feasibility study and conceptual design for a traveler information system for the entire San Joaquin Valley. The study, from developing a scope of work through acceptance of the final report, could be completed within two years. The study would identify the specific objectives of the regional traveler information system and identify a conceptual design for the system, including system architecture.

Project Objectives:

- Provide timely, accurate, and complete information on real-time transportation conditions to the users of the transportation network within the San Joaquin Valley.
- Enhance existing regional ATIS services through the deployment of upgraded and additional dissemination devices.
- Make ATIS data widely available over the Internet.
- Provide enhanced transportation conditions information to television and road broadcast stations.

Sponsorship: Identify a Lead agency using MOU's to be decided by COG Director's Steering Committee.

Deployment Phasing: Phase 1 of this project will study ATIS technology option for the San Joaquin Valley. The second phase of the project will design the traveler information system to be implemented for the San Joaquin Valley. The overall cost of the system would ultimately depend on which ATIS technologies were implemented in the Valley.

	Phase Components
Phase 1	➢ Identify the specific objectives of the regional traveler information system. ➢ Identify a conceptual design for the system including system architecture.
Phase 2	➢ Deploy ATIS components identified in Phase I study
Phase 3	➢ Expand ATIS system developed in Phase II

Deployment Locations: Valleywide with traveler information

Deployment Timeframes:

	Phase Timelines
Phase 1	Near Term: Years 2-3
Phase 2	Near to Mid Term: Years 4-6
Phase 3	Mid to Long Term: Years 7+

Benefits:

General Benefits:

- Provides real-time transportation conditions information to travelers in the San Joaquin Valley.

- May moderate people's travel patterns during commute periods resulting in overall reductions in delay.
- Reduced delay through diverted traffic.

Emissions Reduction:

- Emissions reductions from information systems are difficult to estimate. Estimation is usually based on the number of trips likely to be diverted or changed due to the information provided. This diversion results in an overall reduction in hours of congestion and number of vehicles delayed in incidents.
- Once the details of the proposed project have been decided upon (whichever components are deployed), the proponents should work with regional COG's to assess the emissions reduction potential of the project.

Budget Estimate:

	Phase Budget Estimates	
	Capital Costs	**Operations and Maintenance Per Year**
Phase 1	$60 K	$0 K
Phase 2	$600 K	$60 K
Phase 3	N/A	N/A
Totals	$660K	$60 K

A total of $60,000 would be allocated for the ATIS deployment study and $600,000 for the design and implementation of key ATIS equipment in the San Joaquin Valley. The estimated cost of Phase III would vary depending on the ATIS systems selected and deployed in Phase I & II.

Evaluation Criteria:

- *MOE*
  - Survey of travelers & origin-destination surveys.
  - Traffic volumes
  - Overall traffic delay
  - Incident induced traffic delay
  - Number of messages displayed/transmitted
  - Perceptions of broadcast media
- *MOS*
  - O&M costs
  - Mean time between failures

O&M Considerations: Information projects offer the greatest potential for public/private partnerships to support O&M considerations.

Architecture Considerations: It is critical that ITS projects follow a common architecture as discussed in this Plan in order to provide data in a common format to traveler information systems. The Valley should carefully follow and participate in statewide and other valleywide efforts that establish specific standards and architectures for information systems.

6.4.4.2 Weather/ATMS Integration and Automation (W/Paging System)

General Description:

This project would automate the linkage between road/weather information system (RWIS) detection stations in the field and traffic management system central control systems, including freeway service patrols and other incident management elements. Traffic management staff would be able to consult weather/pavement data using the same ATMS software that controls other portions of the traffic management system, and would automatically receive alerts for specific user-defined weather/pavement conditions. Additionally, various personnel, such as CHP and freeway service patrol operators, could receive automatic alerts via pagers or other communications devices. The extent of this project would vary for Caltrans District 6 and 10, since the District 10 system is currently partially integrated.

Currently, Caltrans District 6 utilizes a separate software system to monitor weather stations, and has a separate monitor that displays data from the stations. The system automatically polls each station at set intervals and returns the updated data to the monitor. Although the system does allow users to define various parameters relative to the display of the information, it does not include operator alarms or notifications per se, that is, operators must proactively consult the monitor to keep track of weather/pavement conditions. The software system that controls the weather system is not integrated with the other software systems that control other ITS devices, so operators cannot consult the weather information while working in other software. Field personnel access to weather information is via voice communications with traffic management system staff.

District 10 has integrated their weather/pavement detectors with changeable message signs, with the signs automatically displaying predefined messages based on information from the weather sensors. However, it is expected that additional upgrades, integration and automation of the weather system are possible and desirable.

This project includes two primary components:

- Deployment of additional weather sensors to fill-in gaps in the existing weather sensing infrastructure.

- Replacement/upgrade of some existing weather sensing stations.
- Integration of weather sensing data into the valleywide ATMS efforts including the Caltrans ATMS and the valleywide Integrated Workstation project identified in this Plan.

Due to the frequent weather related transportation problems experienced in this Valley, all ATMS projects should include some type of real-time tie to weather forecasting, weather conditions, and visibility levels on a 24-hour basis.

Project Objectives:

- Improve the response time, and effectiveness of the response, on the part of traffic and incident management agencies to hazardous pavement and/or weather conditions, such as fog or icing
- Faster and more effective response to these conditions resulting in fewer accidents
- Improve weather conditions information received by transportation managers along major facilities.
- Reduce the potential for large-scale incidents through the improved identification and tracking of severe weather conditions which lower visibility.
- Enhance and integrate weather-sensing functions into the Caltrans ATMS and the Valleywide Integrated Workstation development efforts.
- Provide inputs for variable speed sign deployment along freeways and highways.
- Provide weather information to other agencies in the San Joaquin Valley.
- Increase accuracy and timeliness of incident related motorists information.

Sponsorship: Caltrans with support from CHP, and other regional agencies.

Deployment Phasing: This project consists of a single phase.

	Phase Components
Phase 1	➢ Integration of weather information/functions into the Caltrans ATMS software. ➢ Communications support.

Deployment Locations: State Highways in District 6, State Highways in District 10. Expand to urbanized areas of Valley.

Deployment Timeframes:

	Phase Timelines
Phase 1	Near to Mid Term: Years 1-10

Benefits:

General Benefits:

- Much improved information on current weather conditions impacting safety and mobility on the Region's transportation network.
- Operator benefits resulting from enhanced systems integration.
- Improved information to the travelers on the nature of the weather conditions confronting them both at their current location and down the road.
- Enhanced motorist safety.
- Reduction in the number and severity of incidents and crashes.

Emissions Reductions:

Emissions reductions may result from this project by a reduction in the number and severity of major incidents in poor weather conditions. Reduction estimates can be made by comparing the number of major incidents, hours of delay, and number of vehicles involved in poor weather conditions. The actual estimated emissions reduced by limiting such major incidents are usually quite significant, but apply to only a few days out of any one year. This means that the overall reduction potential of this project type may be somewhat limited as relatively few large scale incidents occur each year, and then only under special weather conditions such as blowing dust or fog.

Budget Estimate:

	Phase Budget Estimates	
	Capital Costs	**Operations and Maintenance Per Year**
Phase 1	$1,500 K	$120K
Totals	$1,500 K	$120K

Evaluation Criteria:

- *MOE*
  - Number/occurrence of poor conditions notifications
  - Number of incidents
  - Number of CMS activation occurring from enhanced information

- Public perceptions of the accuracy of CMS data

➢ *MOP*

- Accuracy of weather devices
- Connect times to remote devices
- Reliability of remote connections

➢ *MOS*

- Mean-time between failures
- O&M costs

O&M Considerations: In order to share weather information valleywide in a meaningful manner, some basic standards should be established for describing conditions. For example, the Region might define ¼ mile visibility as Moderate or Poor. Whatever the specific standards they should be common to the entire valley and provide concise and easy to use for both transportation managers and information disseminators. The parallel is the speed dots used by many agencies on ATMS maps where each color represents a specific speed threshold.

Architecture Considerations: Statewide developments in the Caltrans ATMS may eliminate the need for a specific integration effort of weather functions for the San Joaquin Valley. Caltrans, District 6, should promote the integration of this functionality into future versions of the ATMS. Reference should be made to the System Architecture section of this Plan.

6.4.4.3 Dynamic Speed Signing (DSS) For Weather Conditions

General Description:

In response to a history of commercial vehicle accidents, Caltrans District 2 has implemented an interactive signing project at five locations on Interstate 5 in Shasta County. During the five years prior to installation of the five signing systems (May 1994 to April 1999), the five locations experienced a total of 32 truck crashes. During the 18-month period immediately following the installations (April 1999 to October 2000), only one truck crash was reported. The project appeared to have improved safety concerns at the project locations during the initial evaluation period.

This project would implement dynamic message signs, vehicle speed detectors, and weather sensing equipment along key locations in the San Joaquin valley. The project would implement similar devices used in the Caltrans District 2 evaluation.

The system consists of interactive changeable message signs equipped with radar and closed circuit TV (CCTV) cameras at each location. When the radar units detect vehicles exceeding the curve advisory speed, the changeable message sign automatically activates a warning message displaying the speed of the vehicle followed by the recommended speed for the curve.

The curve warning system described above could be adapted into weather related speed advisory system by the addition of a road weather information station/system (RWIS). The weather parameters from the RWIS (temperature, visibility, pavement condition, etc.) would be incorporated into the dynamic signing system as an additional input. The system would then display to the driver an appropriate advisory message, such as a suggested safe speed, for the prevailing weather and traffic conditions.

The system could be implemented anywhere in the San Joaquin Valley there is a concern about weather related speed safety issues. Ideally, the system would have some type of remote access capabilities so that agency operators could remotely check system diagnostics and operations.

Project Objectives:

- Improve driver recognition of the conditions surrounding them.
- Reduce the potential for large-scale incidents through the use of advisory speeds and improved roadway delineation.
- Reduce the number of incidents in poor weather conditions.

Sponsorship: Caltrans with support from CHP, and other regional agencies.

Deployment Phasing: This project has been broken down into three basic phases.

	Phase Components
Phase 1	➢ Deployment of DSS at key locations in the San Joaquin Valley. ➢ Deployment of RWI's along facilities. ➢ Procurement of DSS misc. support equipment and software.

Deployment Locations: Valleywide in District 6 and 10 (93 locations identified in the District 10 TOC study).

Deployment Timeframes: Weather/ATMS Integration be in place prior to deployment. The project is slated to begin in the near-term.

	Phase Timelines
Phase 1	Years 5-10

Benefits:

General Benefits:

- Improved notification to the driver of roadway/travel conditions will improve driver safety.
- Reduced number of accidents at deployed locations, and reduced number of major incidents during poor weather conditions.

Emissions Reductions:

- Reduction in the number of major incidents would lead to emissions reductions.

Budget Estimate:

	Phase Budget Estimates	
	Capital Costs	**Operations and Maintenance Per Year**
Phase 1	$4,650K	$310K
Totals	$4,650K	$310K

Unit costs were assumed to be $50,000 per DSS and $15,000 per RWI's increment (1/4 mile deployment). Any communications necessary would be available through project 2.1.

Evaluation Criteria:

- *MOE*
  - Number of incidents
  - Number of DSS activations/speed adjustments
  - Public perceptions of the accuracy of DSS data/RWI's effectiveness
  - Number of single vehicle incidents
  - Number of "reckless driving" citations
- *MOS*
  - Mean-time between failures
  - O&M costs

O&M Considerations: None.

Architecture Considerations: The Valley should continue to follow the testing efforts by Caltrans in the use of IRS. The ITS SDP for Fresno and Kern County also indicates the potential deployment of IRS, and the potential for a joint procurement should be considered.

6.4.4.4 National Park Traveler Information System

General Description:

This project would implement a traveler information system oriented to visitors of the national parks and similar major attractions in the San Joaquin Valley, including Kings Canyon, Sequoia and Yosemite National Parks. This traveler information system would expand upon the current system oriented to Yosemite National Park (www.yosemite.com). The National Park Traveler Information System would include a centralized information database, or series of linked databases that operate as a single virtual database, containing comprehensive traveler information for the attractions served by the system, including information on road and

weather conditions. The system would include procedures and the supporting infrastructure necessary for the individual attraction operators to submit information on an on-going basis. For static, or non-real time information, e-mails, Internet file transfers or even faxes could suffice. For real-time information, such as congestion information based on traffic detector data or weather information based on weather station data, more sophisticated communication channels would be required, such as dedicated phone lines. The information collected through the system would be disseminated through a variety of channels, such as an Internet web site, highway advisory radio and changeable message signs. This project would be led by a coalition including Caltrans, county transportation departments and representatives from the parks and any other attractions included in the system.

Project Objectives:

- Provide motorist and tourist with more accurate real time information on access to parks and road conditions

Sponsorship: Regional COG's and National Park Service.

Deployment Phasing:

	Phase Components
Phase 1	➢ ATI's integration and system design ➢ ATI's implementation in parks

Deployment Locations: Regions around Sequoia and Kings Canyon National Parks along with Merced CAG and Yosemite NPS.

Deployment Timeframes: This project is considered a near term deployment to be completed in 3 to 5 years.

	Phase Timelines
Phase 1	Mid Term: Years 5-10

Benefits:

- Improved truck information
- Reduced risk of incidents
- Reduction in unnecessary trips

Budget Estimate:

	Phase Budget Estimates	
	Capital Costs	**Operations and Maintenance Per Year**
Phase 1	$140 K	$14 K
Totals	$140 K	$14 K

Evaluation Criteria:

- Reduction in incidents
- Reduction in park related traffic

O&M Considerations: Operation and maintenance of YATI has proven to be a challenge and may require private partnership. However, the Yosemite Park is considering the development of a traffic and traveler information system at this time.

Architecture Considerations: TBD

6.4.4.5 Remote Advanced Traveler Information System (ATIS) Workstations

General Description:

Remote ATIS workstations would be placed at various locations around the Valley to collect various elements of transportation data for transfer to a centralized traveler information system. The information collected could include: traffic signal system data, freeway flow data, incident and weather information, changeable message sign (CMS) messages, static and dynamic transit data and possibly video images. As implied in the opening sentence, placement of ATIS workstations would be premised on deployment of an ATIS for the San Joaquin Valley.

The ATIS deployment could be based on implementation of physical communication interties and the development of a data exchange network. Data exchange networks are typically used only by public agencies in transportation and incident management while ATIS implies some type of public dissemination of the information contained in the system. A data exchange network could be deployed with the intention of also using it to supply data to an ATIS.

Before deployment of ATIS workstations in the Valley could take place, a consensus approach should be agreed upon as to how such a system would be deployed, what the building blocks would be and who (what agency) would take the lead in deployment and on-going operations and maintenance.

Project Objectives:

- Provide a system to collect data and disseminate to a Valleywide ATIS.

Sponsorship: Regional COG's

Deployment Phasing:

	Phase Components
Phase 1	➢ ATI's evaluation add system design ➢ Workstation deployments at urban TMC's or COG's

Deployment Locations: Valleywide

Deployment Timeframes: This project is considered a mid term deployment to be completed in 6 to 9 years.

	Phase Timelines
Phase 1	Mid Term

Benefits:

- Provide additional more detailed data to a Valleywide ATIS for more informed motorists.

Budget Estimate:

	Phase Budget Estimates	
	Capital Costs	**Operations and Maintenance Per Year**
Phase 1	$125 K	$30 K
Totals	$125 K	$30 K

Evaluation Criteria:

- MOE
  - Number of times system is used
  - Amount of area with information coverage
- MOS
  - O & M costs
  - Mean time between failures

O&M Considerations: Operations costs are assumed to be high due to ongoing communications costs.

Architecture Considerations: Integral component of the ATIS Market Packages.

6.4.4.6 In-Vehicle (Fm Cub-Carrier) Commercial Vehicle Traveler Information System

General Description:

This project would implement a traveler information system for commercial vehicle operators utilizing a wireless, wide area, one-way communications system (e.g., FM subcarrier). Unlike highway advisory radio, which normally utilizes the AM band and can be tuned on any AM radio, the communications system utilized in this system would only be accessible using special radios with FM subcarrier receiving capability. The objective of this project would be to provide a dedicated source of information to commercial vehicle operators that would allow them to make informed choices that would improve their operational efficiency, and conceivably,

reduce congestion and accidents over time by reducing commercial vehicle traffic in hazardous and congested areas.

An important early step in the development of this project would be to work with commercial vehicle operators to determine what information would be most useful to them. A wide variety of information could be provided through the system, including information on commercial vehicle parking, services, regulatory and enforcement information (e.g., inspection stations), truck routes, road closures and restrictions, roadway construction, congestion and delay, and weather and pavement information.

Unlike highway advisory radio, the FM subcarrier communications approach allows for the communication of digital information, and therefore maps and images could also be transmitted. The FM subcarrier communications approach would most likely utilize existing FM transmitters and would broadcast information over a relatively large area, unlike low power AM highway advisory radio which normally is used in spot applications and has a small reception area.

Project Objectives:

- Provide commercial vehicles with enhanced real time traffic and weather data.

Sponsorship: Lead agency to be determined.

Deployment Phasing: This is a single-phase deployment.

	Phase Components
Phase 1	➢ Develop high level design ➢ Deploy System

Deployment Locations: Valleywide

Deployment Timeframes: This project is considered a mid to long term deployment to be completed in years 7 through 14.

	Phase Timelines
Phase 1	Mid to Long Term: Years 7-14

Benefits:

- Increases safety and CUO efficiency providing specific useful information to the trucking industry.

Budget Estimate:

	Phase Budget Estimates	
	Capital Costs	**Operations and Maintenance Per Year**
Phase 1	$100K	$25 K
Totals	$100K	$25 K

Evaluation Criteria:

- TBD

O&M Considerations: This project will require considerable private sector involvement in order to succeed.

Architecture Considerations: None at this time.

6.4.4.7 Implementation of a 511 System for the Valley

General Description:

For many years, the 411-telephone number has been used nationwide as a universal telephone number for "directory assistance". Similarly, 911 has been used as a universal telephone number to summon emergency police, fire and medical assistance, though not necessarily nationwide. In California, over the course of the past decade, two efforts to implement a similar "universal telephone number for traveler information" have met varying degrees of success: the "1-800-COMMUTE" telephone number in southern California and the TravInfo "817-1717" telephone number (from several area codes) in the bay area. Other regions around the nation have embarked on similar efforts to disseminate traveler information via a "regionally universal" telephone number.

Over the past couple years, a nationwide effort has been put forth to reserve a "n11" telephone number (similar to 411 or 911), to be a universal nationwide telephone number for traveler information. Early in 2000, the Federal Communications Commission (FCC) reserved 511 for that purpose. Generally speaking, the FCC issued no guidance on how to implement the 511-telephone number and who would pay for its operation. It was left largely up to the local and regional agencies interested in disseminating traveler information to cooperatively decide how to do so.

The first step of a suggested 2-step project approach would be to initiate a needs assessment and preliminary design analysis for implementing a 511 system in the San Joaquin Valley. In the course of that effort, or immediately following, the interested agencies would work to establish the institutional ground rules (lead agency (ies), participating agencies and funding and operational responsibilities) of implementing a 511 system. The second step, a more detailed design and implementation, would be taken based on the findings of the needs assessment and preliminary design, and the establishment of ground rules for their partner agencies.

Project Objectives:

- Provide a region wide traveler information call in line that will give real time information for specific routes.

Sponsorship: A joint powers authority comprising Caltrans and the local RPTA's will be needed.

Deployment Phasing:

	Phase Components
Phase 1	➢ Provide needs assessment and concept design. ➢ Detailed design and implementation.

Deployment Locations: Valleywide System

Deployment Timeframes: This project is considered a mid to long term deployment to be completed in years 7 through 12.

	Phase Timelines
Phase 1	Mid to Long Term: Years 7-12

Benefits:

- Improved traveler information provide for safer, less congestion transportation networks.

Budget Estimate:

	Phase Budget Estimates	
	Capital Costs	**Operations and Maintenance Per Year**
Phase 1	$2,000K	$200K
Totals	$2,000K	$200K

Evaluation Criteria:

- Number of times that system is used.
- Mean time between failure.
- User satisfaction surveys.

O&M Considerations: Developing an organizational structure to operate system will be critical to project success.

Architecture Considerations: TBD.

6.4.4.8 Truck Stop Traveler Information Demonstration

General Description:

This project would implement commercial vehicle traveler information at truck stops or other commercial vehicle facilities. The system would most likely utilize interactive kiosks to provide traveler information oriented specifically toward commercial vehicle operators. The kiosks could provide access to an Internet web site that could then also be accessed from any computer with Internet access.

A wide variety of information could be provided through the system, including information on commercial vehicle parking, services, regulatory and enforcement information (e.g., inspection stations), truck routes, road closures and restrictions, roadway construction, congestion and delay, and weather and pavement information.

Project Objectives:

- The objective of this project would be to provide a dedicated source of information to commercial vehicle operators that would allow them to make informed choices that would improve their operational efficiency, and conceivably, reduce congestion and accidents over time by reducing commercial vehicle traffic in hazardous and congested areas.

Sponsorship: Public/Private Partnership with Regional COG's

Deployment Phasing: The project is a single phase demonstration project.

	Phase Components
Phase 1	➢ An important early step in the development of this project would be to work with commercial vehicle operators to determine what information would be most useful to them.

Deployment Locations: Regional based on a single number system for the Valley

Deployment Timeframes: This project is considered a mid term deployment to be completed in years 5 through 9.

	Phase Timelines
Phase 1	Mid Term: Years 5-9

Budget Estimate:

	Phase Budget Estimates	
	Capital Costs	**Operations and Maintenance Per Year**
Phase 1	$450K	$45K
Totals	$450K	$45K

6.4.4.9 Roadside Weather Information Stations (RWIS) With CCTV

General Description:

This project would extend coverage of weather stations for the entire San Joaquin Valley. In the San Joaquin Valley, the primary hazards are fog and blowing dust during the late fall and winter months. During wet years, fog will dominate during periods of non-frontal activity, decreasing visibilities over large areas for extended periods of time. Blowing dust occurs in all three regions. In the valley it usually occurs during dry winter months when farmland is not under production. Associated with blowing dust is the hazard of high winds, which can occur in all three regions, but is most prevalent in the desert and mountain areas. Rain, snow and ice are precipitation hazards, which exist in the mountain region during the winter months. This project assumes the installation of 30 RWIS

throughout the San Joaquin Valley. Existing weather stations, which are not within sight of the monitoring agency, should be outfitted with CCTV cameras for verification of weather conditions.

Weather stations which combine a variety of technologies, coupled with CCTV cameras for verification (especially in rural areas), can provide an accurate picture of weather conditions region-wide in real-time. Available technologies include visibility sensors, precipitation intensity and type sensors, wind speed/direction sensors, and pressure transducer sensors. Visibility sensors use infrared technology to measure visibility constraints as the result of various sources such as precipitation, fog, haze, dust, and smoke. Precipitation intensity and type sensors use infrared technology to measure and classify precipitation. Humidity/Air Temperature sensors measure relative humidity and temperature. Wind Speed/Direction sensors monitor wind speed (mph) and direction (bearing). Pressure transducer sensors detect water levels in flood channels. Caltrans operates five weather stations in Kern: two on I-5 and three in Tehachapi on SR 58. These stations are linked via cellular phone service to the TMCs in Fresno and Bishop. Kern County operates a system of twenty-five rain gauge stations located throughout the County. Some of these stations have additional capabilities for measuring wind, temperature and humidity. In addition, the County gathers data from remote weather stations owned and maintained by private corporations. These remote weather stations automatically transmit information to a dedicated weather data computer located at the County communication center. Daily weather data is also collected manually at each County fire station and called in to the County communication center, where it is placed in the weather computer database. The database of weather information is accessed by the national weather service and various water and other agencies. The national weather service disseminates this information, along with weather forecasts, to the CHP and Caltrans.

Project Objectives:

- The objectives of the weather stations and CCTV cameras are to obtain and verify adverse weather conditions in the rural areas of the Valley.

Sponsorship: Caltrans District 6 and 10

Deployment Phasing: This project is a single phase deployment.

	Phase Components
Phase 1	➢ Develop Master Plan for siting of these systems on State Highways and County Roads ➢ Design and deploy systems throughout Valley by District

Deployment Locations: Valleywide locations along District 6 and 10 highways.

Deployment Timeframes: This project is considered a near to mid term deployment to be completed in years 1 through 10.

	Phase Timelines
Phase 1	Near to Mid Term: Years 1-10

Benefits:

- Improved road condition information
- Reduced accidents
- Reduced congestion

Budget Estimate:

	Phase Budget Estimates	
	Capital Costs	**Operations and Maintenance Per Year**
Phase 1	$2,250K	$225K
Totals	$2,250K	$225K

6.4.5 Program Area 5.0: Regional ITS Configuration Management/ Coordination/ Planning

This program area provides support to each of the other program areas in terms of systems configuration management, ITS planning, and coordination support. These efforts generally represent internal agency efforts or may represent contracted efforts in certain conditions. Therefore, the full costs of these efforts may or may not be directly felt by deploying agencies. As displayed in Figure 6.3, it is important to note that the end goal of regional ITS deployment is a regionally integrated "system of systems" where the exchange of information and inter-agency operations far exceeds today's levels.

6.4.5.1 Den/Communications Interties

General Description:

Data exchange networks are typically set up in areas where several jurisdictions are interested in collectively sharing information from their respective traffic management systems. The most common information shared is from traffic signal systems. While information exchange on the network can be used to more efficiently monitor multiple signal systems, the network usually doesn't allow for field device control or system interoperability. However, those capabilities can be included depending on user needs.

Data exchange networks depend on some type of communication infrastructure (dedicated agency owned or leased line) and software to exchange information. Communication intertie projects (see Communication Intertie fact sheet) can establish some of the necessary communication links for a data exchange network. Data exchange networks differ from interties in that data exchange

networks typically focus on the network connectivity and "logical" protocols of sharing data among several agencies. Interties typically focus on the "physical" communication link between agencies. Both, interties and data exchange networks can form the basis and initial implementation of the "center to center" portion of a Regional Architecture.

Communications intertie projects typically take place between a Caltrans Transportation Management Center (TMC) and a local agency TMC/Traffic Operations Center (TOC). To be most effective, the Caltrans TMC and the local agency would be required to have centralized command and control of traffic management systems and field devices within their respective jurisdictions. In other areas of California, intertie projects allow Caltrans and the local agency to more efficiently share transportation management information, including but not limited to: traffic flow and congestion information, weather information, incident information, video images and in some cases, signal timing plans and modes. In some cases, shared control of a limited number and type of field devices has been arranged between agencies. While full control of one another's assets (field devices, signal systems, etc.) is technically possible it may not be a desired arrangement institutionally.

The most important element of an intertie project is a communication link between the intertie agencies. This can either be a dedicated agency owned asset (fiber or copper wire) or some type of telco lease line technology (T1, ISDN or DSL). Another major element of an intertie project is the software, protocols, and interfaces that would allow for the exchange of information between different systems. Interties differ from data exchange networks (see Data Exchange Network fact sheet) in that interties focus on the "physical" communication link between agencies. Data exchange networks typically focus on the network connectivity and "logical" protocols of sharing data among several agencies. Both, interties and data exchange networks can form the basis and initial implementation of the "center to center" portion of a Regional Architecture.

The most logical data exchange network partnerships would initially center around the urbanized areas of the San Joaquin Valley, including: Bakersfield, Visalia/Tulare, Hanford, Fresno, Modesto, and Stockton. The Counties and Caltrans would also be involved in the partnerships. Local signal control systems will be tied into each county designated Regional TMC.

The most logical interties in the San Joaquin Valley would be between the Caltrans Districts (6 and 10) and the counties and major cities of the Valley. In general, local agencies that partner and interconnect more than one agency with Caltrans have been more successful in obtaining state and federal funding than those proposals that intertie only one agency to Caltrans.

Project Objectives:

- Design and construct a communications backbone linking the various TMCs in the Region.
- Establish common communications standards and protocols, as well as common data definitions.
- Design and deploy a common Intertie workstation (Regional Integrated Workstation) for use by transportation and emergency service agencies.

Sponsorship: ·Caltrans District 6 and 10, Urban Area TMCs

Deployment Phasing: The development of this project is important to the goals defined in this SDP and has been identified for mid to long term deployment.

	Phase Components
Phase 1	➢ Local fiber communications plus supporting communications equipment. ➢ Leased communications equipment and services for participating agencies. ➢ Necessary device driver upgrades and computer equipment.

Deployment Locations: District 6 TMC to District 10 TMC; District 10 TMC to Stockton TMC, Modesto TMC and Merced TSCS; District 6 TMC to Fresno TMC; Bakersfield TOC; Visalia-Tulare and Hanford TSCS

Deployment Timeframes: This project has been identified for near-term deployment. Deployment efforts would be expanded to include additional agencies and departments once the initial RIW network is established. Additional expansion should be relatively simple once the RIW core is in place.

	Phase Timelines
Phase 1	Years 8-15

Benefits:

General Benefits:

- Enhanced Coordination and Communication in the Region
- Improved transportation management.
- Decreased incident response and duration due to improved coordination.
- Enhanced management of special event situations.
- Lower deployment costs for future ITS projects.

Emissions Reductions:

- Emissions reductions should result from this project type provided that some form of interagency communications and coordination system is put in place such as the RIW suggested in this project. Use of such as system should result in improved coordination and fewer non-recurring congestion events. The specific benefits of this system will be difficult to estimate. Estimations may be based upon an overall estimate in the number of hours of congestion due to enhanced coordination and operations.

Budget Estimate:

	Phase Budget Estimates	
	Capital Costs	**Operations and Maintenance Per Year**
Phase 1	$4,000K	$400K
Totals	$4,000K	$400K

Fiber-optic deployment costs based on a unit cost of $25/LF. Design costs were assumed to be 15% of capital costs, and contingencies were 15% of capital costs for traditional project components and 30% for software development. Leased communication equipment costs were assumed to be $5,000 per agency with service charges of $150/month.

Evaluation Criteria:

- *MOE*
  - Number of incident advisories exchanged between agencies
  - Number of planned incident entries
  - Average time to diagnose and resolve a signal problem at a remote location
  - Average hours of active system use
- *MOP*
  - Time to access and control a field device.
  - Accuracy of displayed information on traffic conditions.
  - Time to transmit/receive an advisory.
- *MOS*
  - Mean-time between failures
  - O&M costs

O&M Considerations: The development of TMC-TMC communications and a RIW allows for much greater flexibility on the part of agencies to utilize information and respond to situations in a cooperative manner. The Traffic Systems Workgroup and Incident Management Team should consider the desired functions

of the RIW carefully, and support the deployment with the appropriate institutional and policy guidelines.

Architecture Considerations: As noted above, the Valley should consider building off of another region's efforts in developing an integrated workstation.

6.4.5.2 Common/Standard Regional/County Digital Mapping

General Description:

This project would develop a standard electronic map, or set of standardized maps that could be integrated, for the San Joaquin Valley or subregions within the valley, such as counties. The objective of the project would be to reduce the costs to individual agencies to develop maps—the "design it once, deploy it many times" concept—and to promote coordination between the various agency systems that would utilize the maps. Utilization of compatible maps is often a critical factor influencing the extent to which different ITS systems can work together.

Electronic maps are critical components in many ITS applications, including automatic vehicle location (AVL) and computer-aided dispatching (for transit, emergency responders, and maintenance fleets), and traveler information systems that feature custom itinerary planning. Electronic maps are also important components of any ITS applications that rely on real-time vehicle location information, including "next bus" transit station signs, dynamic route guidance, transit schedule adherence monitoring, and "smart shuttle"-type dynamically dispatched transit service. Electronic maps are also often utilized in the central software systems of advanced traffic management systems.

Project Objectives:

- Enhance the Regional GIS files to provide more accurate mapping outside of the regions for purposes of AVL/GPS.
- Provide a common emergency services map reference grid overlay.

Sponsorship: Regional COGs with City and County GIS departments.

Deployment Phasing: This project consists of a single phase of deployment.

	Phase Components
Phase 1	➢ Perform appropriate surveys necessary to enhance the regional GIS map as directed by Regional COGs. ➢ Project provides for 1.5 full time employee equivalents for two years to perform necessary support tasks.

Deployment Locations: Valleywide

Deployment Timeframes: This project is a mid term deployment to be completed in years 7 through 10.

	Phase Timelines
Phase 1	Near Term: Years 0-5

Benefits:

- A more accurate map should reduce future AVL deployment costs and ensure greater accuracy in data.
- A more accurate regional map will also assist in ensuring that all ITS applications utilize an accurate and common mapping base.
- A common grid/coordinate system for emergency services would assist in interagency coordination and cooperation in interagency emergency response situations.

Budget Estimate:

	Phase Budget Estimates	
	Capital Costs	**Operations and Maintenance Per Year**
Phase 1	$1,500K	$150K
Totals	$1,500K	$150K

Evaluation Criteria:

- Accuracy of the regional map for ITS applications.

O&M Considerations: Prior to proceeding with this effort, the project stakeholders should carefully define the allowed uses of the map.

Architecture Considerations: Reference should be made to the National Architecture Location Referencing Standards currently under development.

6.4.5.3 ITS Design Guidelines

General Description:

This project would develop design standard in the development and implementation of ITS components in the San Joaquin Valley for use by local agencies that have just started deploying ITS.

Project Objectives:

- To provide local agencies with guidance needed to implement ITS and benefit from others experience.

Sponsorship: Lead agencies to be selected by Valley COG Directors

Deployment Phasing: This project is a single phase deployment.

	Phase Components
Phase 1	➢ Development ITS standards and guidelines for Valley

Deployment Locations: Valleywide

Deployment Timeframes: This project is a near term deployment to be deployed within 5 years.

	Phase Timelines
Phase 1	Near Term: Years 3-5

Benefits:

- Standardize operations and maintenance of systems and develop opportunities to perform joint procurement.

Budget Estimate:

	Phase Budget Estimates	
	Capital Costs	**Operations and Maintenance Per Year**
Phase 1	$200K	$0K
Totals	$200K	$0K

Evaluation Criteria:

- None apply

O&M Considerations: None apply to this project

Architecture Considerations: TBD

6.4.5.4 Valley ITS Video

General Description:

This project includes the development of an educational videotape that highlights the need for ITS and summarizes recommendations made in the ITS plan.

Project Objectives:

- To educate policy makers and stakeholders on benefits of Valley ITS and obtain project funding.

Sponsorship: Caltrans with TAC involvement

Deployment Phasing: This project is a single-phase deployment.

	Phase Components
Phase 1	➢ Create and produce video

Deployment Locations: Valleywide

Deployment Timeframes: This project is a near term deployment to be completed within 2 years.

	Phase Timelines
Phase 1	Near Term: Years 1-2

Benefits:

- Improved policy making and support for funding

Budget Estimate:

	Phase Budget Estimates	
	Capital Costs	**Operations and Maintenance Per Year**
Phase 1	$10K	$0K
Totals	$10 K	$0K

Evaluation Criteria:

- Not applicable

O&M Considerations: Not applicable

Architecture Considerations: Not applicable

6.5 Multijurisdictional/ County Project Definitions

The specific ITS project definitions for the counties within the San Joaquin Valley are described in Appendix A. The program areas are divided into subsections as follows:

6.5.1 Priority Projects in Fresno County:

- Fresno/Clovis Regional ATMS Completion Project, Phase 3
- Fresno/Clovis area Signal Coordination
- FAX Fare Equipment Deployment and Transit Management System Expansion

6.5.2 Priority Projects in Kern County:

- Smart Call Box System Deployment
- Smart Studs Demo Project
- Incident Management Procedures
- Communication Network, Phase II
- Kern County Regional Communication Links
- RWIS with CCTV System
- Bakersfield TOC Expansion
- GET Fare Equipment Deployment

6.5.3 Priority Projects in Kings County:

- Hanford Central Traffic Signal Control System
- KART AVL Demo

- Hanford Traffic Signal Coordination
- Portable Changeable Message Signs
- Railroad Grade Crossing Treatments

6.5.4 Priority Projects in Madera County:

- Curve Warning System on County Roads
- AVL/Silent Alarm System
- Next Bus System for County Transit
- TOS Expansion in County along State Highways
- Transit Information System

6.5.5 Priority Projects in Merced County:

- Advanced Railroad Grade Crossing projects
- Central Traffic Signals Control for Merced and Atwater
- Next Bus Arrival Sign System for Transit
- Yosemite.com System Deployment

6.5.6 Priority Projects in San Joaquin County:

- San Joaquin Transit Electronic Fare Payment (coordinate with MTC's regional system)
- Vanpool Vehicle Traffic Probes Project
- Stockton area signal coordination
- Fare Equipment Deployment at SMART
- Stockton ATMS Expansion, Phase 2
- Curve Warning System on County Roads

6.5.7 Priority Projects in Stanislaus County:

- MAX AVL System
- Modesto/Ceres Signal Coordination
- MAX Fare Equipment Deployment
- Modesto/Ceres ATMS Expansion

6.5.8 Priority Projects in Tulare County:

- Fast Pass Electronic Fare Collection System
- City of Visalia Transit AVL/silent alarm system
- Visalia/Tulare traffic signal system Central Control
- Visalia/Tulare Arterial Signal Coordination
- Visalia EVP Signal Project

- Porterville EVP Signal Project
- Porterville Red Light Running Enforcement Project

Projects are identified by a unique identification number within each of these subsections. Readers may wish to reference the Appendix A Table of Contents to locate particular projects of interest.

Table 6.1: Summary of Valleywide ITS Projects

ID	Program Area/Project	Involved Agency	Brief Description	Project Initiation* N	Project Initiation* M	Project Initiation* L	Capital Cost Estimates 2001 (Thousands of $)** Total Phase 1	Total Phase 2	Total Phase 3
1.0 Traffic/Freeway Management Systems (ATMS)									
1.1	CURVE WARNING SYSTEM	Valleywide	Several truck rollover accidents have occurred along State Route 99. These accidents have been attributed to excessive speed and sharp curves that exist. While there is posted speed limits, many trucks do not slow down enough to safely negotiate curves. It is recommended that a more visible, "smart" warning system be deployed at the interchange. The purpose of this project is to deploy a curve warning system at approach to the ramp. The curve warning system, referred to by Caltrans as Truck Activated Rollover Warning System (TARWS), is primarily intended to increase the level of safety on this section of roadway, resulting in fewer rollovers and associated injuries. The curve warning system will consist of a static warning sign located well in advance of the curve which reads "CURVE AHEAD". A speed detection system will be installed to determine vehicle speed. If a vehicle's speed indicates that safe curve negotiation is not likely, an LED display, attached to the static sign and reading "REDUCE SPEED" would be illuminated. Curve warning systems are available from a variety of manufacturers. Specifications, technologies and products will be detailed in the Technology Assessment and developed throughout the preliminary engineering process. Three (3) locations have been identified within Caltrans District 10 for installation of TARWS: SR-4 WB offramp onto SB I-5, SR-99 SB offramp onto WB Mariposa Road/ SR-4, and I-5 NB offramp onto WB SR-152, considered Phase I of the project. Phase II will add an additional 16 locations listed in the San Joaquin Goods Movement study. This phase is considered a midterm project to be completed in the next 5 to 10 years.	X	X		**$ 153K**	**$ 820K**	
1.2	CHANGEABLE MESSAGE SIGNS AT KEY DECISION POINTS	District 6 District 10	This project would expand the number of changeable message signs (CMS) located at key routing decision points within the San Joaquin Valley, such as in advance of interstate-to-interstate interstate to major state route interchanges. This effort would supplement the CMS implementation efforts that are currently underway by Caltrans Districts 6 and 10. Both District 6 and 10 operate numerous CMS in the San Joaquin Valley, with plans of deploying additional CMS in the future. Changeable message signs are a proven tool for conveying messages to travelers, providing travelers the ability to anticipate and, where alternate routes exist, to avoid congestion, incident scenes, and hazardous weather or pavement conditions. Changeable message signs can be used effectively in conjunction with highway advisory radio, with the sign providing a very brief message and a referral to tune to the advisory radio for more complete information. The specific locations for the CMS would most likely come directly from the District 6 and 10 long-range traffic management system plans. For costing purposes, it is assumed that approximately 6 to 8 signs would be installed.	X			**$ 1,440K**		
1.3	PORTABLE CHANGEABLE MESSAGE SIGN (CMS) POOL	District 6 and 10 Maintenance Division	This project will establish a pool of portable changeable message signs that would be made available to various public agencies for use in construction work zones, special event traffic control and other appropriate incident management applications. Currently, many agencies that could benefit from the signs cannot afford, or justify, purchase of the signs. Caltrans is the most likely candidate to purchase the signs and administer the lending program. For costing purposes, it has been assumed that 20 signs would be purchased. The signs could be made available at no cost or for a fee that would be less than that charged by commercial equipment rental companies. Agencies borrowing the signs may or may not financially contribute toward maintenance of the signs, depending on the funding source.	X			**$ 500K**		
1.4	DYNAMIC ALTERNATE ROUTE SIGNS	Urban Traffic Corridors in: • Stockton • Fresno/Clovis • Merced/Atwater • Modesto/Ceres • Visalia/Tulare/Goshen • Bakersfield	This project would implement dynamic variable message signs (VMS) specifically sited, and primarily devoted, to detouring traffic onto alternate routes during incidents, including accidents and weather related road closures. These signs could differ from the large, permanent changeable message signs deployed by Caltrans at key decision points in several respects. First, they would be sited in conjunction with a specific alternate route/detour strategy developed for a particular route and alternate routes. Second, the signs could be smaller than the Caltrans signs. Third, the signs could include features, such as arrows or flashing beacons, that are not included on the traditional CMS. Finally, the alternate routes signs could be deployed as trailblazers along the alternate route, rather than merely in advance of the main route/alternate route decision point. The objective of this project would be to improve compliance with detours and reduce driver uncertainty along detour routes. If successful in reducing the volume of vehicles entering hazardous or congested roadway segments, this project holds the potential to reduce congestion, delay and accidents. In order to be successful, it would be critical that this project include development of an alternate route plan and procedures to support the usage of the signs, and that this plan be effectively linked to an overall multi-agency coordinated incident management strategy. This project would also require a commitment on behalf of the operating agency to devote the time and attention necessary to utilize the signs effectively. Even more so than a single CMS, keeping the dynamic message signs current and accurate would be critical. This project assumes the installation of 30 dyanamic alternate route signs for all the urban traffic corridors.		X	X	**$ 600K**		
1.5	EXPANSION OF CALTRANS TRAFFIC OPERATION SYSTEMS (TOS)	District 6 District 10	Caltrans considers most field elements that aid in traffic surveillance and management activities to be part of the TOS. The most common field elements deployed as a comprehensive TOS in urbanized areas include, but are not limited to: traffic detection (inductive loops, video, acoustic), closed circuit television (CCTV) cameras, changeable message signs (CMS), highway advisory radio (HAR), communications systems and centralized command and control systems/centers with expert systems to aid in incident detection and response as well as automated ramp metering operations. Additional elements that are typically added to rural settings include, but are not limited to: road weather information systems (RWIS) and other systems that aid in improved emergency response times and dissemination of travel advisory information. In the context of the San Joaquin Valley ITS Strategic Deployment Plan, the first step in expansion of the Caltrans TOS would be examination of the existing TOS/TSM Master Plans for Districts 6 and 10. From those Master Plans an Action Plan would be developed for the common sense integration of TOS elements into a seamless central operating system, presumably in the Caltrans TMC(s). One product of the Action Plan would be the development of a Program of Projects, with potential funding sources, to implement the Action Plan and Master Plan. The Caltrans District 6 TOS plan includes the installation of 43 CCTV cameras, 21 CMS locations, 10 HAR locations, and 12 RWIS in the district. The plan also identifies an additional 43 CCTV locations, 1 CMS location, 10 HAR locations and 30 RWIS locations that have not yet been funded.	X	X				
1.6	COMMERCIAL VEHICLE PARKING MANAGEMENT SYSTEM	Valleywide	This project would deploy a system to monitor commercial vehicle parking availability at a number of locations in real-time, and utilize a variety of dissemination tools to make the information available to commercial vehicle operators. Detection systems at individual parking facilities would monitor parking availability. The real-time parking availability information would then be coupled with information on services available, prices, location/direcdtion and other information. Information could be made availalble in various formats and at various levels of detail through a range of devices, including changeable message signs, the Internet, and highway advisory radio. Information could be collected for both rest stops and private operations. Potential partners in the project include Caltrans and private commercial vehicle facility operators.	X	X		**$2,000**		
2.0 Incident Management/Emergency Services									
2.1	ALTERNATE ROUTE PLANS DATABASE/WEB SITE	Valleywide	This project would aid in the dissemination and utilization of alternate route plans by providing access to the plans via the Internet. During the needs identification process, it was noted that in many cases alternate routes plans to facilitiate traffic diversions during incidents, including accidents, construction and weather-related closures, do exist, but are not utilized to the extent they should be because some agencies are not aware of the plans and/or do not have convenient access to them. If successful, this project would make traffic diversions more coordinated and effective, including reducing the adverse impacts that detoured traffic imposes on alternate routes, and reducing the volume of traffic on roadway segments with hazardous conditions or heavy congestion. This project would focus on collecting and providing access to existing alternate route plans, although it would likely include some development of new plans to fill gaps, etc. In addition to the collection of plans and development of dissemination tools, this project should include agency discussions to stimulate understanding and use of the alternate route plans.	X			**$ 150K**		

Table 6.1: Summary of Valleywide ITS Projects

ID	Program Area/Project	Involved Agency	Brief Description	Project Initiation*			Capital Cost Estimates 2001 (Thousands of $)**		
				N	M	L	Total		
							Phase 1	Phase 2	Phase 3
2.2	INTEGRATION OF INCIDENT/TRAFFIC COMMUNICATIONS CHANNELS	Valleywide by geographic region	This project would integrate radio communications among agenices that respond to incidents, such as local police, state patrol, fire departments, Caltrans, and local traffic agencies. The objective of the project would be to improve communications and thereby improve the effectiveness of incident management, resulting in reduced response times, reduced incident duration and associated traffic delays. Currently, most agencies that must, or should, work together during incidents cannot easily communicate with one another over their respective radio systems. This project would identify a specific study area and set of agencies, then identify and implement a solution to provide integrated communications. Depending on the existing equipment and approaches, the potential strategies to provide for integrated communications include both heavily capital intensive solutions, such as those involving major changes in communications infrastructure, and less intensive solutions, such as those that could involve changes in procedures, reprogramming of existing equipment, etc.		X		**$ 500K**		
2.3	INTEGRATED SURVEILLANCE STATIONS/SMART CALLBOX DEPLOYMENT	District 6 District 10 Stanislaus County Kern County TBD	The basic premise behind integrated surveillance stations/callbox deployments, also known as "Smart Callboxes" is the clustering of multiple capabilities at a single field location. Callbox locations can be equipped with traffic and weather surveillance devices, and utilize the communication capability of the call box to transmit the surveillance data back to a traffic management center or centralized database archive. The typical technology options that are attached to the callboxes include: traffic detection devices for operations (speed, volume) or planning (census, classification) purposes and road weather information systems (RWIS). Traffic counts and classification data form the basis for transportation planning, engineering, and financial analysis. Counts are required when developing, designing, and updating traffic models, conducting corridor studies, developing traffic impact assessments, air quality impact assessments, level of service (LOS) monitoring, etc. Historically, regional count information has been available from Caltrans; however, the process through which Caltrans conducts traffic counts at designated control stations in each county (other than at permanent count stations) once every three years. For the other two years, the actual control station count is increased considering application of an average growth rate (typically 2 percent). As a result, the accuracy of the count data is diminished in years when actual counts are not conducted. In addition, the counts are taken during one representative week in each quarter of the year. This count schedule may or may not account for average and/or peak seasonal or average annual traffic condidtions along specific routes in the region. A Smart Call Traffic Monitoring Program can use the existing or planned call box system with integrated counter devices, existing Caltrans or other agency inductive loops, and various classification equipment to provide acurate, reliable, and timely traffic census and classification data throughout the Central Coast. The count/classification data collected through Smart Call Boxes is needed to calibrate and validate regional and local transportation models. The count/classification data will also enable agencies in the Central Coast, especially Caltrans; to monitor heavily traveled corridors to determine the appropriate application of improvements and funding priority. In addition, the Smart Call Box can remotely sense an incident considering average speed data compared to actual speeds of vehicles along a State Route or local highway. The "Smart" Call Box is very similar to permanent traffic counter equipment except that downloading the data occurs through a modem call via the cellular network to the "Smart" Call Box. Caltrans and other agencies currently retrieve or download the data manually in the field at traffic control stations or sites to a laptop computer. Remote collection of traffic data allows the agency to reduce staff collection costs and collect year-round data.		X	X	**$ 3,000**	**$ 12,000**	**$ 10,000**
3.0 Transit Systems									
3.1	COMPUTER-AIDED DISPATCH INTEGRATION	• Stockton • Merced • Modesto • Fresno • Visalia/Tulare • Bakersfield	This project would integrate the computer-aided dispatch systems of various emergency response and transportation agencies that jointly participate in traffic incident management, including local police, state patrol, HAZMAT response, Caltrans, and fire departments. The objective of the project would be to improve information exchange between agencies to improve the efficiency of their coordinated incident response activities, resulting in reduced response times, faster and more effective incident clean-up, and ultimately, reduced secondary accidents and incident-related congestion and delay. The focus of this project would be the communications linkages and software interfaces that would allow different agencies selected access to other agencies computer-aided dispatch systems. This access could including monitoring, in real-time, the dispatch activities of other agencies, sending and receiving messages, and under certain circumstances and according to mutually agreed upon procedures, providing input directly into other agencies systems. The extent of access to be provided to various agencies would be a critical consideration to be determined by the participating agencies. The communications link for this project could utilize dedicated phone lines, or depending on distance and availability, fiber optic cable.		X		**$2,000**		
3.2	TRANSIT MANAGEMENT SYSTEM COMPLETION OR EXPANSION	• Fresno • Stockton • Bakersfield • Modesto	This project would provide additional funding assistance to a transit operator that has begun implementation of a transit management system but lacks the resources to complete the implementation in a timely manner, or to implement all of the desired functions. A transit management sytem typically includes automatic vehicle location (AVL), computer-aided scheduling and dispatch software, mobile data terminals, automated schedule adherence monitoring, computer report generation and data management, and maintenance management software. Transit management systems may also include traveler information elements such as automated itinerary planning systems, station signs showing real-time vehicle arrival information, and Internet web sites. Candidates for this project include those agencies that have begun implementation of transit management systems, including Fresno Area Express, Modesto Area Express, Golden Empire Transit and San Joaquin Regional Transit.	X	X		**$ 800K**		
3.3	TRANSIT INFORMATION SYSTEM	Valleywide by region	This project would implement a system for collecting, processing and disseminating transit information, including "static" information such as routes and schedules, and in the cases of those operators with vehicle tracking systems, real-time information such as estimated vehicle arrival times at specific locations. The objective of the project would be to improve the availability and accessibility of transit information, thereby making transit more convenient and increasing transit utilization. Uncertainty about transit schedules, stops, fares and the timing of arrivals at specific stops are often cited by transit non-users as impediments. This project would establish a centralized transit information database, residing in a computer that would probably be housed at one of the San Joaquin Valley transit operations, or perhaps at a location, such as a Caltrans traffic management facility, where other traveler information is compiled. The project would include procedures and supporting communications infrastructure that would allow participating transit operators to submit information to the system. For static information, the communications system could be very minimal, such as via e-mail or Internet file transfer. The communications necessary to support real-time information would be more costly and elaborate and could include a dial-up or dedicated phone connection. The project would also include dissemination tools to make the information available to travelers. These tools could include an Internet web site, telephone information system, and kiosks.		X		**$ 600K**		

Table 6.1: Summary of Valleywide ITS Projects

ID	Program Area/Project	Involved Agency	Brief Description	Project Initiation*			Capital Cost Estimates 2001 (Thousands of $)**		
				N	M	L	Total		
							Phase 1	Phase 2	Phase 3
3.4	COMMON FARE EQUIPMENT DEPLOYMENT	• KART • SMART • FAX • MAX • GET • Other Regional Transit Providers	This project would coordinate the fare payment systems of one or more transit systems, allowing riders to use the same fare media, such as a magnetic strip swipe card, interchangeably on any of the participating systems. The objective of this project would be to increase the convenience of fare payment for riders and promote transfers between systems. The introduction of electronic fare collection systems can also reduce fare handling costs for transit operators. In addition to on-board fare collection equipment, this project would also include the computing and communications resources necessary to coordinate fare accounting among the participating agencies. This project could involve two or more agencies that do not have electronic fare payment systems (e.g., implement new equipment at all participating agencies), or expand upon a system already implemented by one or more agencies by equipping additional agencies.		X		$ 4,000		
4.0 Traveler Information Systems									
4.1	REGIONWIDE TRAVELER INFORMATION SYSTEM	Valleywide with Lead Agency to be determined by COG's	This project would consist of the first phase, a feasibility study and conceptual design, for a traveler information system for the entire San Joaquin Valley. The objective of the regional traveler information system would be to provide travelers with a "one stop shopping" opportunity to collect traveler information for the entire valley. In this respect, the system would be especially useful for those traveling over large distances within the valley or traveling through the valley. The need for traveler information, including consolidated information for long-distance travelers was one of the high priority problems identified in the needs assessment. The ultimate traveler information system would probably include information on both highway and transit, and possible information on other modes, including airports and pedestrian and bicycle facilities. The system would include a central database, or a series of linked databases acting as a virtual central database, containing information from a number of agencies, including Caltrans and city and county transportation agencies. The system would also include the procedures and communications infrastructure necessary for individual agencies to submit information to the system on an on-going basis. This communications infrastructure would most likely utilized dedicated phone lines, although fiber optic cable and wireless options are possible. The traveler information system would disseminate information through a variety of channels, including the various information tools operated by the agencies that contribute information to the system, such as changeable message signs, highway advisory radio and the Internet. This project, the first phase of the development of the regional traveler information system, consisting of a study, would involve a committee representing the various agencies in the valley that would either contribute or utilize information from the system. The study, from developing a scope of work through acceptance of the final report, could be completed within two years. The study would identify the specific objectives of the regional traveler information system and identify a conceptual design for the system, including a system architecture. Phase 1 of this project will study ATIS technology option for the San Joaquin Valley. The second phase of the project will design the traveler information system to be implemented for the San Joaquin Valley. The overall cost of the system would ultimately depend on which ATIS technologies were implemented in the Valley.	X	X		$ 60K	$ 600K	
4.2	WEATHER/ATMS INTEGRATION AND AUTOMATION (W/PAGING SYSTEM)	District 6 District 10	This project would automate the linkage between road/weather information system (RWIS) detection stations in the field and traffic management system central control systems, including freeway service patrols and other incident management elements. Traffic management staff would be able to consult weather/pavement data using the same ATMS software that controls other portions of the traffic management system, and would automatically receive alerts for specific user-defined weather/pavement conditions. Additionally, various personnel, such as CHP and freeway service patrol operators, could receive automatic alerts via pagers or other communications devices. The extent of this project would vary for Caltrans District 6 and 10, since the District 10 system is currently partially integrated. The objective of the project would be to improve the response time, and effectiveness of the response, on the part of traffic and incident management agencies to hazardous pavement and/or weather conditions, such as fog or icing. Faster and more effective response to these conditions should result in fewer accidents. Currently, Caltrans District 6 utilizes a separate software system to monitor weather stations, and has a separate monitor that displays data from the stations. The system automatically polls each station at set intervals and returns the updated data to the monitor. Although the system does allow users to define various parameters relative to the display of the information, it does not include operator alarms or notifications per se, that is, operators must proactively consult the monitor to keep track of weather/pavement conditions. The software system that controls the weather system is not integrated with the other software systems that control other ITS devices, so operators cannot consult the weather information while working in other softwares. Field personnel access to weather information is via voice communications with traffic management system staff. District 10 has integrated their weather/pavement detectors with changeable message signs, with the signs automatically displaying predefined messages based on information from the weather sensors. However, it is expected that additional upgrades, integration and automation of the weather system are possible and desirable.	X	X		$ 1,500		
4.3	DYNAMIC SPEED SIGNING FOR WEATHER CONDITIONS	Valleywide locations in District 6 and 10.	In response to a history of commercial vehicle accidents, Caltrans District 2 has implemented an interactive signing project at five locations on Interstate 5 in Shasta County. During the five years prior to installation of the five signing systems (May 1994 to April 1999), the five locations experienced a total of 32 truck crashes. During the 18-month period immediately following the installations (April 1999 to October 2000), only one truck crash was reported. A longer evaluation period would likely yield a more sound statistical finding, however, the project appears to have improved safety concerns at the project locations during the initial evaluation period. The system consists of interactive changeable message signs equipped with radar and closed circuit TV (CCTV) cameras at each location. When the radar units detect vehicles exceeding the curve advisory speed, the changeable message sign automatically activates a warning message displaying the speed of the vehicle followed by the recommended speed for the curve. The curve warning system described above could be adapted into weather related speed advisory system by the addition of a road weather information station/system (RWIS). The weather parameters from the RWIS (temperature, visibility, pavement condition, etc.) would be incorporated into the dynamic signing system as an additional input. The system would then display to the driver an appropriate advisory message, such as a suggested safe speed, for the prevailing weather and traffic conditions. The system could be implemented anywhere in the San Joaquin Valley there is a concern about weather related speed safety issues. Ideally, the system would have some type of remote access capabilities so that agency operators could remotely check system diagnostics and operations. Caltrans District 10 has identified 93 locations in the district TOC study.	X			$ 4,650		

Table 6.1: Summary of Valleywide ITS Projects

ID	Program Area/Project	Involved Agency	Brief Description	Project Initiation*			Capital Cost Estimates 2001 (Thousands of $)**		
				N	M	L	Total		
							Phase 1	Phase 2	Phase 3
4.4	NATIONAL PARK TRAVELER INFORMATION SYSTEM	Regions around Sequoia and Kings Canyon National Parks.	This project would implement a traveler information system oriented to visitors of the national parks and similar major attractions in the San Joaquin Valley, including Kings Canyon, Sequoia and Yosemite National Parks. This traveler information system would expand upon the current system oriented to Yosemite National Park (www.yosemite.com). The National Park Traveler Information System would include a centralized information database, or series of linked databases that operate as a single virtual database, containing comprehensive traveler information for the attractions served by the system, including information on road and weather conditions. The system would include procedures and the supporting infrastructure necessary for the individual attraction operators to submit information on an on-going basis. For static, or non-real time information, e-mails, Internet file transfers or even faxes could suffice. For real-time information, such as congestion information based on traffic detector data or weather information based on weather station data, more sophisticated communication channels would be required, such as dedicated phone lines. The information collected through the system would be disseminated through a variety of channels, such as an Internet web site, highway advisory radio and changeable message signs. This project would be led by a coalition including Caltrans, county transportation departments and representatives from the parks and any other attractions included in the system.	X			**$140K**		
4.5	REMOTE ADVANCED TRAVELER INFORMATION SYSTEM (ATIS) WORKSTATIONS	Valleywide	Remote ATIS workstations would be placed at various locations around the Valley to collect various elements of transprotation data for transfer to a centralized traveler information system. The information collected could include: traffic signal system data, freeway flow data, incident and weather information, changeable message sign (CMS) messages, static and dynamic transit data and possibly video images. As implied in the opening sentence, placement of ATIS workstations would be premised on deployment of an ATIS for the San Joaquin Valley. The ATIS deployment could be based on implementation of physical communication interties and the development of a data exchage network. Data exchange networks are typically used only by public agencies in transportation and incident management while ATIS implies some type of public dissemination of the information contained in the system. A data exchange network could be deployed with the intention of also using it to supply data to an ATIS. Before deployment of ATIS workstations in the Valley could take place, a consensus approach should be agreed upon as to how such a system would be deployed, what the building blocks would be and who (what agency) would take the lead in deployment and on-going operations and maintenance.		X		**$ 125K**		
4.6	IN-VEHICLE (FM SUB-CARRIER) COMMERCIAL VEHICLE TRAVELER INFORMATION SYSTEM	Valleywide with lead agency TBD.	This project would implement a traveler information system for commerical vehicle operators utilizing a wireless, wide area, one-way communications system (e.g., FM subcarrier). Unlike highway advisory radio, which normally utilizes the AM band and can be tuned on any AM radio, the communications system utilized in this system would only be accessible using special radios with FM subcarrier receiving capability. The objective of this project would be to provide a dedicated source of information to commercial vehicle operators that would allow them to make informed choices that would improve their operational efficiency, and conceivably, reduce congestion and accidents over time by reducing commercial vehicle traffic in hazardous and congested areas. An important early step in the development of this project would be to work with commercial vehicle operators to determine what information would be most useful to them. A wide variety of information could be provided through the system, including information on commercial vehicle parking, services, regulatory and enforcement information (e.g., inspection stations), truck routes, road closures and restrictions, roadway construction, congestion and delay, and weather and pavement information. Unlike highway advisory radio, the FM subcarrier communications approach allows for the communication of digital information, and therefore maps and images could also be transmitted. The FM subcarrier communications approach would most likely utilize existing FM transmitters and would broadcast information over a relatively large area, unlike low power AM highway advisory radio which normally is used in spot applications and has a small reception area.		X		**$ 100K**		
4.7	IMPLEMENTATION OF A 511 SYSTEM FOR THE VALLEY	Valleywide	For many years the 411 telephone number has been used nationwide as a universal telephone number for "directory assistance". Similarly, 911 has been used as a universal telephone number to summon emergency police, fire and medical assistance, though not necessarily nationwide. In California, over the course of the past decade, two efforts to implement a similar "universal telephone number for traveler information" have met varying degrees of success: the "1-800-COMMUTE" telephone number in southern California and the TravInfo "817-1717" telephone number (from several area codes) in the bay area. Other regions around the nation have embarked on similar efforts to disseminate traveler information via a "regionally universal" telephone number. Over the past couple years, a nationwide effort has been put forth to reserve a "n11" telephone number (similar to 411 or 911), to be a universal nationwide telephone number for traveler information. Early in 2000, the Federal Communications Commission (FCC) reserved 511 for that purpose. Generally speaking, the FCC issued no guidance on how to implement the 511 telephone number and who would pay for its operation. It was left largely up to the local and regional agencies interested in disseminating traveler information to coopperatively decide how to do so. The first step of a suggested 2 step project approach would be to initiate a needs assessment and preliminary design analysis for implementing a 511 system in the San Joaquin Valley. In the course of that effort, or immediately following, the interested agencies would work to establish the institutional ground rules (lead agency(ies), participating agencies and funding and operational responsibilities) of implementing a 511 system. The second step, a more detailed design and implementation, would be taken based on the findings of the needs assessment and preliminary design, and the establishment of ground rules for ther partner agencies.		X		**$2,000**		
4.8	TRUCK STOP TRAVELER INFORMATION DEMONSTRATION	Valleywide	This project would implement commercial vehicle traveler information at truck stops or other commercial vehicle facilities. The system would most likely utilize interactive kiosks to provide traveler information oriented specfically toward commercial vehicle operators. The kiosks could provide access to an Internet web site that could then also be accessed from any computer with Internet access. The objective of this project would be to provide a dedicated source of information to commercial vehicle operators that would allow them to make informed choices that would improve their operational efficiency, and conceivably, reduce congestion and accidents over time by reducing commercial vehicle traffic in hazardous and congested areas. An important early step in the development of this project would be to work with commercial vehicle operators to determine what information would be most useful to them. A wide variety of information could be provided through the system, including information on commercial vehicle parking, services, regulatory and enforcement information (e.g., inspection stations), truck routes, road closures and restrictions, roadway construction, congestion and delay, and weather and pavement information.	X			**$ 450K**		

Table 6.1: Summary of Valleywide ITS Projects

ID	Program Area/Project	Involved Agency	Brief Description	Project Initiation* N	Project Initiation* M	Project Initiation* L	Capital Cost Estimates 2001 (Thousands of $)** Total Phase 1	Phase 2	Phase 3
4.9	ROADSIDE WEATHER INFORMATION STATIONS (RWIS) WITH CCTV	Valleywide locations in District 6 and 10.	This project would extend coverage of weather stations for the entire San Joaquin Valley. The objectives of the weather stations and CCTV cameras are to obtain and verify adverse weather conditions in the rural areas of Kern. In the San Joaquin Valley, the primary hazards are fog and blowing dust during the late fall and winter months. During wet years, fog will dominate during periods of non-frontal activity, decreasing visibilities over large areas for extended periods of time. Blowing dust occurs in all three regions. In the valley it usually occurs during dry winter months when farm land is not under production. Associated with blowing dust is the hazard of high winds, which can occur in all three regions, but is most prevalent in the desert and mountain areas. Rain, snow and ice are precipitation hazards which exist in the mountain region during the winter months. This project assumes the installation of 30 RWIS throughout the San JoaquinValley. Existing weather stations which are not within sight of the monitoring agency, should be outfitted with CCTV cameras for verification of weather conditions.Weather stations which combine a variety of technologies, coupled with CCTV cameras for verification (especially in rural areas), can provide an accurate picture of weather conditions region-wide in real-time. Available technologies include visability sensors, precipitation intensity and type sensors, wind speed/direction sensors, and pressure transducer sensors. Visibility sensors use infrared technology to measure visibility constraints as the result of various sources such as preciptation, fog, haze, dust, and smoke. Precipitation intensity and type sensors use infrared technology to measure and classify precipitation. Humidity/Air Temperature sensors measure relative humidity and temperature. Wind Speed/Direction sensors monitor wind speed (mph) and direction (bearing). Pressure transducer sensors detect water levels in flood channels. Caltrans operates five weather stations in Kern: two on I-5 and three in Tehachapi on SR 58. These stations are linked via cellular phone service to the TMCs in Fresno and Bishop. Kern County operates a system of twenty-five rain gauge stations located throughout the County. Some of these stations have additional capabilities for measuring wind, temperature and humidity. In addition, the County gathers data from remote weather stations owned and maintained by private corporations. These remote weather stations automatically transmit information to a dedicated weather data computer located at the County communication center. Daily weather data is also collected manually at each County fire station and called in to the County communication center, where it is placed in the weather computer database. The database of weather information is accessed by the national weather service and various water and other agencies. The national weather service disseminates this information, along with weather forecasts, to the CHP and Caltrans.	X			**$ 2,250**		
5.0 Regional ITS Configuration Management/Coordination/Planning									
5.1	DEN/ COMMUNICATIONS INTERTIES	Valleywide: ● District to District TMC ● Regional TMC to District ● Local to Regional TMC's Including: Regional TMC's in Stockton, Modesto, Fresno, and Bakersfield.	Data exchange networks are typically set up in areas where several jurisdictions are interested in collectively sharing information from their respective traffic management systems. The most common information shared is from traffic signal systems. While information exchange on the network can be used to more efficiently monitor multiple signal systems, the network usually doesn't allow for field device control or system interoperability. However, those capabilities can be included depending on user needs. Data exchange networks depend on some type of communication infrastructure (dedicated agency owned or leased line) and software to exchange information. Communication intertie projects (see Communication Intertie fact sheet) can establish some of the necessary communication links for a data exchange network. Data exchange networks differ from interties in that data exchange networks typically focus on the network connectivity and "logical" protocols of sharing data among several agencies. Interties typically focus on the "physical" communication link between agencies. Both, interties and data exchange networks can form the basis and initial implementation of the "center to center" portion of a Regional Architecture. Communications intertie projects typically take place between a Caltrans Transportation Management Center (TMC) and a local agency TMC/Traffic Operations Center (TOC). To be most effective, the Caltrans TMC and the local agency would be required to have centralized command and control of traffic management systems and field devices within their respective jurisdictions. In other areas of California, intertie projects allow Caltrans and the local agency to more efficiently share transportation management information, including but not limited to: traffic flow and congestion information, weather information, incident information, video images and in some cases, signal timing plans and modes. In some cases, shared control of a limited number and type of field devices has been arranged between agencies. While full control of one another's assets (field devices, signal systems, etc.) is technically possible it may not be a desired arrangement institutionally. The most important element of an intertie project is a communication link between the intertie agencies. This can either be a dedicated agency owned asset (fiber or copper wire) or some type of telco lease line technology (T1, ISDN or DSL). Another major element of an intertie project is the software, protocols, and interfaces that would allow for the exchange of information between different systems. Interties differ from data exchange networks (see Data Exchange Network fact sheet) in that interties focus on the "physical" communication link between agencies. Data exchange networks typically focus on the network conectivity and "logical" protocols of sharing data among several agencies. **Both, interties and data exchange networks can form the basis and initial implementation of the "center to center" portion of a Regional Architecture.** The most logical interties in the San Joaquin Valley would be between the Caltrans Districts (6 and 10) and the counties and major cities of the Valley. In general, local agencies that partner and interconnect more than one agency with Caltrans have been more successful in obtaining state and federal funding than those proposals that intertie only one agency to Caltrans. The most logical interties in the San Joaquin Valley would be between the Caltrans Districts (6 and 10) and the counties and major cities of the Valley. In general, local agencies that partner and interconnect more than one agency with Caltrans have been more successful in obtaining state and federal funding than those proposals that intertie only one agency to Caltrans.		X	X	**$ 4,000**		
5.2	COMMON/STANDARD REGIONAL/COUNTY DIGITAL MAPPING	Valleywide by COG's	This project would develop a standard electronic map, or set of standardized maps that could be integrated, for the San Joaquin Valley or subregions within the valley, such as counties. The objective of the project would be to reduce the costs to individual agencies to develop maps—the "design it once, deploy it many times" concept—and to promote coordination between the various agency systems that would utilize the maps. Utilization of compatible maps is often a critical factor influencing the extent to which different ITS systems can work together. Electronic maps are critical components in many ITS applications, including automatic vehicle location (AVL) and computer-aided dispatching (for transit, emergency responders, and maintenance fleets), and traveler information systems that feature custom itinerary planning. Electronic maps are also important components of any ITS applications that rely on real-time vehicle location information, including "next bus" transit station signs, dynamic route guidance, transit schedule adherence monitoring, and "smart shuttle"-type dynamically dispatched transit service. Electronic maps are also often utilized in the central software systems of advanced traffic management systems.		X		**$1,500**		
5.3	ITS DESIGN GUIDELINES	Valleywide	This project would develop design standard in the development and implementation of ITS components in the San Joaquin Valley for use by local agencies that have just started deploying ITS.	X			**$200K**		
5.4	VALLEY ITS VIDEO	Valleywide by TAC with Caltrans Lead	This project includes the development of an educational video tape that highlights the need for ITS and summarizes recommendations made in the ITS plan.	X			**$ 10K**		
Total Estimated Capital Deployment Costs for All Potential ITS Projects Over 20 Years									**$ 56,148**

Table 6.2: Summary of Regional ITS Projects

ID	Program Area/Project	Involved Agency	Brief Description	Project Initiation* N	Project Initiation* M	Project Initiation* L	Capital Cost Estimates 2001 (Thousands of $)** Total Phase 1	Total Phase 2	Total Phase 3
KINGS COUNTY									
1.0 Traffic/Freeway Management Systems (ATMS)									
1.1KI	***URBAN AREA TRAFFIC SIGNAL COORDINATION PROJECT***	City of Hanford	This project would implement local traffic signal coordination plans at specific urbanized locations along regionally significant arterials in the County not currently developed. The objective of this project would primarily be to reduce delays at traffic signals by improving coordination between adjacent signals, with improved safety a possible secondary benefit depending on the specific improvements made. The specific improvements to be made would vary by location, which could include intra- and inter-jurisdictional efforts. The types of improvements that are possible include upgrading traffic signal controllers and detection, adding or upgrading signal interconnects, and communications systems enabling centralized (i.e., remote) timing plan updating and maintenance and malfunction monitoring. Although providing emergency vehicle preemption, transit vehicle priority or automated enforcement would not be the focus or justification for these improvements, the equipment installed as part of this project may support these features. This project would be led by local agency traffic operations staff. The provision of traffic signal coordination for small communities is most often initiated with use of either time-based coordination (TBC) or a closed-loop system (CLS). Depending on the type of controller equipment now in place, and depending on the level of staffing support that the City (or County) is able to make in the maintenance of signal coordination plans, the initial cost and recurring effort to achieve signal coordination in Hanford would vary from a very low cost, to a moderate cost. A number of communication alternatives are possible to tie the intersection controllers to a supervisory computer at City Hall (in the CLS alternative). With a CLS, the capability is created to remotely monitor intersection operation and the capability to remotely change both basic and coordination timing. A first step in the signal coordination capability would be the design and implementation of TBC timing plans. A feasibility study on possible and appropriate upgrade plans for creation and installation of a traffic signal system could be completed at the same time. Any small community that has more than 10 traffic signals would probably benefit from having signal coordination implemented along its heaviest-traveled street(s) so that vehicles can progress through a series of signalized intersections without stopping. The initial effort to achieve this basic level of coordination is relatively low, especially if it is contracted out. The resulting basic timing plans (perhaps just 2 or 3 plans which run between 7AM and 6 PM) can be left in place with very little subsequent retiming effort required or needed. Traffic signal coordination typically has one of the very highest benefit-to-cost ratios of any public works activity.	X	X		**$2,000**		
1.2KI	***ADVANCED RAILROAD HIGHWAY INTERFACE TECHNOLOGY DEPLOYMENT***	City of Hanford Kings County	This project would deploy a demonstration of railroad-highway grade crossing technology at needed grade crossings with safety (high accident) and/or high volume and delay concerns. The objective of the demonstration would be to field validate a specific strategy or strategies for improving safety, reducing delay and/or providing travelers with improved real-time information on grade crossing status. The demonstration could feature any combination of detection (both for trains and approaching vehicles), warning/traveler information, and control devices. Many different strategies are possible. Possible strategies include sensors coupled with message signs, in-vehicle devices and/or highway advisory radio that would provide approaching travelers with information on the expected duration of a crossing blockage. Another possible application would tie sensors to emergency vehicle dispatching systems to provide dispatchers and drivers with real time crossing status information. This project could provide a blueprint for applying technology to enhance grade crossing safety throughout the entire San Joaquin Valley area. One major cause of crashes at railroad grade crossings is the persistent presence of the heavy Tule fog in the Valley, and the inability for drivers to see grade crossings which are occupied with a train, usually in motion, until they are too close to stop. If some kind of train presence detection could be devised, and tied to an advance-warning beacon, approaching drivers would be forewarned about the dangerous situation. Such an active presence could be detected by an advanced detector, and need not involve the cooperation / joint solution with the railroad. Because of liability, railroads are not eager to create new and unproven detection or safety mechanisms; they have a well-defined program for active warning devices at the crossing which are very involved "systems" tied in with the railroad's own advance detection systems. The possibility of deploying an advanced technology solution, especially at locations where no active warning devices now exist, would be the basis for this project. Highway traffic at highway-rail intersections (HRIs) could be managed, where operational requirements demand advanced features (e.g., where rail operational speeds are greater than 80 miles per hour). This would include all capabilities from the Standard Railroad Grade Crossing and augments these with additional safety features to mitigate the risks associated with higher rail speeds. The active warning systems would include positive barrier systems, which preclude entrance into the intersection when the barriers are activated. Like the Standard Package, the HRI equipment is activated on notification by wayside interface equipment, which detects, or communicates with, the approaching train. The wayside interface equipment would provide additional information about the arriving train so that the train's direction of travel, estimated time of arrival, and the estimated duration of closure may be derived. This enhanced information may be conveyed to the driver prior to, or in context with, warning system activation. This would also include additional detection capabilities, enabling it to detect an entrapped or otherwise immobilized vehicle within the HRI and provide an immediate notification to highway and railroad officials.	X	X		**$1,000**		
1.3KI	***CENTRAL CONTROL OF TRAFFIC SIGNALS***	City of Hanford	Basic signal coordination provides signal control for a series of signals on an independent basis, without bringing surveillance or monitoring information to a central location. Central control provides communications to a central point where monitoring and control functions can occur. The capabilities of the central system can vary widely, from simple monitoring of signal controller functions to full graphic display of intersection traffic movement. One of the strengths of central computer control is the ability to design and implement multiple signal timing plans that deal with particular times, or days of traffic that vary from the norm (special events, etc.). Enhanced maintenance monitoring functions can also be provided (immediate identification of failed loops, burned out lamps, etc.). System features will vary by city.	X	X		**$200**		
2.0 Incident Management/Emergency Services									
3.0 Transit Systems									
3.1KI	***KART AVL DEMONSTRATION***	KART, KCAG	This project would equip KART transit vehicles with Automatic Vehicle Location (AVL) equipment to track vehicles. The AVL system is most typically deployed using GPS (satellite-based) position acquisition equipment, which would pinpoint the exact (to within 20 meters) location of the tracked vehicle. Such tracking would be ongoing all the time, and not limited to the transit service area. If a bus were removed from the area, it could still be located using the AVL equipment. . The vehicle coordinate information is transmitted to a central receiving site (dispatch center) using a data radio communications medium, allowing transit dispatchers to track the busses. In many cases, the tracking information could be integrated into the same workstation that the dispatchers use in supervising and managing the transit vehicles. KART is the public transportation system in Kings County, serving the 4 cities in the County (Avenal, Corcoran, Lemoore and Hanford) as well as throughout the County along major routes. The service is contracted by a joint powers agency (KCAPTA), and provides both fixed route and paratransit service. An Automatic Vehicle Location (AVL) system for KART would improve the system's efficiency. When buses are tracked remotely using an AVL system, dispatchers could monitor relative positions of vehicles, and take contemporaneous actions to better space vehicles on fixed routes. Dispatchers would also be able to monitor and track paratransit vehicles, and ascertain whether scheduled pickups could be made, and whether additional pickups could be fit into the current day's schedule. With this system in place, KCAPTA should also be able to monitor movements of the transit fleet, so as to provide a supervisory control over their contractor's service.	X			**$700**		

Table 6.2: Summary of Regional ITS Projects

ID	Program Area/Project	Involved Agency	Brief Description	Project Initiation* N	Project Initiation* M	Project Initiation* L	Capital Cost Estimates 2001 (Thousands of $)** Total Phase 1	Total Phase 2	Total Phase 3
3.2KI	***DEMAND-RESPONSIVE TRANSIT SYSTEM INTEGRATION STUDY***	KART, KCAG	This project would fund a study of demand-responsive transit system integration strategies, culminating in a specific set of recommendations to implement strategies within specified transit agencies. The primary objective of integrating multiple demand-responsive transit services is to improve operating efficiency by reducing service redundancies and sharing vehicles, staff and scheduling/dispatch technology among agencies. These improvements result in an overall better quality of service to riders, and riders may benefit directly through enhanced schedule and/or destination options enabled through the integration of services across agencies. Typically, especially in county-based or rural oriented demand respsonsive transit environments, a number of different agencies operate within a given geographic area, providing service to many of the same destinations but often serving a slightly different client base. One of the primary objectives of demand-responsive transit service integration strategies is to reduce these redundancies and associated inefficiencies. Demand-responsive service integration includes a wide range of potential specific activities, ranging from simple coordination to full integration. Examples of specific strategies include consolidation of scheduling and/or dispatch functions (where multiple agencies can share the cost of improvements and share access), agreements to share access to vehicles under specified circumstances, and consolidation of ride reservation systems.		X		**$600**		
4.0 Traveler Information Systems									
5.0 Regional ITS Configuration Management/Coordination/Planning									
5.1KI	***DEN/COMMUNICATIONS INTERTIES***	Valleywide through Regional TMC's • City of Hanford • City of Lemoore • Kings County • Caltrans District 6	The project would develop logical data exchange network partnerships, initially focus on the urbanized areas of the County. Presumably the County and Caltrans would also be involved in the partnerships. In addition, the logical interties between Caltrans District 6, the County and major cities of the County. In general, local agencies that partner and interconnect more than one agency with Caltrans have been more successful in obtaining state and federal funding than those proposals that intertie only one agency to Caltrans. Data exchange networks are typically set up in areas where several jurisdictions are interested in collectively sharing information from their respective traffic management systems. The most common information shared is from traffic signal systems. While information exchange on the network can be used to more efficiently monitor multiple signal systems, the network usually doesn't allow for field device control or system interoperability. However, those capabilities can be included depending on user needs. Data exchange networks depend on some type of communication infrastructure (dedicated agency owned or leased line) and software to exchange information. Communication intertie projects can establish some of the necessary communication links for a data exchange network. Data exchange networks differ from interties in that data exchange networks typically focus on the network connectivity and "logical" protocols of sharing data among several agencies. Interties typically focus on the "physical" communication link between agencies. Both, interties and data exchange networks can form the basis and initial implementation of the "center to center" portion of a Regional Architecture. Communications intertie projects typically take place between a Caltrans Transportation Management Center (TMC) and a local agency TMC/Traffic Operations Center (TOC). To be most effective, the Caltrans TMC and the local agency would be required to have centralized command and control of traffic management systems and field devices within their respective jurisdictions. In other areas of California, intertie projects allow Caltrans and the local agency to more efficiently share transportation management information, including but not limited to: traffic flow and congestion information, weather information, incident information, video images and in some cases, signal timing plans and modes. In some cases, shared control of a limited number and type of field devices has been arranged between agencies. While full control of one another's assets (field devices, signal systems, etc.) is technically possible it may not be a desired arrangement institutionally. The most important element of an intertie project is a communication link between the intertie agencies. This can either be a dedicated agency owned asset (fiber or copper wire) or some type of telco lease line technology (T1, ISDN or DSL). Another major element of an intertie project is the software, protocols, and interfaces that would allow for the exchange of information between different systems. Interties differ from data exchange networks (see Data Exchange Network fact sheet) in that interties focus on the "physical" communication link between agencies. Data exchange networks typically focus on the network conectivity and "logical" protocols of sharing data among several agencies. Both, interties and data exchange networks can form the basis and initial implementation of the "center to center" portion of a Regional Architecture.			X	**$200**		
			Total Estimated Capital Deployment Costs for All Potential ITS Projects Over 20 Years						**$4,650**
TULARE COUNTY									
1.0 Traffic/Freeway Management Systems (ATMS)									
1.1T	***CENTRAL CONTROL OF TRAFFIC SIGNALS IN URBAN AREA***	City of Tulare County of Tulare	Basic signal coordination provides signal control for a series of signals on an independent basis, without bringing surveillance or monitoring information to a central location. Central control provides communications to a central point where monitoring and control functions can occur. The capabilities of the central system can vary widely, from simple monitoring of signal controller functions to full graphic display of intersection traffic movement. One of the strengths of central computer control is the ability to design and implement multiple signal timing plans that deal with particular times, or days of traffic that vary from the norm (special events, etc.). Enhanced maintenance monitoring functions can also be provided (immediate identification of failed loops, burned out lamps, etc.). System features will vary by city.	X			**$300**		
1.2T	***CENTRALIZED TRAFFIC SIGNAL CONTROL UPGRADE***	City of Visalia	This project would upgrade the current QuicNet BiTran 2 AMTS system to the Current QuicNet 4 system. The project would upgrade include hardware and software Basic signal coordination provides signal control for a series of signals on an independent basis, without bringing surveillance or monitoring information to a central location. Central control provides communications to a central point where monitoring and control functions can occur. The capabilities of the central system can vary widely, from simple monitoring of signal controller functions to full graphic display of intersection traffic movement. One of the strengths of central computer control is the ability to design and implement multiple signal timing plans that deal with particular times, or days of traffic that vary from the norm (special events, etc.). Enhanced maintenance monitoring functions can also be provided (immediate identification of failed loops, burned out lamps, etc.). System features will vary by city.	X			**$ 70**		
1.3T	***VISALIA ATMS EXPANSION***	City of Visalia	This project would provide for a variety of travel management enhancements that could include the installation of a sophisticated traffic control center that controls traffic signals, the installation of traffic surveillance using closed circuit TV, providing up to the minute information on traffic to travelers. The project would include the upgrade of existing Traffic Control Center into an advanced Traffic Management Center (TMC). The project would integrate the system components with other regional systems, including Caltrans. The project would include the study developing the ATMS plan, installation of the ATMS components including the integration of installation of fiber optic cable for improved communication and closed circuit TV, and the installation of a new traffic signal system in the TMC.		X		**$800**		

Table 6.2: Summary of Regional ITS Projects

ID	Program Area/Project	Involved Agency	Brief Description	Project Initiation*			Capital Cost Estimates 2001 (Thousands of $)**		
				N	M	L	Total		
							Phase 1	Phase 2	Phase 3
1.4T	***VISALIA-TULARE-GOSHEN URBAN AREA TRAFFIC SIGNAL INTERCONNECT AND COORDINATION PROJECT***	City of Visalia City of Tulare County of Tulare	This project would implement local traffic signal coordination plans at specific urbanized locations along regionally significant arterials in the County not currently developed. The objective of this project would primarily be to reduce delays at traffic signals by improving coordination between adjacent signals, with improved safety a possible secondary benefit depending on the specific improvements made. The specific improvements to be made would vary by location, which could include intra- and inter-jurisdictional efforts. The types of improvements that are possible include upgrading traffic signal controllers and detection, adding or upgrading signal interconnects, and communications systems enabling centralized (i.e., remote) timing plan updating and maintenance and malfunction monitoring. Although providing emergency vehicle preemption, transit vehicle priority or automated enforcement would not be the focus or justification for these improvements, the equipment installed as part of this project may support these features. This project would be led by local agency traffic operations staff. The provision of traffic signal coordination for small communities is most often initiated with use of either time-based coordination (TBC) or a closed-loop system (CLS). Depending on the type of controller equipment now in place, and depending on the level of staffing support that the City (or County) is able to make in the maintenance of signal coordination plans, the initial cost and recurring effort to achieve signal coordination in Hanford would vary from a very low cost, to a moderate cost. A number of communication alternatives are possible to tie the intersection controllers to a supervisory computer at City Hall (in the CLS alternative). With a CLS, the capability is created to remotely monitor intersection operation and the capability to remotely change both basic and coordination timing. A first step in the signal coordination capability would be the design and implementation of TBC timing plans. A feasibility study on possible and appropriate upgrade plans for creation and installation of a traffic signal system could be completed at the same time. Any small community that has more than 10 traffic signals would probably benefit from having signal coordination implemented along its heaviest-traveled street(s) so that vehicles can progress through a series of signalized intersections without stopping. The initial effort to achieve this basic level of coordination is relatively low, especially if it is contracted out. The resulting basic timing plans (perhaps just 2 or 3 plans which run between 7AM and 6 PM) can be left in place with very little subsequent retiming effort required or needed. Traffic signal coordination typically has one of the very highest benefit-to-cost ratios of any public works activity.	X	X		**$3,500**		
1.5T	***INTEGRATED SMART CORRIDORS***	Caltrans District 6 Visalia Tulare Goshen FUA	This project would implement a package of ITS applications in a highway corridor consisting of at least one main route and one parallel route. The focus of the project would be to improve the level of coordination of traffic management activities on the main route and parallel route(s); in effect to conduct corridor-level rather than facility-specific ITS traffic management. The range of ITS applications that could be included in a smart corridor application include essentially the full range of freeway management, arterial street management (e.g., traffic signalization) and traveler information strategies, including surveillance and detection; incident management, including coordinated and dynamic traffic detouring strategies utilizing both the main and parallel route(s); changeable message signs; dynamic trailblazer signs; highway advisory radio; and integrated traffic signal operations, including coordination between ramp meters and adjacent traffic signals. The smart corridor project would feature implementation of a combination of ITS applications, with the emphasis being on linking operations across multiple facilities serving a defined travel corridor. Given the multi-facility nature of this project, the multi-jurisdictional coordination aspects of the project will be critical, including developing consensus on the specific objectives of the project and on the individual coordination procedures and technques. The first step in the development of this project would be to identify a candidate project corridor, based on accidents and congestion, travel patterns, availability of alternate routes and interest among the potential project partcipants.			X	**$2,500**		
1.6T	***EVP DEPLOYMENTS***	Visalia Tulare Goshen FUA	The project would implement Emergency Vehicle Preemption (EVP) along key arterials throughout the County for use by City and County fire departments. The implementation EVP at a traffic signal modifies normal signal operation to provide a nearly immediate green signal for an approaching emergency vehicle. This type of system is most often deployed on fire trucks because of the nature of the fire truck vehicle performance. The acceleration rate of fire trucks is rather slow due to their relatively low power-to-weight ratio. If fire trucks must slow down (and sometimes stop) when they encounter signalized intersections along their emergency run, the overall delay in responding to their emergency destination can easily exceed 1 to 2 minutes. For fire events, this delay can mean a significant difference in the level of destruction, the level of effort in suppressing the fire, the level of personal danger for firefighters at the scene, and the number and extent of injuries for victims. Depending on the level of congestion and the distance traveled, fire trucks can encounter many traffic signals, and heavy congestion. Driving in oncoming traffic lanes is a "last resort" maneuver, which fire departments rightly avoid. If the fire truck encounters a red signal, it can assert the right of way and go through, but only after gaining assurance that it can safely cross through the intersection. EVP isn't needed in every community. Only when traffic congestion is very significant, or only when long emergency vehicle runs are likely to encounter a large number of signalized intersections, would the provision of EVP be cost effective. Some cities in the Central Valley already have EVP in place, the 3M Opticom™ system being predominant. Priority request equipment would be installed in each fire truck and matching reception equipment would be installed at each signalized intersection where EVP is to be granted. Some larger agencies that have used EVP for many years have broadened the application to also equip ambulance vehicles and, in some cases, police vehicles with this on-board preemption request equipment. While these vehicles have much better acceleration characteristics, and the added delay at signals while on their emergency runs is much lower, granting EVP to these vehicles may provide another benefit. The crossing of very wide and very busy signalized intersections is very difficult in today's traffic. Each year, many such emergency vehicles are "totaled" after being T-boned when crossing a busy intersection. EVP helps reduce and prevent this occurrence. However, this project assumes only fire department vehicles would be equipped with EVP devices. This project would include the installation of EVP along major arterials in the Visalia-Tulare-Goshen FUA. Phase 1 of the project would include the installation of EVP at 34 intersections along key arterials throughout downtown Visalia Phase II of the project would expand EVP deployment throughout the rest of the FUA.	X	X		**$286**	**1,000**	
1.7T	***CALTRANS TRAFFIC OPERATION SYSTEMS (TOS) GAP CLOSURE PROJECT (REGION)***	District 6 Tulare County City of Visalia City of Tulare	Caltrans considers most field elements that aid in traffic surveillance and management activities to be part of the TOS. The most common field elements deployed as a comprehensive TOS in urbanized areas include, but are not limited to: traffic detection (inductive loops, video, acoustic), closed circuit television (CCTV) cameras, changeable message signs (CMS), highway advisory radio (HAR), communications systems and centralized command and control systems/centers with expert systems to aid in incident detection and response as well as automated ramp metering operations. Additional elements that are typically added to rural settings include, but are not limited to: road weather information systems (RWIS) and other systems that aid in improved emergency response times and dissemination of travel advisory information. In the context of the San Joaquin Valley ITS Strategic Deployment Plan, "Early Winners" exercise, the first step in expansion of the Caltrans TOS would be examination of the existing TOS/TSM Master Plans for Districts 6 and 10. From those Master Plans an Action Plan would be developed for the common sense integration of TOS elements into a seamless central operating system, presumably in the Caltrans TMC(s). One product of the Action Plan would be the development of a Program of Projects, with potential funding sources, to implement the Action Plan and Master Plan.		X		**$4,000**		

Table 6.2: Summary of Regional ITS Projects

ID	Program Area/Project	Involved Agency	Brief Description	Project Initiation*			Capital Cost Estimates 2001 (Thousands of $)**		
				N	M	L	Total		
							Phase 1	Phase 2	Phase 3
1.8T	***ADVANCED RAILROAD HIGHWAY INTERFACE TECHNOLOGY DEPLOYMENT***	Tulare County	This project would deploy railroad-highway grade crossing technology at needed grade crossings with safety (high accident) and/or high volume and delay concerns. The objective of the project would use field validated strategies for improving safety, reducing delay and/or providing travelers with improved real-time information on grade crossing statu developed by the Kings County Advanced HRI Technology Deployment Demonstration project. The project could feature any combination of detection (both for trains and approaching vehicles), warning/traveler information, and control devices. Many different strategies are possible. Possible strategies include sensors coupled with message signs, in-vehicle devices and/or highway advisory radio that would provide approaching travelers with information on the expected duration of a crossing blockage. Another possible application would tie sensors to emergency vehicle dispatching systems to provide dispatchers and drivers with real time crossing status information. This project would use the blueprint for applying technology to enhance grade crossing safety developed by the demonstration project. One major cause of crashes at railroad grade crossings is the persistent presence of the heavy Tule fog in the Valley, and the inability for drivers to see grade crossings which are occupied with a train, usually in motion, until they are too close to stop. If some kind of train presence detection could be devised, and tied to an advance-warning beacon, approaching drivers would be forewarned about the dangerous situation. Such an active presence could be detected by an advanced detector, and need not involve the cooperation / joint solution with the railroad. Because of liability, railroads are not eager to create new and unproven detection or safety mechanisms; they have a well-defined program for active warning devices at the crossing which are very involved "systems" tied in with the railroad's own advance detection systems. The possibility of deploying an advanced technology solution, especially at locations where no active warning devices now exist, would be the basis for this project. Highway traffic at highway-rail intersections (HRIs) could be managed, where operational requirements demand advanced features (e.g., where rail operational speeds are greater than 80 miles per hour). This would include all capabilities from the Standard Railroad Grade Crossing and augments these with additional safety features to mitigate the risks associated with higher rail speeds. The active warning systems would include positive barrier systems, which preclude entrance into the intersection when the barriers are activated. Like the Standard Package, the HRI equipment is activated on notification by wayside interface equipment, which detects, or communicates with, the approaching train. The wayside interface equipment would provide additional information about the arriving train so that the train's direction of travel, estimated time of arrival, and the estimated duration of closure may be derived. This enhanced information may be conveyed to the driver prior to, or in context with, warning system activation. This would also include additional detection capabilities, enabling it to detect an entrapped or otherwise immobilized vehicle within the HRI and provide an immediate notification to highway and railroad officials.		X		**$400**		
1.9T	***CITY OF PORTERVILLE EMERGENCY PRE-EMPTION SIGNAL PROJECT***	City of Porterville	The project would implement Emergency Vehicle Preemption (EVP) along key arterials throughout the City of Porterville for use by the City fire department. The implementation EVP at a traffic signal modifies normal signal operation to provide a nearly immediate green signal for an approaching emergency vehicle. This type of system is most often deployed on fire trucks because of the nature of the fire truck vehicle performance. The acceleration rate of fire trucks is rather slow due to their relatively low power-to-weight ratio. If fire trucks must slow down (and sometimes stop) when they encounter signalized intersections along their emergency run, the overall delay in responding to their emergency destination can easily exceed 1 to 2 minutes. For fire events, this delay can mean a significant difference in the level of destruction, the level of effort in suppressing the fire, the level of personal danger for firefighters at the scene, and the number and extent of injuries for victims. Depending on the level of congestion and the distance traveled, fire trucks can encounter many traffic signals, and heavy congestion. Driving in oncoming traffic lanes is a "last resort" maneuver, which fire departments rightly avoid. If the fire truck encounters a red signal, it can assert the right of way and go through, but only after gaining assurance that it can safely cross through the intersection. Priority request equipment would be installed in each fire truck and matching reception equipment would be installed at each signalized intersection where EVP is to be granted. The provision of EVP is cost effective when traffic congestion is very significant, or when long emergency vehicle runs are likely to encounter a large number of signalized intersections. Some cities in the San Joaquin Valley already have EVP in place, the 3M Opticom™ system being predominant. Some larger agencies that have used EVP for many years have broadened the application to also equip ambulance vehicles and, in some cases, police vehicles with this on-board preemption request equipment. While these vehicles have much better acceleration characteristics, and the added delay at signals while on their emergency runs is much lower, granting EVP to these vehicles may provide another benefit. The crossing of very wide and very busy signalized intersections is very difficult in today's traffic. Each year, many such emergency vehicles are "totaled" after being T-boned when crossing a busy intersection. EVP helps reduce and prevent this occurrence. However, this project assumes only fire department vehicles would be equipped with EVP devices.	X			**$200**		
1.10T	***CITY OF PORTERVILLE RED LIGHT ENFORCEMENT PROJECT***	City of Porterville	This project would provide law enforcement officials with the ability to enforce violations electronically through automated photo enforcement. Photo enforcement involves the utilization of a fixed or CCTV positioned camera and a vehicle detection sensor to take a photograph or digital image of a vehicle that initiates an illegal activity. Typical uses of this application include railroad-crossing enforcement, red light violation enforcement, speed limit enforcement, and weigh station enforcement. Typically, the organizations that supply the technology generally take on the responsibility for retrieving the image from the system, processing the film (if necessary), and issuing warnings or citations, depending on the issuing agency. Select intersections in the cities of Ceres and Modesto should be identified and considered for automated photo enforcement for red light violations within key intersections in the City of Porterville..	X			**$ 50**		
2.0 Incident Management/Emergency Services									
2.1T	***ALTERNATE ROUTE SIGNING***	Visalia Tulare Goshen FUA Traffic Corridors	This project would include the installation of 70 static alternate route signs within the County for designated detour routes. This project would implement changeable message signs specifically sited, and primarily devoted, to detouring traffic onto alternate routes during incidents, including accidents and weather related road closures. These signs could differ from the large, permanent changeable message signs deployed by Caltrans at key decision points in several respects. First, they would be sited in conjunction with a specific alternate route/detour strategy developed for a particular route and alternate routes. Second, the signs could be smaller than the Caltrans signs. Third, the signs could include features, such as arrows or flashing beacons, that are not included on the traditional CMS. Finally, the alternate routes signs could be deployed as trailblazers along the alternate route, rather than merely in advance of the main route/alternate route decision point. The objective of this project would be to improve compliance with detours and reduce driver uncertainty along detour routes. If successful in reducing the volume of vehicles entering hazardous or congested roadway segments, this project holds the potential to reduce congestion, delay and accidents. In order to be successful, it would be critical that this project include development of an alternate route plan and procedures to support the usage of the signs, and that this plan be effectively linked to an overall multi-agency coordinated incident management strategy. This project would also require a commitment on behalf of the operating agency to devote the time and attention necessary to utilize the signs effectively. Even more so than a single CMS, keeping the dynamic message signs current and accurate would be critical.		X		**$ 3,000**		

Table 6.2: Summary of Regional ITS Projects

ID	Program Area/Project	Involved Agency	Brief Description	Project Initiation*			Capital Cost Estimates 2001 (Thousands of $)**		
				N	M	L	Total		
							Phase 1	Phase 2	Phase 3
2.2T	***TRAFFIC SAFETY TASK FORCE***	TCAG, CHP, Caltrans, with heavy involvement from all other emergency service agencies.	This project would develop, for a specific focused area within the County, an interjurisdictional and cross-agency teaming arrangement that would be mobilized to respond to any major traffic related incident in the team's coverage area. Once a specific geographic area has been selected for this project (due in large part to the presence of a project champion), an ad-hoc working group would be established to bring this Traffic Safety Team into existence. In order to be self-sustaining, such a Team would need to be activated, on average, at least 4 times per year. Therefore, the coverage area should be large enough so that this would be achieved. The Team would need to have authority to activate itself. That is, within each organization where a Team member is employed, that Team member should have the capability to cease his/her routine and respond to a Team-declared incident when needed. The Team should be equipped with adequate and sufficient person-to-person communication devices (most likely cellular telephones with 3-way and/or conference calling capability) to contact other Team members as needed. Finally, a rigorous and extensive agency and staff networking outreach capability should be developed for use in this Team. The Team itself may or may not have independently owned and controlled traffic control devices for use in deployments responding to incidents. Each agency's own devices should be accessible if the Traffic Safety Team is created effectively. This Team creation would be a initiated as pilot project for duplication throughout all other areas of the Valley. The use of a contracted facilitator should be employed on this pilot project, with plenty of documentation, lessons learned, and formats to be followed for institutional acceptance of the IMT Team concept. Other areas within the Valley would then be able to model their own Team on the findings and documentation provided in this project.		X	X	**$150**		
3.0 Transit Systems									
3.1T	***VISALIA TRANSIT AVL / SILENT ALARM***	Visalia City Coach	This project would equip transit vehicles in the Visalia area (Visalia City Coach's 8 routes) with ITS equipment to both track vehicles and give the bus operator the capability to send a silent alarm for an emergency condition. Automatic Vehicle Location (AVL) equipment generally utilizes satellite technology for pinpointing the exact (to within 20 meters) location of the tracked vehicle. Such tracking is ongoing all the time, and is not limited to the Visalia area. If a bus were removed from the area, it could still be located using the AVL equipment. Providing the bus operator with a silent alarm capability will increase the security level of both bus operators and transit patrons. Bus tracking would be viewed by transit dispatchers in the dispatch office. In many cases, the tracking information can be integrated into the same workstation that the dispatchers use in supervising and managing the transit vehicles.	X			**$800**		
3.2T	***TRANSIT MANAGEMENT SYSTEM***	Visalia City Coach Tulare Transit	This project would provide funding to implement a transit management system or provide additional funding for the expansion of an existing Transit Management System (TrMS). A TrMS typically includes automatic vehicle location (AVL), computer-aided scheduling and dispatch software, mobile data terminals, automated schedule adherence monitoring, computer report generation and data management, and maintenance management software. Transit management systems may also include traveler information elements such as automated itinerary planning systems, station signs showing real-time vehicle arrival information, and Internet web sites. The project shall be consistent with other regional systems and shall take into consideration other potential projects with overlapping components such as AVL.		X	X	**$2,000**		
3.3T	***FAST PASS FARE EQUIPMENT STUDY AND DEVELOPMENT***	TCAG, Visalia City Coach, Tulare County Transit (STAGE)	This project would coordinate the fare payment systems of one or more transit systems, allowing riders to use the same fare media, such as a magnetic strip swipe card, interchangeably on any of the participating systems. The objective of this project would be to increase the convenience of fare payment for riders and promote transfers between systems. The introduction of electronic fare collection systems can also reduce fare handling costs for transit operators. In addition to on-board fare collection equipment, this project would also include the computing and communications resources necessary to coordinate fare accounting among the participating agencies. This project could involve two or more agencies that do not have electronic fare payment systems (e.g., implement new equipment at all participating agencies), or expand upon a system already implemented by one or more agencies by equipping additional agencies.	X	X		**$ 500**		
3.4T	***CITY OF VISALIA NEXT BUS ARRIVAL SIGNS***	Visalia City Coach	This project would deploy dynamic message signs at selected higher-usage bus stops equipped with bus shelters. Currently, only one firm (NextBus) is providing this kind of service. Their equipment is placed on board transit vehicles, and GPS-derived current location and speed information is transmitted to NextBus computers at a remote location where the information is processed, and bus arrival prediction is then published to an Internet IP address. The IP address corresponds to a particular dynamic message sign. NextBus has a patent for this "arrival prediction using GPS coordinate data scheme, and their equipment combination uses a CDPD data modem to transmit the information from the bus to the NextBus servers. Their current coverage area does include the Merced area, but not with the CDPD provider that they have currently use (AT&T Wireless). Nonetheless, CDPD coverage is available in Merced, and the NextBus concept therefore may be workable there. The cost for the CDPD "air time" may make this more expensive than in AT&T's coverage area. Also, once an initial installation is completed (using capital funding from some source), then the agency would need to continue the payments for CDPD air time (currently ~$60 per month per bus, and $30 per month per dynamic message sign. Once the service is in place, transit patrons would be able to determine real-time bus locations and expected arrival times at their bus stop. The dynamic message sign at the bus stop would be one source of this information, but NextBus also publishes the information in map form to an internet website, and in WAP form to hand-held PDAs. The information would therefore also be accessible to transit dispatchers as well as agencies that oversee and/or fund transit operations. NextBus can provide a broad cross-section of transit operations data that would be useful to these 2 management groups as well.		X		**$500**		
3.5SJ	***TRANSIT INFORMATION SYSTEM***	Visalia City Coach Tulare Transit	This project would implement a system for collecting, processing and disseminating transit information, including "static" information such as routes and schedules, and in the cases of those operators with vehicle tracking systems, real-time information such as estimated vehicle arrival times at specific locations. The objective of the project would be to improve the availability and accessibility of transit information, thereby making transit more convenient and increasing transit utilization. Uncertainty about transit schedules, stops, fares and the timing of arrivals at specific stops are often cited by transit non-users as impediments. This project would establish a centralized transit information database, residing in a computer that would probably be housed at one of the San Joaquin Valley transit operations, or perhaps at a location, such as a Caltrans traffic management facility, where other traveler information is compiled. The project would include procedures and supporting communications infrastructure that would allow participating transit operators to submit information to the system. For static information, the communications system could be very minimal, such as via e-mail or Internet file transfer. The communications necessary to support real-time information would be more costly and elaborate and could include a dial-up or dedicated phone connection. The project would also include dissemination tools to make the information available to travelers. These tools could include an Internet web site, telephone information system, and kiosks.		X		**$600**		
4.0 Traveler Information Systems									
5.0 Regional ITS Configuration Management/Coordination/Planning									

Table 6.2: Summary of Regional ITS Projects

ID	Program Area/Project	Involved Agency	Brief Description	Project Initiation* N	Project Initiation* M	Project Initiation* L	Capital Cost Estimates 2001 (Thousands of $)** Total Phase 1	Total Phase 2	Total Phase 3
5.1T	***DATA EXCHANGE NETWORK (DEN)/ COMMUNICATIONS INTERTIES***	City of Visalia City of Tulare Tulare County Caltrans District 6	The project would develop logical data exchange network partnerships, initially focus on the urbanized areas of the County. Presumably the County and Caltrans would also be involved in the partnerships. In addition, the logical interties between Caltrans District 6, the County and major cities of the County. The video feed would run from Caltrans District 6 along SR-99 and SR-198. In general, local agencies that partner and interconnect more than one agency with Caltrans have been more successful in obtaining state and federal funding than those proposals that intertie only one agency to Caltrans. Data exchange networks are typically set up in areas where several jurisdictions are interested in collectively sharing information from their respective traffic management systems. The most common information shared is from traffic signal systems. While information exchange on the network can be used to more efficiently monitor multiple signal systems, the network usually doesn't allow for field device control or system interoperability. However, those capabilities can be included depending on user needs. Data exchange networks depend on some type of communication infrastructure (dedicated agency owned or leased line) and software to exchange information. Communication intertie projects can establish some of the necessary communication links for a data exchange network. Data exchange networks differ from interties in that data exchange networks typically focus on the network connectivity and "logical" protocols of sharing data among several agencies. Interties typically focus on the "physical" communication link between agencies. Both, interties and data exchange networks can form the basis and initial implementation of the "center to center" portion of a Regional Architecture. Communications intertie projects typically take place between a Caltrans Transportation Management Center (TMC) and a local agency TMC/Traffic Operations Center (TOC). To be most effective, the Caltrans TMC and the local agency would be required to have centralized command and control of traffic management systems and field devices within their respective jurisdictions. In other areas of California, intertie projects allow Caltrans and the local agency to more efficiently share transportation management information, including but not limited to: traffic flow and congestion information, weather information, incident information, video images and in some cases, signal timing plans and modes. In some cases, shared control of a limited number and type of field devices has been arranged between agencies. While full control of one another's assets (field devices, signal systems, etc.) is technically possible it may not be a desired arrangement institutionally. The most important element of an intertie project is a communication link between the intertie agencies. This can either be a dedicated agency owned asset (fiber or copper wire) or some type of telco lease line technology (T1, ISDN or DSL). Another major element of an intertie project is the software, protocols, and interfaces that would allow for the exchange of information between different systems. Interties differ from data exchange networks (see Data Exchange Network fact sheet) in that interties focus on the "physical" communication link between agencies. Data exchange networks typically focus on the network conectivity and "logical" protocols of sharing data among several agencies. Both, interties and data exchange networks can form the basis and initial implementation of the "center to center" portion of a Regional Architecture.			X	**$300**		
			Total Estimated Capital Deployment Costs for All Potential ITS Projects Over 20 Years						**$20,956**
MERCED COUNTY									
1.0 Traffic/Freeway Management Systems (ATMS)									
1.1ME	***MERCED COUNTY RAILROAD GRADE CROSSING TREATMENTS***	City of Merced City of Atwater Merced County	This project would seek to implement advanced technology to reduce the accident experience at railroad grade crossings in Merced County. The Kern County demonstration project could provide a blueprint for applying technology to enhance grade crossing safety throughout the entire San Joaquin Valley area. One major cause of crashes at railroad grade crossings is the persistent presence of the heavy Thule fog in the Valley, and the inability for drivers to see grade crossings which are occupied with a train, usually in motion, until they are too close to stop. If some kind of train presence detection could be devised, and tied to an advance-warning beacon, approaching drivers would be forewarned about the dangerous situation. Such an active presence could be detected by an advanced detector, and need not involve the cooperation / joint solution with the railroad. Because of liability, railroads are not eager to create new and unproven detection or safety mechanisms; they have a well-defined program for active warning devices at the crossing which are very involved "systems" tied in with the railroad's own advance detection systems. The possibility of deploying an advanced technology solution, especially at locations where no active warning devices now exist, would be the basis for this project.		X	X	**$1,200**		
1.2ME	***EVP DEPLOYMENTS***	City of Merced City of Atwater Merced County	The project would implement Emergency Vehicle Preemption (EVP) along key arterials throughout the County for use by City and County fire departments. The implementation EVP at a traffic signal modifies normal signal operation to provide a nearly immediate green signal for an approaching emergency vehicle. This type of system is most often deployed on fire trucks because of the nature of the fire truck vehicle performance. The acceleration rate of fire trucks is rather slow due to their relatively low power-to-weight ratio. If fire trucks must slow down (and sometimes stop) when they encounter signalized intersections along their emergency run, the overall delay in responding to their emergency destination can easily exceed 1 to 2 minutes. For fire events, this delay can mean a significant difference in the level of destruction, the level of effort in suppressing the fire, the level of personal danger for firefighters at the scene, and the number and extent of injuries for victims. Depending on the level of congestion and the distance traveled, fire trucks can encounter many traffic signals, and heavy congestion. Driving in oncoming traffic lanes is a "last resort" maneuver, which fire departments rightly avoid. If the fire truck encounters a red signal, it can assert the right of way and go through, but only after gaining assurance that it can safely cross through the intersection. EVP isn't needed in every community. Only when traffic congestion is very significant, or only when long emergency vehicle runs are likely to encounter a large number of signalized intersections, would the provision of EVP be cost effective. Some cities in the Central Valley already have EVP in place, the 3M Opticom™ systems being predominant. Priority request equipment would be installed in each fire truck and matching reception equipment would be installed at each signalized intersection where EVP is to be granted. Some larger agencies that have used EVP for many years have broadened the application to also equip ambulance vehicles and, in some cases, police vehicles with this on-board preemption request equipment. While these vehicles have much better acceleration characteristics, and the added delay at signals while on their emergency runs is much lower, granting EVP to these vehicles may provide another benefit. The crossing of very wide and very busy signalized intersections is very difficult in today's traffic. Each year, many such emergency vehicles are "totaled" after being T-boned when crossing a busy intersection. EVP helps reduce and prevent this occurrence. However, this project assumes only fire department vehicles would be equipped with EVP devices.	X	X		**$2,500**		
1.3ME	***CENTRAL CONTROL OF TRAFFIC SIGNALS IN URBAN AREAS***	City of Merced City of Atwater Merced County	Basic signal coordination provides signal control for a series of signals on an independent basis, without bringing surveillance or monitoring information to a central location. Central control provides communications to a central point where monitoring and control functions can occur. The capabilities of the central system can vary widely, from simple monitoring of signal controller functions to full graphic display of intersection traffic movement. One of the strengths of central computer control is the ability to design and implement multiple signal timing plans that deal with particular times, or days of traffic that vary from the norm (special events, etc.). Enhanced maintenance monitoring functions can also be provided (immediate identification of failed loops, burned out lamps, etc.). System features will vary by city.	X			**$200**		
1.4ME	***UC MERCED ATMS***	City of Merced City of Atwater Merced County District 10	This project would provide for a variety of travel management enhancements that could include the installation of a sophisticated traffic control center that controls traffic signals, the installation of traffic surveillance using closed circuit TV, providing up to the minute information on traffic to travelers. The project would include the development or an advanced Traffic Management Center (TMC). The project would integrate the system components with other regional systems, including Caltrans. The project would include the study developing the ATMS plan, installation of the ATMS components including the integration of installation of fiber optic cable for improved communication and closed circuit TV, and the installation of a new traffic signal system in the TMC.			X	**$800**		

Table 6.2: Summary of Regional ITS Projects

ID	Program Area/Project	Involved Agency	Brief Description	Project Initiation*			Capital Cost Estimates 2001 (Thousands of $)**		
				N	M	L	Total		
							Phase 1	Phase 2	Phase 3
1.5ME	***CALTRANS TRAFFIC OPERATION SYSTEMS (TOS) GAP CLOSURE PROJECT (REGION)***	City of Merced City of Atwater Merced County District 10	Caltrans considers most field elements that aid in traffic surveillance and management activities to be part of the TOS. The most common field elements deployed as a comprehensive TOS in urbanized areas include, but are not limited to: traffic detection (inductive loops, video, acoustic), closed circuit television (CCTV) cameras, changeable message signs (CMS), highway advisory radio (HAR), communications systems and centralized command and control systems/centers with expert systems to aid in incident detection and response as well as automated ramp metering operations. Additional elements that are typically added to rural settings include, but are not limited to: road weather information systems (RWIS) and other systems that aid in improved emergency response times and dissemination of travel advisory information. In the context of the San Joaquin Valley ITS Strategic Deployment Plan, "Early Winners" exercise, the first step in expansion of the Caltrans TOS would be examination of the existing TOS/TSM Master Plans for Districts 6 and 10. From those Master Plans an Action Plan would be developed for the common sense integration of TOS elements into a seamless central operating system, presumably in the Caltrans TMC(s). One product of the Action Plan would be the development of a Program of Projects, with potential funding sources, to implement the Action Plan and Master Plan.		X	X	**$4,000**		
1.6ME	***URBAN AREA TRAFFIC SIGNAL COORDINATION PROJECT***	Merced Atwater FUA City of Merced City of Atwater Merced County	This project would implement local traffic signal coordination plans at specific urbanized locations along regionally significant arterials in the County not currently developed. The objective of this project would primarily be to reduce delays at traffic signals by improving coordination between adjacent signals, with improved safety a possible secondary benefit depending on the specific improvements made. The specific improvements to be made would vary by location, which could include intra- and inter-jurisdictional efforts. The types of improvements that are possible include upgrading traffic signal controllers and detection, adding or upgrading signal interconnects, and communications systems enabling centralized (i.e., remote) timing plan updating and maintenance and malfunction monitoring. Although providing emergency vehicle preemption, transit vehicle priority or automated enforcement would not be the focus or justification for these improvements, the equipment installed as part of this project may support these features. This project would be led by local agency traffic operations staff. The provision of traffic signal coordination for small communities is most often initiated with use of either time-based coordination (TBC) or a closed-loop system (CLS). Depending on the type of controller equipment now in place, and depending on the level of staffing support that the City (or County) is able to make in the maintenance of signal coordination plans, the initial cost and recurring effort to achieve signal coordination in Hanford would vary from a very low cost, to a moderate cost. A number of communication alternatives are possible to tie the intersection controllers to a supervisory computer at City Hall (in the CLS alternative). With a CLS, the capability is created to remotely monitor intersection operation and the capability to remotely change both basic and coordination timing. A first step in the signal coordination capability would be the design and implementation of TBC timing plans. A feasibility study on possible and appropriate upgrade plans for creation and installation of a traffic signal system could be completed at the same time. Any small community that has more than 10 traffic signals would probably benefit from having signal coordination implemented along its heaviest-traveled street(s) so that vehicles can progress through a series of signalized intersections without stopping. The initial effort to achieve this basic level of coordination is relatively low, especially if it is contracted out. The resulting basic timing plans (perhaps just 2 or 3 plans which run between 7AM and 6 PM) can be left in place with very little subsequent retiming effort required or needed. Traffic signal coordination typically has one of the very highest benefit-to-cost ratios of any public works activity.		X	X	**$3,500**		
2.0 Incident Management/Emergency Services									
2.1ME	***ALTERNATE ROUTE SIGNING***	City of Merced City of Atwater Merced County Caltrans District 10	This project would include the installation of 70 static alternate route signs within the County for designated detour routes. This project would implement changeable message signs specifically sited, and primarily devoted, to detouring traffic onto alternate routes during incidents, including accidents and weather related road closures. These signs could differ from the large, permanent changeable message signs deployed by Caltrans at key decision points in several respects. First, they would be sited in conjunction with a specific alternate route/detour strategy developed for a particular route and alternate routes. Second, the signs could be smaller than the Caltrans signs. Third, the signs could include features, such as arrows or flashing beacons, that are not included on the traditional CMS. Finally, the alternate routes signs could be deployed as trailblazers along the alternate route, rather than merely in advance of the main route/alternate route decision point. The objective of this project would be to improve compliance with detours and reduce driver uncertainty along detour routes. If successful in reducing the volume of vehicles entering hazardous or congested roadway segments, this project holds the potential to reduce congestion, delay and accidents. In order to be successful, it would be critical that this project include development of an alternate route plan and procedures to support the usage of the signs, and that this plan be effectively linked to an overall multi-agency coordinated incident management strategy. This project would also require a commitment on behalf of the operating agency to devote the time and attention necessary to utilize the signs effectively. Even more so than a single CMS, keeping the dynamic message signs current and accurate would be critical		X	X	**$ 3,000**		
2.2ME	***TRAFFIC SAFETY TASK FORCE***	MCAG, CHP, Caltrans, with heavy involvement from all other emergency service agencies.	This project would develop, for a specific focused area within the County, an interjurisdictional and cross-agency teaming arrangement that would be mobilized to respond to any major traffic related incident in the team's coverage area. Once a specific geographic area has been selected for this project (due in large part to the presence of a project champion), an ad-hoc working group would be established to bring this Traffic Safety Team into existence. In order to be self-sustaining, such a Team would need to be activated, on average, at least 4 times per year. Therefore, the coverage area should be large enough so that this would be achieved. The Team would need to have authority to activate itself. That is, within each organization where a Team member is employed, that Team member should have the capability to cease his/her routine and respond to a Team-declared incident when needed. The Team should be equipped with adequate and sufficient person-to-person communication devices (most likely cellular telephones with 3-way and/or conference calling capability) to contact other Team members as needed. Finally, a rigorous and extensive agency and staff networking outreach capability should be developed for use in this Team. The Team itself may or may not have independently owned and controlled traffic control devices for use in deployments responding to incidents. Each agency's own devices should be accessible if the Traffic Safety Team is created effectively. This Team creation would be a initiated as pilot project for duplication throughout all other areas of the Valley. The use of a contracted facilitator should be employed on this pilot project, with plenty of documentation, lessons learned, and formats to be followed for institutional acceptance of the IMT Team concept. Other areas within the Valley would then be able to model their own Team on the findings and documentation provided in this project.		X	X	**$150**		
3.0 Transit Systems									
3.1ME	***MERCED COUNTY NEXT BUS ARRIVAL SIGNS***	Merced County Transit (The Bus)	This project would deploy dynamic message signs at selected higher-usage bus stops equipped with bus shelters. Currently, only one firm (NextBus) is providing this kind of service. Their equipment is placed on board transit vehicles, and GPS-derived current location and speed information is transmitted to NextBus computers at a remote location where the information is processed, and bus arrival prediction is then published to an Internet IP address. The IP address corresponds to a particular dynamic message sign. NextBus has a patent for this "arrival prediction using GPS coordinate data scheme, and their equipment combination uses a CDPD data modem to transmit the information from the bus to the NextBus servers. Their current coverage area does include the Merced area, but not with the CDPD provider that they have currently use (AT&T Wireless). Nonetheless, CDPD coverage is available in Merced, and the NextBus concept therefore may be workable there. The cost for the CDPD "air time" may make this more expensive than in AT&T's coverage area. Also, once an initial installation is completed (using capital funding from some source), then the agency would need to continue the payments for CDPD air time (currently ~$60 per month per bus, and $30 per month per dynamic message sign. Once the service is in place, transit patrons would be able to determine real-time bus locations and expected arrival times at their bus stop. The dynamic message sign at the bus stop would be one source of this information, but NextBus also publishes the information in map form to an internet website, and in WAP form to hand-held PDAs. The information would therefore also be accessible to transit dispatchers as well as agencies that oversee and/or fund transit operations. NextBus can provide a broad cross-section of transit operations data that would be useful to these 2 management groups as well.		X	X	**$400**		

Table 6.2: Summary of Regional ITS Projects

ID	Program Area/Project	Involved Agency	Brief Description	Project Initiation*			Capital Cost Estimates 2001 (Thousands of $)**		
				N	M	L	Total		
							Phase 1	Phase 2	Phase 3
3.2ME	***MERCED TRANSIT AVL / SILENT ALARM***	Merced County Transit (The Bus)	This project would equip transit vehicles in the Merced area with ITS equipment to both track vehicles and give the bus operator the capability to send a silent alarm for an emergency condition. Automatic Vehicle Location (AVL) equipment generally utilizes satellite technology for pinpointing the exact (to within 20 meters) location of the tracked vehicle. Such tracking is ongoing all the time, and is not limited to the Merced area. If a bus were removed from the area, it could still be located using the AVL equipment. Providing the bus operator with a silent alarm capability will increase the security level of both bus operators and transit patrons. Bus tracking would be viewed by transit dispatchers in the dispatch office. In many cases, the tracking information can be integrated into the same workstation that the dispatchers use in supervising and managing the transit vehicles.	X	X		**$1,000**		
3.3ME	***TRANSIT MANAGEMENT SYSTEM (TRMS)***	Merced County Transit (The Bus)	This project would provide funding to implement a transit management system. A transit management system typically includes automatic vehicle location (AVL), computer-aided scheduling and dispatch software, mobile data terminals, automated schedule adherence monitoring, computer report generation and data management, and maintenance management software. Transit management systems may also include traveler information elements such as automated itinerary planning systems, station signs showing real-time vehicle arrival information, and Internet web sites. The project shall be consistent with other regional systems including Fresno Area Express, Golden Empire Transit and San Joaquin Regional Transit. In addition, the Transit Management System shall take into consideration other potential projects with overlapping components such as AVL.			X	**$1,500**		
3.4ME	***TRANSIT INFORMATION SYSTEM***	Merced County Transit (The Bus)	This project would implement a system for collecting, processing and disseminating transit information, including "static" information such as routes and schedules, and in the cases of those operators with vehicle tracking systems, real-time information such as estimated vehicle arrival times at specific locations. The objective of the project would be to improve the availability and accessibility of transit information, thereby making transit more convenient and increasing transit utilization. Transit users often site uncertainty in transit schedules, stops, fares and the timing of arrivals at specific stops as impediments. This project would establish a centralized transit information database, residing in a computer that would probably be housed at one of the San Joaquin Valley transit operations, or perhaps at a location, such as a Caltrans traffic management facility, where other traveler information is compiled. The project would include procedures and supporting communications infrastructure that would allow participating transit operators to submit information to the system. For static information, the communications system could be very minimal, such as via e-mail or Internet file transfer. The communications necessary to support real-time information would be more costly and elaborate and could include a dial-up or dedicated phone connection. The project would also include dissemination tools to make the information available to travelers. These tools could include an Internet web site, telephone information system, and kiosks.			X	**$600**		
4.0 Traveler Information Systems									
4.1ME	***YOSEMITE.COM***	MCAG	This project would implement a traveler information system oriented to visitors of Yosemite National Park. This traveler information system would expand upon the current system oriented to Yosemite National Park (www.yosemite.com). The overall objective would be to work with private sector sponsors to operate and maintain the website. The National Park Traveler Information System would include a centralized information database, or series of linked databases that operate as a single virtual database, containing comprehensive traveler information for the attractions served by the system, including information on road and weather conditions. The system would include procedures and the supporting infrastructure necessary for the individual attraction operators to submit information on an on-going basis. For static, or non-real time information, e-mails, Internet file transfers or even faxes could suffice. For real-time information, such as congestion information based on traffic detector data or weather information based on weather station data, more sophisticated communication channels would be required, such as dedicated phone lines. The information collected through the system would be disseminated through a variety of channels, such as an Internet web site, highway advisory radio and changeable message signs. This project would be led by a coalition including Caltrans, county transportation departments and representatives from the parks and any other attractions included in the system	X	X		**$200**		
5.0 Regional ITS Configuration Management/Coordination/Planning									
5.1ME	***DATA EXCHANGE NETWORK (DEN)/ COMMUNICATIONS INTERTIES***	Valleywide through Regional TMC's City of Merced City of Atwater Merced County Caltrans District 10	The project would develop logical data exchange network partnerships, initially focus on the urbanized areas of the County. Presumably the County and Caltrans would also be involved in the partnerships. In addition, the logical interties between Caltrans District 6, the County and major cities of the County. In general, local agencies that partner and interconnect more than one agency with Caltrans have been more successful in obtaining state and federal funding than those proposals that intertie only one agency to Caltrans. Data exchange networks are typically set up in areas where several jurisdictions are interested in collectively sharing information from their respective traffic management systems. The most common information shared is from traffic signal systems. While information exchange on the network can be used to more efficiently monitor multiple signal systems, the network usually doesn't allow for field device control or system interoperability. However, those capabilities can be included depending on user needs. Data exchange networks depend on some type of communication infrastructure (dedicated agency owned or leased line) and software to exchange information. Communication intertie projects can establish some of the necessary communication links for a data exchange network. Data exchange networks differ from interties in that data exchange networks typically focus on the network connectivity and "logical" protocols of sharing data among several agencies. Interties typically focus on the "physical" communication link between agencies. Both, interties and data exchange networks can form the basis and initial implementation of the "center to center" portion of a Regional Architecture. Communications intertie projects typically take place between a Caltrans Transportation Management Center (TMC) and a local agency TMC/Traffic Operations Center (TOC). To be most effective, the Caltrans TMC and the local agency would be required to have centralized command and control of traffic management systems and field devices within their respective jurisdictions. In other areas of California, intertie projects allow Caltrans and the local agency to more efficiently share transportation management information, including but not limited to: traffic flow and congestion information, weather information, incident information, video images and in some cases, signal timing plans and modes. In some cases, shared control of a limited number and type of field devices has been arranged between agencies. While full control of one another's assets (field devices, signal systems, etc.) is technically possible it may not be a desired arrangement institutionally. The most important element of an intertie project is a communication link between the intertie agencies. This can either be a dedicated agency owned asset (fiber or copper wire) or some type of telco lease line technology (T1, ISDN or DSL). Another major element of an intertie project is the software, protocols, and interfaces that would allow for the exchange of information between different systems. Interties differ from data exchange networks (see Data Exchange Network fact sheet) in that interties focus on the "physical" communication link between agencies. Data exchange networks typically focus on the network conectivity and "logical" protocols of sharing data among several agencies. Both, interties and data exchange networks can form the basis and initial implementation of the "center to center" portion of a Regional Architecture.			X	**$300**		
			Total Estimated Capital Deployment Costs for All Potential ITS Projects Over 20 Years						**$19,350**

Table 6.2: Summary of Regional ITS Projects

ID	Program Area/Project	Involved Agency	Brief Description	Project Initiation* N	Project Initiation* M	Project Initiation* L	Capital Cost Estimates 2001 (Thousands of $)** Total Phase 1	Total Phase 2	Total Phase 3
STANISLAUS COUNTY									
1.1ST	***MODESTO/CERES ATMS COMPLETION***	Stanislaus County City of Modesto City of Ceres District 10	City of Modesto CCTV System Master Plan The City of Modesto CCTV system will assume a multi-purpose role in providing monitoring and surveillance capabilities to traffic management operators. The Master Plan is intended to conceptually depict the long term traffic control & surveillance system to be implemented in the City. The major functions of the CCTV system are Incident Detection, Incident Verification & Response, Monitoring of traffic signal coordination along major corridors, Monitoring high volume intersection operation, queue build-up and high accident locations, Evaluate Traffic Management Strategies. The development of the CCTV system will make use of the existing City fiber optic communication network, which will provide opportunities for a cost-effective communications media for video signals and control signal transmission. The CCTV camera site locations will be identified based on established camera site selection criteria. The CCTV cameras are located at strategic locations throughout the City to provide surveillance and monitoring capabilities for the operators at the Traffic Management Center in the City. A total of 33 preliminary CCTV camera locations were identified throughout the City as part of the CCTV system master plan to provide surveillance and monitoring capabilities. After a more detailed field video survey, 10 critical locations were identified for design and the viewing ranges for the remaining locations were determined. City of Ceres CCTV Master Plan The City of Ceres CCTV system will also serve the role of providing monitoring and surveillance capabilities to the traffic management operators. The CCTV system in the City will perform the same major functions of incident detection, verification and response, monitoring of critical intersection operation and preliminary CCTV camera traffic signal coordination along major corridors. Six (6) locations were identified along major corridors in the City. Based on the video reviews, four critical locations were identified for design as part of this phase of the project. ATMS implementation. Each of the proposed cameras shall be capable of transmitting full motion video and control signals making use of proposed communication cable fibers and communication hubs. The video and control signals shall make use of different communication paths from each of the proposed cameras to the City TMC. Appropriate fiber optic and other communication equipment shall be installed in the proposed hubs and the TMC such that full-motion video and control signals can be transmitted and received. Ceres ATMS Communication Network Alternative The primary elements of the recommended communication alternative iclude a 24-strand single–mode fiber optic cable will be installed for the trunk line with redundancy ring considerations. The majority of the existing and planned intersections will be connected to communication hubs via twisted pair cables. Every six controllers will be connected by a pair of twisted wires of six-pair cable, employing a multi-drop network structure. The remaining four pairs will be used as voice communication media and spares. The communication hubs will be located for point of conversion of various communication media and for future expansion. Remote intersections, intersections that are generally more than ½ mile apart, would be designed to be connected to the center via spread spectrum radio. The system has the capability of transmitting video signals of the potential CCTV camera installations throughout the City through the fiber optic trunk line. Ceres Communication Hubs With the use of fiber optic in a hybrid network with twisted pair cable as well as wireless means (spread spectrum radio), interfaces will be needed to convert digital light wave energy to electrical energy. This is performed via "communication hubs." The hubs are housed in a suitable controller cabinet.	X	X	X	**$ 4,100**		
1.2ST	***MODESTO-CERES URBAN AREA TRAFFIC SIGNAL INTERCONNECT AND COORDINATION PROJECT***	City of Modesto City of Ceres Stanislaus County	This project would implement local traffic signal coordination plans at specific urbanized locations along regionally significant arterials in the County not currently developed. The objective of this project would primarily be to reduce delays at traffic signals by improving coordination between adjacent signals, with improved safety a possible secondary benefit depending on the specific improvements made. The specific improvements to be made would vary by location, which could include intra- and inter-jurisdictional efforts. The types of improvements that are possible include upgrading traffic signal controllers and detection, adding or upgrading signal interconnects, and communications systems enabling centralized (i.e., remote) timing plan updating and maintenance and malfunction monitoring. Although providing emergency vehicle preemption, transit vehicle priority or automated enforcement would not be the focus or justification for these improvements, the equipment installed as part of this project may support these features. This project would be led by local agency traffic operations staff. The provision of traffic signal coordination for small communities is most often initiated with use of either time-based coordination (TBC) or a closed-loop system (CLS). Depending on the type of controller equipment now in place, and depending on the level of staffing support that the City (or County) is able to make in the maintenance of signal coordination plans, the initial cost and recurring effort to achieve signal coordination in Hanford would vary from a very low cost, to a moderate cost. A number of communication alternatives are possible to tie the intersection controllers to a supervisory computer at City Hall (in the CLS alternative). With a CLS, the capability is created to remotely monitor intersection operation and the capability to remotely change both basic and coordination timing. A first step in the signal coordination capability would be the design and implementation of TBC timing plans. A feasibility study on possible and appropriate upgrade plans for creation and installation of a traffic signal system could be completed at the same time. Any small community that has more than 10 traffic signals would probably benefit from having signal coordination implemented along its heaviest-traveled street(s) so that vehicles can progress through a series of signalized intersections without stopping. The initial effort to achieve this basic level of coordination is relatively low, especially if it is contracted out. The resulting basic timing plans (perhaps just 2 or 3 plans which run between 7AM and 6 PM) can be left in place with very little subsequent retiming effort required or needed. Traffic signal coordination typically has one of the very highest benefit-to-cost ratios of any public works activity.	X	X		**$3,000**		
1.3ST	***INTEGRATED SMART CORRIDORS***	City of Modesto City of Ceres Stanislaus County Caltrans District 10	This project would implement a package of ITS applications in a highway corridor consisting of at least one main route and one parallel route. The focus of the project would be to improve the level of coordination of traffic management activities on the main route and parallel route(s); in effect to conduct corridor-level rather than facility-specific ITS traffic management. The range of ITS applications that could be included in a smart corridor application include essentially the full range of freeway management, arterial street management (e.g., traffic signalization) and traveler information strategies, including surveillance and detection; incident management, including coordinated and dynamic traffic detouring strategies utilizing both the main and parallel route(s); changeable message signs; dynamic trailblazer signs; highway advisory radio; and integrated traffic signal operations, including coordination between ramp meters and adjacent traffic signals. The smart corridor project would feature implementation of a combination of ITS applications, with the emphasis being on linking operations across multiple facilities serving a defined travel corridor. Given the multi-facility nature of this project, the multi-jurisdictional coordination aspects of the project will be critical, including developing consensus on the specific objectives of the project and on the individual coordination procedures and technques. The first step in the development of this project would be to identify a candidate project corridor, based on accidents and congestion, travel patterns, availability of alternate routes and interest among the potential project partcipants.			X	**$3,500**		

Table 6.2: Summary of Regional ITS Projects

ID	Program Area/Project	Involved Agency	Brief Description	Project Initiation*			Capital Cost Estimates 2001 (Thousands of $)**		
				N	M	L	Total		
							Phase 1	Phase 2	Phase 3
1.4ST	***ADVANCED RAILROAD HIGHWAY INTERFACE TECHNOLOGY DEPLOYMENT*** ***SR 132 IR/RIS***	Stanislaus County City of Modesto City of Ceres Caltrans District 10 StanCOG	This project would deploy railroad-highway grade crossing technology at needed grade crossings with safety (high accident) and/or high volume and delay concerns. The objective of the project would use field validated strategies for improving safety, reducing delay and/or providing travelers with improved real-time information on grade crossing statu developed by the Kings County Advanced HRI Technology Deployment Demonstration project. The project could feature any combination of detection (both for trains and approaching vehicles), warning/traveler information, and control devices. Many different strategies are possible. Possible strategies include sensors coupled with message signs, in-vehicle devices and/or highway advisory radio that would provide approaching travelers with information on the expected duration of a crossing blockage. Another possible application would tie sensors to emergency vehicle dispatching systems to provide dispatchers and drivers with real time crossing status information. This project would use the blueprint for applying technology to enhance grade crossing safety developed by the demonstration project. One major cause of crashes at railroad grade crossings is the persistent presence of the heavy Tule fog in the Valley, and the inability for drivers to see grade crossings which are occupied with a train, usually in motion, until they are too close to stop. If some kind of train presence detection could be devised, and tied to an advance-warning beacon, approaching drivers would be forewarned about the dangerous situation. Such an active presence could be detected by an advanced detector, and need not involve the cooperation / joint solution with the railroad. Because of liability, railroads are not eager to create new and unproven detection or safety mechanisms; they have a well-defined program for active warning devices at the crossing which are very involved "systems" tied in with the railroad's own advance detection systems. The possibility of deploying an advanced technology solution, especially at locations where no active warning devices now exist, would be the basis for this project. Highway traffic at highway-rail intersections (HRIs) could be managed, where operational requirements demand advanced features (e.g., where rail operational speeds are greater than 80 miles per hour). This would include all capabilities from the Standard Railroad Grade Crossing and augments these with additional safety features to mitigate the risks associated with higher rail speeds. The active warning systems would include positive barrier systems, which preclude entrance into the intersection when the barriers are activated. Like the Standard Package, the HRI equipment is activated on notification by wayside interface equipment, which detects, or communicates with, the approaching train. The wayside interface equipment would provide additional information about the arriving train so that the train's direction of travel, estimated time of arrival, and the estimated duration of closure may be derived. This enhanced information may be conveyed to the driver prior to, or in context with, warning system activation. This would also include additional detection capabilities, enabling it to detect an entrapped or otherwise immobilized vehicle within the HRI and provide an immediate notification to highway and railroad officials.		X		**$750**		
1.5ST	***RED LIGHT RUNNING/ PHOTO ENFORCEMENT***	City of Modesto City of Ceres	This project would provide law enforcement officials with the ability to enforce violations electronically through automated photo enforcement. Photo enforcement involves the utilization of a fixed or CCTV positioned camera and a vehicle detection sensor to take a photograph or digital image of a vehicle that initiates an illegal activity. Typical uses of this application include railroad-crossing enforcement, red light violation enforcement, speed limit enforcement, and weigh station enforcement. Typically, the organizations that supply the technology generally take on the responsibility for retrieving the image from the system, processing the film (if necessary), and issuing warnings or citations, depending on the issuing agency. Select intersections in the cities of Ceres and Modesto should be identified and considered for automated photo enforcement for red light violations within the FUA. Hatch and Mitchell Sort term. Other loactions 5-10 years	X	X	X	**$ 20**	**$150**	
1.6ST	***TOS AND COMMUNICATIO NS GAP CLOSURE PROJECT***	Stanislaus County City of Modesto City of Ceres District 10	This project would close the existing communications infrastructure gaps along SR 99 to the Caltrans, District 10 Transportation Management Center (CVTMC). In addition, ramp meters would be deployed in existing gap areas along the above facilities. The project also includes communications to the ramp meter locations, and may include the update and deployment of ramp metering software at the TMC.		X	X	**$5,000**		
1.7ST	***INTEGRATED SURVEILLANCE STATIONS/SMART CALL BOX DEPLOYMENT (REGIONAL)***	Stanislaus County City of Modesto City of Ceres District 10	The basic premise behind integrated surveillance stations/callbox deployments, also known as "Smart Call Boxes" is the clustering of multiple capabilities at a single field location. Call Box locations can be equipped with traffic and weather surveillance devices, and utilize the communication capability of the call box to transmit the surveillance data back to a traffic management center or centralized database archive. The typical technology options that are attached to the call boxes include: traffic detection devices for operations (speed, volume) or planning (census, classification) purposes and road weather information systems (RWIS). A Smart Call Box Traffic Monitoring Program can use the existing or planned call box system with integrated counter devices, existing Caltrans or other agency inductive loops, and various classification equipment. These call boxes could provide accurate, reliable, and timely traffic census and classification data throughout the Region. The count/classification data collected through Smart Call Boxes is needed to calibrate and validate regional and local transportation models. The count/classification data will also enable agencies in the FUA, especially Caltrans; to monitor heavily traveled corridors to determine the appropriate application of improvements and funding priority. In addition, the Smart Call Box can remotely sense an incident considering average speed data compared to actual speeds of vehicles along a State Route or local highway. The "Smart" Call Box is very similar to permanent traffic counter equipment except that downloading the data occurs through a modem call via the cellular network to the "Smart" Call Box. Caltrans and other agencies currently retrieve or download the data manually in the field at traffic control stations or sites to a laptop computer. Remote collection of traffic data allows the agency to reduce staff collection costs and collect year-round data.		X	X	**$3,000**		
1.8ST	***COMMUNICATIO NS INTERTIE PROJECT BETWEEN MODESTO AND CERES, COUNTY, AND CALTRANS***	Stanislaus County City of Modesto City of Ceres District 10	This project would establish/complete the backbone wireline communications between the largest transportation players in the County. A fiber optic backbone is already in place within the cities of Modesto and Ceres. Communications would likely utilize fiber optic cable, however other opportunities should be reviewed for the various needs. This project should consider the establishment of regional standards for fiber communications deployment, including consideration of modes, capacity needs, communications protocols, and perhaps equipment types.		X	X	**$1,500**		

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				N	M	L	Total		
							Phase 1	Phase 2	Phase 3
2.0 Incident Management/Emergency Services									
2.1ST	***TRAFFIC SAFETY TASK FORCE***	StanCOG, CHP, Caltrans, with heavy involvement from all other emergency service agencies.	This project would develop, for a specific focused area within the County, an interjurisdictional and cross-agency teaming arrangement that would be mobilized to respond to any major traffic related incident in the team's coverage area. Once a specific geographic area has been selected for this project (due in large part to the presence of a project champion), an ad-hoc working group would be established to bring this Traffic Safety Team into existence. In order to be self-sustaining, such a Team would need to be activated, on average, at least 4 times per year. Therefore, the coverage area should be large enough so that this would be achieved. The Team would need to have authority to activate itself. That is, within each organization where a Team member is employed, that Team member should have the capability to cease his/her routine and respond to a Team-declared incident when needed. The Team should be equipped with adequate and sufficient person-to-person communication devices (most likely cellular telephones with 3-way and/or conference calling capability) to contact other Team members as needed. Finally, a rigorous and extensive agency and staff networking outreach capability should be developed for use in this Team. The Team itself may or may not have independently owned and controlled traffic control devices for use in deployments responding to incidents. Each agency's own devices should be accessible if the Traffic Safety Team is created effectively. This Team creation would be a initiated as pilot project for duplication throughout all other areas of the Valley. The use of a contracted facilitator should be employed on this pilot project, with plenty of documentation, lessons learned, and formats to be followed for institutional acceptance of the IMT Team concept. Other areas within the Valley would then be able to model their own Team on the findings and documentation provided in this project.	X	X		**$150**		
2.2ST	***EVP DEPLOYMENTS***	City of Modesto	The project would implement Emergency Vehicle Preemption (EVP) along key arterials throughout the County for use by City and County fire departments. The implementation EVP at a traffic signal modifies normal signal operation to provide a nearly immediate green signal for an approaching emergency vehicle. This type of system is most often deployed on fire trucks because of the nature of the fire truck vehicle performance. The acceleration rate of fire trucks is rather slow due to their relatively low power-to-weight ratio. If fire trucks must slow down (and sometimes stop) when they encounter signalized intersections along their emergency run, the overall delay in responding to their emergency destination can easily exceed 1 to 2 minutes. For fire events, this delay can mean a significant difference in the level of destruction, the level of effort in suppressing the fire, the level of personal danger for firefighters at the scene, and the number and extent of injuries for victims. Depending on the level of congestion and the distance traveled, fire trucks can encounter many traffic signals, and heavy congestion. Driving in oncoming traffic lanes is a "last resort" maneuver, which fire departments rightly avoid. If the fire truck encounters a red signal, it can assert the right of way and go through, but only after gaining assurance that it can safely cross through the intersection. EVP isn't needed in every community. Only when traffic congestion is very significant, or only when long emergency vehicle runs are likely to encounter a large number of signalized intersections, would the provision of EVP be cost effective. Some cities in the Central Valley, including the City of Ceres, already have EVP in place, the 3M Opticom™ system being predominant. Priority request equipment would be installed in each fire truck and matching reception equipment would be installed at each signalized intersection where EVP is to be granted. Some larger agencies that have used EVP for many years have broadened the application to also equip ambulance vehicles and, in some cases, police vehicles with this on-board preemption request equipment. While these vehicles have much better acceleration characteristics, and the added delay at signals while on their emergency runs is much lower, granting EVP to these vehicles may provide another benefit. The crossing of very wide and very busy signalized intersections is very difficult in today's traffic. Each year, many such emergency vehicles are "totaled" after being T-boned when crossing a busy intersection. EVP helps reduce and prevent this occurrence. However, this project assumes only fire department vehicles would be equipped with EVP devices.	X	X		**$2,500**		
2.3ST	***ALTERNATE ROUTE SIGNING***	Stanislaus County City of Modesto City of Merced	This project would include the installation of 70 static alternate route signs within the County for designated detour routes. This project would implement changeable message signs specifically sited, and primarily devoted, to detouring traffic onto alternate routes during incidents, including accidents and weather related road closures. These signs could differ from the large, permanent changeable message signs deployed by Caltrans at key decision points in several respects. First, they would be sited in conjunction with a specific alternate route/detour strategy developed for a particular route and alternate routes. Second, the signs could be smaller than the Caltrans signs. Third, the signs could include features, such as arrows or flashing beacons, that are not included on the traditional CMS. Finally, the alternate routes signs could be deployed as trailblazers along the alternate route, rather than merely in advance of the main route/alternate route decision point. The objective of this project would be to improve compliance with detours and reduce driver uncertainty along detour routes. If successful in reducing the volume of vehicles entering hazardous or congested roadway segments, this project holds the potential to reduce congestion, delay and accidents. In order to be successful, it would be critical that this project include development of an alternate route plan and procedures to support the usage of the signs, and that this plan be effectively linked to an overall multi-agency coordinated incident management strategy. This project would also require a commitment on behalf of the operating agency to devote the time and attention necessary to utilize the signs effectively. Even more so than a single CMS, keeping the dynamic message signs current and accurate would be critical		X	X	**$ 3,000**		
2.4ST	***REMOTE SURVEILLANCE AND INCIDENT SCENE MANAGEMENT PROJECT***	Stanislaus County City of Modesto City of Merced	This new experimental program involves a video system capable of sending images via cellular or microwave technology to a TMC. The images are then put on the internet and key experts who could provide technical advise to the responders at the scene can access the pictures with a password. This process would allow the expert to talk to the scene by telephone, look at the problems on the internet, and help devise solutions for safe and timely resolution. This technology has been purchased for the Washington State DOT and is being installed on their incident response trucks. There is also a handheld unit for getting close up images of truck equipment and other details. Trauma center doctors, hazardous materials specialists, recovery companies, and investigative specialists are some of the resource personnel that will be able to look at problems and give advice. This type of system has significant application for rural interstates. Problems that require special knowledge can now close roads for several hours while the experts respond to the scene. The two-way communication link with video going to the experts can potentially save hours of delay for motorists.			X	**$400**		
2.5ST	***INTEGRATION OF COMMUNICATIONS CHANNELS PROJECT***	StanCOG	There are currently common channels for state agencies to talk to each other. There are channels for county agencies and also for city agencies to talk to others within their own government, but they cannot always communicate with outside government agencies. Technology exists to allow cross communication for major incidents and consideration should be given to establishing a link to be used in case of large multi-agency incidents.		X	X	**$200**		
3.0 Transit Systems									
3.1ST	***MODESTO TRANSIT AVL / SILENT ALARM***	Modesto Area Express	This project would equip transit vehicles in the Modesto area (43 busses) with ITS equipment to both track vehicles and give the bus operator the capability to send a silent alarm for an emergency condition. Automatic Vehicle Location (AVL) equipment generally utilizes satellite technology for pinpointing the exact (to within 20 meters) location of the tracked vehicle. Such tracking is ongoing all the time, and is not limited to the Visalia area. If a bus were removed from the area, it could still be located using the AVL equipment. Providing the bus operator with a silent alarm capability will increase the security level of both bus operators and transit patrons. Bus tracking would be viewed by transit dispatchers in the dispatch office. In many cases, the tracking information can be integrated into the same workstation that the dispatchers use in supervising and managing the transit vehicles.	X			**$ 650**		

Table 6.2: Summary of Regional ITS Projects

ID	Program Area/Project	Involved Agency	Brief Description	Project Initiation*			Capital Cost Estimates 2001 (Thousands of $)**		
				N	M	L	Total		
							Phase 1	Phase 2	Phase 3
3.2ST	***TRANSIT MANAGEMENT SYSTEM (TRMS) COMPLETION PROJECT***	Modesto Area Express	Transit agencies emphasized the point that they do not want to "recreate the wheel," and that MAX's transit management system deployment efforts should act as a building block for the rest of the region. This project would look at the most effective options for continuing MAX's TrMS deployment efforts by deploying AVL on uninstrumented rural and urban transit vehicles. Additional TrMS functions should be deployed with a view towards eventual region wide deployment. Options for deploying compatible components across all vehicles should be sought. MAX's system is J1708 compliant. The example provided was that fare equipment in a large bus may not be appropriate to a small rural service vehicle. Different devices may be used, but they should operate across a common software/system with completely compatible standards.			X	**$2,000**		
3.3ST	***DEMAND-RESPONSIVE TRANSIT SYSTEM INTEGRATION STUDY***	StanCOG	This project would fund a study of demand-responsive transit system integration strategies, culminating in a specific set of recommendations to implement strategies within specified transit agencies. The primary objective of integrating multiple demand-responsive transit services is to improve operating efficiency by reducing service redundancies and sharing vehicles, staff and scheduling/dispatch technology among agencies. These improvements result in an overall better quality of service to riders, and riders may benefit directly through enhanced schedule and/or destination options enabled through the integration of services across agencies. Typically, especially in county-based or rural oriented demand respsonsive transit environments, a number of different agencies operate within a given geographic area, providing service to many of the same destinations but often serving a slightly different client base. One of the primary objectives of demand-responsive transit service integration strategies is to reduce these redundancies and associated inefficiencies. Demand-responsive service integration includes a wide range of potential specific activities, ranging from simple coordination to full integration. Examples of specific strategies include consolidation of scheduling and/or dispatch functions (where multiple agencies can share the cost of improvements and share access), agreements to share access to vehicles under specified circumstances, and consolidation of ride reservation systems.		X	X	**$1,200**		
3.4ST	***COMMON ELECTRONIC FARE PAYMENT SYSTEM***	Modesto Area Express (MAX)	This project would create a transit fare payment system that would allow a single prepaid card to be used on all of the transit systems in the San Joaquin County area. Since a large number of County residents commute to the San Francisco Bay Area, it would be ideal to "piggyback" onto the systemwide electronic fare system now being developed for the Bay area (namely, TransLink). TransLink, a regional transit fare payment system using 'smart card' technology, is scheduled to launch as a demonstration project in the San Francisco Bay Area in mid-2001. The nine-county Bay Area will be first in the U.S. to have a single card that can be used on all forms of public transit in the region: buses, trains and ferries. The project began with the award of a contract to Motorola, Inc. in mid-1999. Motorola, Inc. is developing the system under contract to MTC. It is being developed in two phases to ensure that the system meets the needs of the Bay Area riding public and transit Operators. The six-month demonstration project will include approximately 5,000 transit riders using TransLink on six Bay Area transit systems [AC Transit, BART, Caltrain, Golden Gate Transit, SF Muni, and Santa Clara Valley Transportation Authority (VTA)]. The results of this demonstration will be thoroughly evaluated before the system is implemented region wide (in 2002).	X	X		**$4,000**		
3.5ST	***STANISLAUS COUNTY NEXT BUS ARRIVAL SIGNS***	Modesto Area Express (MAX)	This project would deploy dynamic message signs at selected higher-usage bus stops equipped with bus shelters. Currently, only one firm (NextBus) is providing this kind of service. Their equipment is placed on board transit vehicles, and GPS-derived current location and speed information is transmitted to NextBus computers at a remote location where the information is processed, and bus arrival prediction is then published to an Internet IP address. The IP address corresponds to a particular dynamic message sign. NextBus has a patent for this "arrival prediction using GPS coordinate data scheme, and their equipment combination uses a CDPD data modem to transmit the information from the bus to the NextBus servers. The cost for the CDPD "air time" may make this more expensive than in AT&T's coverage area. Also, once an initial installation is completed (using capital funding from some source), then the agency would need to continue the payments for CDPD air time (currently ~$60 per month per bus, and $30 per month per dynamic message sign. Once the service is in place, transit patrons would be able to determine real-time bus locations and expected arrival times at their bus stop. The dynamic message sign at the bus stop would be one source of this information, but NextBus also publishes the information in map form to an internet website, and in WAP form to hand-held PDAs. The information would therefore also be accessible to transit dispatchers as well as agencies that oversee and/or fund transit operations. NextBus can provide a broad cross-section of transit operations data that would be useful to these two management groups as well.		X	X	**$800**		
3.6ST	***COMBINED TRANSIT OPERATIONS/ DISPATCH CENTER PROJECT***	Modesto Area Express (MAX)	This project would bring together the various transit dispatching operations into a single and improved transit dispatch center. The application of scarce transit funds to a single center, versus the current system of independent centers, would allow for economies of scale and more effective dispatch through a coordinated single center.			X	**$6,000**		
4.0 Traveler Information Systems									
4.1ST	***MODESTO/CERES TRAVELER INFORMATION SYSTEM***	City of Modesto City of Ceres Sanislaus County	This project would implement a comprehensive Integrated Traveler Information System (ITIS) that includes the following systems: • Closed Circuit Television (CCTV) • System Detection • Changeable Message Signs (CMS) • Highway Advisory Radio (HAR) • Public Information Database (PIDB) • Traveler Advisory Telephones (TAT) • Community Access Television (CATV) information system • HAR/HAT Voice-Response System • Kiosks • Communication Network The goal of the system is to disseminate timely and reliable traffic congestion information along the major arterial streets within the FUA. System detector data would be collected, analyzed and disseminated via the ITIS. In addition, this information can be shared with the regional ATMS including Caltrans and other angencies in the region. This information can be provided to the public through an Internet website, a telephone advisory system, and interactive touch-screen kiosks located at strategic locations.			X	**$ 400**		

Table 6.2: Summary of Regional ITS Projects

ID	Program Area/Project	Involved Agency	Brief Description	Project Initiation* N	Project Initiation* M	Project Initiation* L	Capital Cost Estimates 2001 (Thousands of $)** Total Phase 1	Total Phase 2	Total Phase 3
5.0 Regional ITS Configuration Management/Coordination/Planning									
5.1ST	***DATA EXCHANGE NETWORK (DEN)/ COMMUNICATIONS INTERTIES***	Valleywide through Regional TMC's City of Modesto City of Ceres Stanislaus County Caltrans District 10	The project would develop logical data exchange network partnerships, initially focus on the urbanized areas of the County. Presumably the County and Caltrans would also be involved in the partnerships. In addition, the logical interties between Caltrans District 6, the County and major cities of the County. In general, local agencies that partner and interconnect more than one agency with Caltrans have been more successful in obtaining state and federal funding than those proposals that intertie only one agency to Caltrans. Data exchange networks are typically set up in areas where several jurisdictions are interested in collectively sharing information from their respective traffic management systems. The most common information shared is from traffic signal systems. While information exchange on the network can be used to more efficiently monitor multiple signal systems, the network usually doesn't allow for field device control or system interoperability. However, those capabilities can be included depending on user needs. Data exchange networks depend on some type of communication infrastructure (dedicated agency owned or leased line) and software to exchange information. Communication intertie projects can establish some of the necessary communication links for a data exchange network. Data exchange networks differ from interties in that data exchange networks typically focus on the network connectivity and "logical" protocols of sharing data among several agencies. Interties typically focus on the "physical" communication link between agencies. Both, interties and data exchange networks can form the basis and initial implementation of the "center to center" portion of a Regional Architecture. Communications intertie projects typically take place between a Caltrans Transportation Management Center (TMC) and a local agency TMC/Traffic Operations Center (TOC). To be most effective, the Caltrans TMC and the local agency would be required to have centralized command and control of traffic management systems and field devices within their respective jurisdictions. In other areas of California, intertie projects allow Caltrans and the local agency to more efficiently share transportation management information, including but not limited to: traffic flow and congestion information, weather information, incident information, video images and in some cases, signal timing plans and modes. In some cases, shared control of a limited number and type of field devices has been arranged between agencies. While full control of one another's assets (field devices, signal systems, etc.) is technically possible it may not be a desired arrangement institutionally. The most important element of an intertie project is a communication link between the intertie agencies. This can either be a dedicated agency owned asset (fiber or copper wire) or some type of telco lease line technology (T1, ISDN or DSL). Another major element of an intertie project is the software, protocols, and interfaces that would allow for the exchange of information between different systems. Interties differ from data exchange networks (see Data Exchange Network fact sheet) in that interties focus on the "physical" communication link between agencies. Data exchange networks typically focus on the network conectivity and "logical" protocols of sharing data among several agencies. Both, interties and data exchange networks can form the basis and initial implementation of the "center to center" portion of a Regional Architecture.			X	**$200**		
			Total Estimated Capital Deployment Costs for All Potential ITS Projects Over 20 Years						**$42,520**
SAN JOAQUIN COUNTY									
1.0 Traffic/Freeway Management Systems (ATMS)									
1.1SJ	***CITY OF STOCKTON EXPANSION OF ATMS AND CENTRAL CONTROL SYSTEM, PHASE 2***	City of Stockton San Joaquin County Caltrans District 10 SMART	The first phase, or base system, of the Stockton ATMS Master Plan was completed in 1997. The second phase will build upon its current multi-purpose role of providing monitoring and surveillance capabilities to traffic management operators and is intended to conceptually depict the long term traffic control & surveillance system to be implemented in the City. The major functions of the system are: • Incident Detection • Incident Verification & Response • Monitoring of traffic signal coordination along major corridors • Monitoring high volume intersection operation, queue build-up and high accident locations • Evaluate Traffic Management Strategies The second phase expansion will primarily consist of the elements: • Expand Central Network • Additional CCTV Cameras • Interconnect New Traffic Signals • New Traffic Signal Controllers • Integration with Caltrans The expansion of the system will make use of the existing City fiber optic communication network, which will provide opportunities for a cost-effective communications media for video signals and control signal transmission. The central network will be expanded through a combination of multiplexing the existing fiber network and extending the system to other portions of the City that were not included in the first phase of development. The CCTV camera site locations will be identified based on established camera site selection criteria. The CCTV cameras are located at strategic locations throughout the City to provide surveillance and monitoring capabilities for the operators at the Traffic Management Center in the City. A total of 10 additional CCTV camera locations were identified throughout the City to provide surveillance and monitoring capabilities.	X			**$9,700+**		
1.2SJ	***CALTRANS TRAFFIC OPERATION SYSTEMS (TOS) GAP CLOSURE PROJECT (REGION)***	Caltrans District 10 SJCOG	Caltrans considers most field elements that aid in traffic surveillance and management activities to be part of the TOS. The most common field elements deployed as a comprehensive TOS in urbanized areas include, but are not limited to: traffic detection (inductive loops, video, acoustic), closed circuit television (CCTV) cameras, changeable message signs (CMS), highway advisory radio (HAR), communications systems and centralized command and control systems/centers with expert systems to aid in incident detection and response as well as automated ramp metering operations. Additional elements that are typically added to rural settings include, but are not limited to: road weather information systems (RWIS) and other systems that aid in improved emergency response times and dissemination of travel advisory information.	X	X	X	**$2,000**		

Table 6.2: Summary of Regional ITS Projects

ID	Program Area/Project	Involved Agency	Brief Description	Project Initiation*			Capital Cost Estimates 2001 (Thousands of $)**		
				N	M	L	Total		
							Phase 1	Phase 2	Phase 3
1.3SJ	***COMMUNICATIONS INTERTIE PROJECT BETWEEN STOCKTON, COUNTY AND CALTRANS***	City of Stockton San Joaquin County Caltrans District 10	Communications intertie projects typically take place between a Caltrans Transportation Management Center (TMC) and a local agency TMC/Traffic Operations Center (TOC). To be most effective, the Caltrans TMC and the local agency would be required to have centralized command and control of traffic management systems and field devices within their respective jurisdictions. In other areas of California, intertie projects allow Caltrans and the local agency to more efficiently share transportation management information, including but not limited to: traffic flow and congestion information, weather information, incident information, video images and in some cases, signal timing plans and modes. In some cases, shared control of a limited number and type of field devices has been arranged between agencies. While full control of one another's assets (field devices, signal systems, etc.) is technically possible, it may not be a desired arrangement institutionally. The communication link between the intertie agencies can either be a dedicated agency owned asset (fiber or copper wire) or some type of telecommunication lease line technology (T1, ISDN or DSL). Another major element of an intertie project is the software, protocols, and interfaces that would allow for the exchange of information between different systems. This project would establish/complete backbone wireline communications between the largest transportation players in the County. The most logical interties in Stockton FUA would be between the Caltrans Districts 10 and the City of Stockton, which would also be linked to ATMS workstations in the County. Communications would likely utilize fiber optic cable, however other opportunities should be reviewed for the various needs. This project should consider the establishment of regional standards for fiber communications deployment, including consideration of modes, capacity needs, communications protocols, and perhaps equipment types.	X	X		**$3,000**		
1.4SJ	***URBAN AREA TRAFFIC SIGNAL COORDINATION PROJECT***	City of Stockton	This project would implement a number of local traffic signal coordination projects, spread out at specific urbanized locations along regionally significant arterials in the Stockton FUA, which are identified below. The objective of these projects would primarily be to reduce delays at traffic signals by improving coordination between adjacent signals, with improved safety, and possible secondary benefits depending on the specific improvements made. The specific improvements to be made would vary by location, which could include intra- and inter-jurisdictional efforts. The types of improvements that are possible include upgrading traffic signal controllers and detection, upgrading signal interconnects, and communications systems enabling centralized (i.e., remote) timing plan updating and maintenance and malfunction monitoring. Although providing emergency vehicle preemption, transit vehicle priority or automated enforcement would not be the focus or justification for these improvements, the equipment installed as part of these projects may support these features. Local agency traffic operations staff would lead these projects. The provision of traffic signal coordination for small communities is most often initiated with use of either time-based coordination (TBC) or a closed-loop system (CLS). Depending on the type of controller equipment now in place, and depending on the level of staffing support that the City (or County) is able to make in the maintenance of signal coordination plans, the initial cost and recurring effort to achieve signal coordination in Hanford would vary from a very low cost, to a moderate cost. A number of communication alternatives are possible to tie the intersection controllers to a supervisory computer at City Hall (in the CLS alternative). With a CLS, the capability is created to remotely monitor intersection operation and the capability to remotely change both basic and coordination timing. A first step in the signal coordination capability would be the design and implementation of TBC timing plans. A feasibility study on possible and appropriate upgrade plans for creation and installation of a traffic signal system could be completed at the same time. Any small community that has more than 10 traffic signals would probably benefit from having signal coordination implemented along its heaviest-traveled street(s) so that vehicles can progress through a series of signalized intersections without stopping. The initial effort to achieve this basic level of coordination is relatively low, especially if it is contracted out. The resulting basic timing plans (perhaps just 2 or 3 plans which run between 7AM and 6 PM) can be left in place with very little subsequent retiming effort required or needed. Traffic signal coordination typically has one of the very highest benefit-to-cost ratios of any public works activity.	X	X		**$1,500**		
1.5SJ	***EVP DEPLOYMENTS***	City of Stockton	Emergency Vehicle Preemption (EVP) is the ITS implementation at a traffic signal which modifies normal signal operation to provide a nearly immediate green signal for an approaching emergency vehicle. This type of ITS project is most often deployed on fire trucks because of the nature of the fire truck vehicle performance. The acceleration rate of fire trucks is rather slow due to their relatively low power-to-weight ratio. If fire trucks must slow down (and sometimes stop) when they encounter signalized intersections along their emergency run, the overall delay in responding to their emergency destination can easily exceed 1 to 2 minutes. For fire events, this delay can mean a significant difference in the level of destruction, the level of effort in suppressing the fire, the level of personal danger for firefighters at the scene, and the number and extent of injuries for victims. Depending on the level of congestion and the distance traveled, fire trucks can encounter many traffic signals, and heavy congestion. Driving in oncoming traffic lanes is a "last resort" maneuver, which fire departments rightly avoid. If the fire truck encounters a red signal, it can assert the right of way and go through, but only after gaining assurance that it can safely cross through the intersection. Some larger agencies that have used EVP for many years have broadened the application to also equip ambulance vehicles and, in some cases, police vehicles with this on-board preemption request equipment. While these vehicles have much better acceleration characteristics, and the added delay at signals while on their emergency runs is much lower, granting EVP to these vehicles may provide another benefit. The crossing of very wide and very busy signalized intersections is very difficult in today's traffic. Each year, many such emergency vehicles are "totaled" after being T-boned when crossing a busy intersection. EVP helps reduce and prevent this occurrence. Potential corridors for EVP deployments include Hammer Lane, Pacific Avenue, Pershing Avenue, West Lane, March Lane, Harding Way, and 8th Street.		X		**$3,500**		
1.6SJ	***PORT OF STOCKTON ITS PROJECT***	City of Stockton San Joaquin County	This project would enhance the existing staging areas utilized by the Port of Stockton for trucks waiting to enter the Port. The project would provide a monitoring system at both the Port and the two staging areas that would direct trucks, through a series of CMS, coming to the Port into the staging areas when the Port is backed up. The effort would establish a monitoring system using technologies such as CMS (5), CCTV (3), video detection system, and a workstation.			X	**$ 300**		
1.7SJ	***INTEGRATED SMART CORRIDORS***	Stockton FUA: City of Stockton San Joaquin County Caltrans District 10	This project would implement a package of ITS applications in a highway corridor consisting of at least one main route and one parallel route. The focus of the project would be to improve the level of coordination of traffic management activities on the main route and parallel route(s); in effect to conduct corridor-level rather than facility-specific ITS traffic management. The range of ITS applications that could be included in a smart corridor application include essentially the full range of freeway management, arterial street management (e.g., traffic signalization) and traveler information strategies, including surveillance and detection; incident management, including coordinated and dynamic traffic detouring strategies utilizing both the main and parallel route(s); changeable message signs; dynamic trailblazer signs; highway advisory radio; and integrated traffic signal operations, including coordination between ramp meters and adjacent traffic signals. The smart corridor project would feature implementation of a combination of ITS applications, with the emphasis being on linking operations across multiple facilities serving a defined travel corridor. Given the multi-facility nature of this project, the multi-jurisdictional coordination aspects of the project will be critical, including developing consensus on the specific objectives of the project and on the individual coordination procedures and technques. The first step in the development of this project would be to identify a candidate project corridor, based on accidents and congestion, travel patterns, availability of alternate routes and interest among the potential project partcipants.			X	**$4,000**		

Table 6.2: Summary of Regional ITS Projects

ID	Program Area/Project	Involved Agency	Brief Description	Project Initiation*			Capital Cost Estimates 2001 (Thousands of $)**		
				N	M	L	Total		
							Phase 1	Phase 2	Phase 3
1.8SJ	***ADVANCED RAILROAD HIGHWAY INTERFACE TECHNOLOGY DEPLOYMENT***	City of Stockton San Joaquin County	This project would deploy railroad-highway grade crossing technology at needed grade crossings with safety (high accident) and/or high volume and delay concerns. The objective of the project would use field validated strategies for improving safety, reducing delay and/or providing travelers with improved real-time information on grade crossing statu developed by the Kings County Advanced HRI Technology Deployment Demonstration project. The project could feature any combination of detection (both for trains and approaching vehicles), warning/traveler information, and control devices. Many different strategies are possible. Possible strategies include sensors coupled with message signs, in-vehicle devices and/or highway advisory radio that would provide approaching travelers with information on the expected duration of a crossing blockage. Another possible application would tie sensors to emergency vehicle dispatching systems to provide dispatchers and drivers with real time crossing status information. This project would use the blueprint for applying technology to enhance grade crossing safety developed by the demonstration project. One major cause of crashes at railroad grade crossings is the persistent presence of the heavy Tule fog in the Valley, and the inability for drivers to see grade crossings which are occupied with a train, usually in motion, until they are too close to stop. If some kind of train presence detection could be devised, and tied to an advance-warning beacon, approaching drivers would be forewarned about the dangerous situation. Such an active presence could be detected by an advanced detector, and need not involve the cooperation / joint solution with the railroad. Because of liability, railroads are not eager to create new and unproven detection or safety mechanisms; they have a well-defined program for active warning devices at the crossing which are very involved "systems" tied in with the railroad's own advance detection systems. The possibility of deploying an advanced technology solution, especially at locations where no active warning devices now exist, would be the basis for this project. Highway traffic at highway-rail intersections (HRIs) could be managed, where operational requirements demand advanced features (e.g., where rail operational speeds are greater than 80 miles per hour). This would include all capabilities from the Standard Railroad Grade Crossing and augments these with additional safety features to mitigate the risks associated with higher rail speeds. The active warning systems would include positive barrier systems, which preclude entrance into the intersection when the barriers are activated. Like the Standard Package, the HRI equipment is activated on notification by wayside interface equipment, which detects, or communicates with, the approaching train. The wayside interface equipment would provide additional information about the arriving train so that the train's direction of travel, estimated time of arrival, and the estimated duration of closure may be derived. This enhanced information may be conveyed to the driver prior to, or in context with, warning system activation. This would also include additional detection capabilities, enabling it to detect an entrapped or otherwise immobilized vehicle within the HRI and provide an immediate notification to highway and railroad officials.		X		**$750**		
1.9SJ	***VANPOOL VEHICLE TRAFFIC PROBES***	San Joaquin County	Several attempts to utilize transit vehicles as traffic probes have been undertaken around the United States and the world over the past several years. These efforts have met with mixed results for a few different reasons. The inherent, and unpredictable, stop and start nature of most transit vehicle trips does not lend itself well to judging the general flow of traffic. Algorithms, which have not always proven reliable, needed top be developed to account for passenger drop-off and pick-up activity. These implementations typically worked best on vehicles that made fewer and more predictable stops. Before the advent of geographic positioning systems (GPS), these systems employed roadside beacons, or similar technologies, to track vehicle location and progress over a pre-defined route. This was an infrastructure intensive solution that was relatively expensive to implement, especially compared to today's GPS based vehicle tracking systems. A GPS based system allows greater coverage to determine vehicle location, heading and velocity without the roadside infrastructure investment. Given the above information, the general assertion is that vehicle probes are most reliable and less expensive to implement on vehicles that travel longer distances, make fewer stops and utilize GPS technology. Long distance express transit buses and vanpools typically fit these criteria.	X			**$ 500**		
2.0 Incident Management/Emergency Services									
2.1SJ	***ALTERNATE ROUTE DATABASE/ WEBSITE***	San Joaquin County	This project would aid in the dissemination and utilization of alternate route plans by providing access to the plans via the Internet. During the needs identification process, it was noted that in many cases alternate routes plans to facilitiate traffic diversions during incidents, including accidents, construction and weather-related closures, do exist, but are not utilized to the extent they should be because some agencies are not aware of the plans and/or do not have convenient access to them. If successful, this project would make traffic diversions more coordinated and effective, including reducing the adverse impacts that detoured traffic imposes on alternate routes, and reducing the volume of traffic on roadway segments with hazardous conditions or heavy congestion. This project would focus on collecting and providing access to existing alternate route plans, although it would likely include some development of new plans to fill gaps, etc. In addition to the collection of plans and development of dissemination tools, this project should include agency discussions to stimulate understanding and use of the alternate route plans.		X		**$ 20**		
2.2SJ	***TRAFFIC SAFETY TASK FORCE***	SJCOG, CHP, Caltrans, with heavy involvement from all other emergency service agencies.	This project would integrate radio communications among agenices that respond to incidents, such as local police, state patrol, fire departments, Caltrans, and local traffic agencies. The objective of the project would be to improve communications and thereby improve the effectiveness of incident management, resulting in reduced response times, reduced incident duration and associated traffic delays. Currently, most agencies that must, or should, work together during incidents cannot easily communicate with one another over their respective radio systems. This project would identify a specific study area and set of agencies, then identify and implement a solution to provide integrated communications. Depending on the existing equipment and approaches, the potential strategies to provide for integrated communications include both heavily capital intensive solutions, such as those involving major changes in communications infrastructure, and less intensive solutions, such as those that could involve changes in procedures, reprogramming of existing equipment, etc.		X		**$150**		
2.3SJ	***PORTABLE CMS POOL***	SJCOG, Caltrans, CHP, San Joaquin County, Stockton	This project will establish a pool of portable changeable message signs that would be made available to various public agencies for use in construction work zones, special event traffic control and other appropriate incident management applications. Currently, many agencies that could benefit from the signs cannot afford, or justify, purchase of the signs. Caltrans is the most likely candidate to purchase the signs and administer the lending program. For costing purposes, it has been assumed that 20 signs would be purchased. The signs could be made available at no cost or for a fee that would be less than that charged by commercial equipment rental companies. Agencies borrowing the signs may or may not financially contribute toward maintenance of the signs, depending on the funding source.	X			**$150**		
2.4SJ	***ALTERNATE ROUTE SIGNING***	Stockton FUA: City of Stockton San Joaquin County	This project would include the installation of 58 static alternate route signs within the County for designated detour routes. This project would implement changeable message signs specifically sited, and primarily devoted, to detouring traffic onto alternate routes during incidents, including accidents and weather related road closures. These signs could differ from the large, permanent changeable message signs deployed by Caltrans at key decision points in several respects. First, they would be sited in conjunction with a specific alternate route/detour strategy developed for a particular route and alternate routes. Second, the signs could be smaller than the Caltrans signs. Third, the signs could include features, such as arrows or flashing beacons that are not included on the traditional CMS. Finally, the alternate routes signs could be deployed as trailblazers along the alternate route, rather than merely in advance of the main route/alternate route decision point. The objective of this project would be to improve compliance with detours and reduce driver uncertainty along detour routes. If successful in reducing the volume of vehicles entering hazardous or congested roadway segments, this project holds the potential to reduce congestion, delay and accidents. In order to be successful, it would be critical that this project include development of an alternate route plan and procedures to support the usage of the signs, and that this plan be effectively linked to an overall multi-agency coordinated incident management strategy. This project would also require a commitment on behalf of the operating agency to devote the time and attention necessary to utilize the signs effectively. Even more so than a single CMS, keeping the dynamic message signs current and accurate would be critical	X	X		**$ 1,740**		

Table 6.2: Summary of Regional ITS Projects

ID	Program Area/Project	Involved Agency	Brief Description	Project Initiation*			Capital Cost Estimates 2001 (Thousands of $)**		
				N	M	L	Total		
							Phase 1	Phase 2	Phase 3
3.0 Transit Systems									
3.1SJ	**TRANSIT MANAGEMENT SYSTEM (TrMS) UPGRADES**	San Joaquin Regional Transit District	This project would provide funding to implement a transit management system. A transit management system typically includes automatic vehicle location (AVL), computer-aided scheduling and dispatch software, mobile data terminals, automated schedule adherence monitoring, computer report generation and data management, and maintenance management software. Transit management systems may also include traveler information elements such as automated itinerary planning systems, station signs showing real-time vehicle arrival information, and Internet web sites. The project shall be consistent with other regional systems including Fresno Area Express, Golden Empire Transit and San Joaquin Regional Transit. In addition, the Transit Management System shall take into consideration other potential projects with overlapping components such as AVL. This project will build upon the *SMARTtrac* system implemented by the San Joaquin Regional Transit District, which is an advanced public transportation system that uses a Global Positioning System to track its buses and provide passengers with real-time bus arrival information. The *SMARTtrac* system is the first of its kind in the nation, integrating real-time vehicle location with an interactive voice response system (IVRS) providing bus stop arrival information. All bus stops in the Stockton Metropolitan Area and on Intercity routes connecting Lodi, Tracy, Lathrop and Manteca have been assigned a four-digit identification number. This number is located on the bus stop sign. A potential rider can call *SMARTtrac* and find out when the bus will reach the stop based on the location of the bus at the time of the call, which allows time to reach the stop just a few minutes before the bus arrives.		X	X	**$2,000**		
3.2SJ	***TRANSIT INFORMATION SYSTEM***	San Joaquin Regional Transit District	This project would implement a system for collecting, processing and disseminating transit information, including "static" information such as routes and schedules, and in the cases of those operators with vehicle tracking systems, real-time information such as estimated vehicle arrival times at specific locations. The objective of the project would be to improve the availability and accessibility of transit information, thereby making transit more convenient and increasing transit utilization. Transit users often site uncertainty in transit schedules, stops, fares and the timing of arrivals at specific stops as impediments. This project would establish a centralized transit information database, residing in a computer that would probably be housed at one of the San Joaquin Valley transit operations, or perhaps at a location, such as a Caltrans traffic management facility, where other traveler information is compiled. The project would include procedures and supporting communications infrastructure that would allow participating transit operators to submit information to the system. For static information, the communications system could be very minimal, such as via e-mail or Internet file transfer. The communications necessary to support real-time information would be more costly and elaborate and could include a dial-up or dedicated phone connection. The project would also include dissemination tools to make the information available to travelers. These tools could include an Internet web site, telephone information system, and kiosks.		X		**$600**		
3.3SJ	***SMART NEXTBUS ARRIVAL SIGNS***	San Joaquin Regional Transit District	This project would deploy dynamic message signs at selected higher-usage bus stops equipped with bus shelters. Currently, only one firm (NextBus) is providing this kind of service. Their equipment is placed on board transit vehicles, and GPS-derived current location and speed information is transmitted to NextBus computers at a remote location where the information is processed, and bus arrival prediction is then published to an Internet IP address. The IP address corresponds to a particular dynamic message sign. NextBus has a patent for this "arrival prediction using GPS coordinate data scheme, and their equipment combination uses a CDPD data modem to transmit the information from the bus to the NextBus servers. The cost for the CDPD "air time" may make this more expensive than in AT&T's coverage area. Also, once an initial installation is completed (using capital funding from some source), then the agency would need to continue the payments for CDPD air time (currently ~$60 per month per bus, and $30 per month per dynamic message sign. Once the service is in place, transit patrons would be able to determine real-time bus locations and expected arrival times at their bus stop. The dynamic message sign at the bus stop would be one source of this information, but NextBus also publishes the information in map form to an Internet website, and in WAP form to hand-held PDAs. The information would therefore also be accessible to transit dispatchers as well as agencies that oversee and/or fund transit operations. NextBus can provide a broad cross-section of transit operations data that would be useful to these 2 management groups as well.	X	X		**$800**		
3.4SJ	***SAN JOAQUIN TRANSIT ELECTRONIC FARE PAYMENT***	AC Transit, BART, Caltrain, Golden Gate Transit, SF Muni, Santa Clara Valley Transportation Authority (VTA).	This project would coordinate the fare payment systems of one or more transit systems, allowing riders to use the same fare media, such as a magnetic strip swipe card, interchangeably on any of the participating systems. The objective of this project would be to increase the convenience of fare payment for riders and promote transfers between systems. The introduction of electronic fare collection systems can also reduce fare handling costs for transit operators. Since a large number of County residents commute to the San Francisco Bay Area, it would be ideal to "piggyback" onto the systemwide electronic fare system now being developed for the Bay area (namely, TransLink). TransLink, a regional transit fare payment system using 'smart card' technology, is scheduled to launch as a demonstration project in the San Francisco Bay Area in mid-2001. The nine-county Bay Area will be first in the U.S. to have a single card that can be used on all forms of public transit in the region: buses, trains and ferries. The project began with the award of a contract to Motorola, Inc. in mid-1999. Motorola, Inc. is developing the system under contract to MTC. It is being developed in two phases to ensure that the system meets the needs of the Bay Area riding public and transit Operators. The six-month demonstration project will include approximately 5,000 transit riders using TransLink on six Bay Area transit systems (AC Transit, BART, Caltrain, Golden Gate Transit, SF Muni, and Santa Clara Valley Transportation Authority). The results of this demonstration will be thoroughly evaluated before the system is implemented regionwide (in 2002). In addition to on-board fare collection equipment, this project would also include the computing and communications resources necessary to coordinate fare accounting among the participating agencies. This project could involve two or more agencies that do not have electronic fare payment systems (e.g., implement new equipment at all participating agencies), or expand upon a system already implemented by one or more agencies by equipping additional agencies.			X	**$2,000**		
3.5SJ	***DEMAND-RESPONSIVE TRANSIT SYSTEM INTEGRATION STUDY***	San Joaquin County San Joaquin Regional Transit District	This project would fund a study of demand-responsive transit system integration strategies, culminating in a specific set of recommendations to implement strategies within specified transit agencies. The primary objective of integrating multiple demand-responsive transit services is to improve operating efficiency by reducing service redundancies and sharing vehicles, staff and scheduling/dispatch technology among agencies. These improvements result in an overall better quality of service to riders, and riders may benefit directly through enhanced schedule and/or destination options enabled through the integration of services across agencies. Typically, especially in county-based or rural oriented demand respsonsive transit environments, a number of different agencies operate within a given geographic area, providing service to many of the same destinations but often serving a slightly different client base. One of the primary objectives of demand-responsive transit service integration strategies is to reduce these redundancies and associated inefficiencies. Demand-responsive service integration includes a wide range of potential specific activities, ranging from simple coordination to full integration. Examples of specific strategies include consolidation of scheduling and/or dispatch functions (where multiple agencies can share the cost of improvements and share access), agreements to share access to vehicles under specified circumstances, and consolidation of ride reservation systems.		X		**$150**		

Table 6.2: Summary of Regional ITS Projects

ID	Program Area/Project	Involved Agency	Brief Description	Project Initiation*			Capital Cost Estimates 2001 (Thousands of $)**		
				N	M	L	Total		
							Phase 1	Phase 2	Phase 3
4.0 Traveler Information Systems									
4.1SJ	***METROPOLITAN TRAVELER INFORMATION SYSTEM***	San Joaquin County	This project would implement a comprehensive Integrated Traveler Information System (ITIS) that includes the following systems: • Closed Circuit Television (CCTV) • System Detection • Changeable Message Signs (CMS) • Highway Advisory Radio (HAR) • Public Information Database (PIDB) • Traveler Advisory Telephones (TAT) • Community Access Television (CATV) information system • HAR/HAT Voice-Response System • Kiosks • Communication Network The goal of the system is to disseminate timely and reliable traffic congestion information along the major arterial streets within the Stockton FUA. System detector data would be collected, analyzed and disseminated via the ITIS. In addition, this information can be shared with the regional ATMS including Caltrans and the County. This information can be provided to the public through an Internet website, a telephone advisory system, and interactive touch-screen kiosks located at strategic locations. To complement the system, links should be made with TravInfo. TravInfo is an open access traveler information system in the San Francisco Bay Area. The Field Operational Test took place over a two-year period from September 1996 to September 1998 with funding from the Federal Highway Administration and the California Department of Transportation (Caltrans). TravInfo provides a free public service of real-time traffic information through a phone line, FM data broadcast, and the Internet with the goal to broadly disseminate accurate, comprehensive, timely, and reliable information on traffic conditions and multi-modal travel options to the public in the Bay Area.		X	X	**$400**		
5.0 Regional ITS Configuration Management/Coordination/Planning									
5.1SJ	***DATA EXCHANGE NETWORK (DEN)/ COMMUNICATIONS INTERTIES***	Valleywide through Regional TMC's City of Stockton San Joaquin County Caltrans District 10	The project would develop logical data exchange network partnerships, initially focus on the urbanized areas of the County. Presumably the County and Caltrans would also be involved in the partnerships. In addition, the logical interties between Caltrans District 6, the County and major cities of the County. In general, local agencies that partner and interconnect more than one agency with Caltrans have been more successful in obtaining state and federal funding than those proposals that intertie only one agency to Caltrans. Data exchange networks are typically set up in areas where several jurisdictions are interested in collectively sharing information from their respective traffic management systems. The most common information shared is from traffic signal systems. While information exchange on the network can be used to more efficiently monitor multiple signal systems, the network usually doesn't allow for field device control or system interoperability. However, those capabilities can be included depending on user needs. Data exchange networks depend on some type of communication infrastructure (dedicated agency owned or leased line) and software to exchange information. Communication intertie projects can establish some of the necessary communication links for a data exchange network. Data exchange networks differ from interties in that data exchange networks typically focus on the network connectivity and "logical" protocols of sharing data among several agencies. Interties typically focus on the "physical" communication link between agencies. Both, interties and data exchange networks can form the basis and initial implementation of the "center to center" portion of a Regional Architecture. Communications intertie projects typically take place between a Caltrans Transportation Management Center (TMC) and a local agency TMC/Traffic Operations Center (TOC). To be most effective, the Caltrans TMC and the local agency would be required to have centralized command and control of traffic management systems and field devices within their respective jurisdictions. In other areas of California, intertie projects allow Caltrans and the local agency to more efficiently share transportation management information, including but not limited to: traffic flow and congestion information, weather information, incident information, video images and in some cases, signal timing plans and modes. In some cases, shared control of a limited number and type of field devices has been arranged between agencies. While full control of one another's assets (field devices, signal systems, etc.) is technically possible it may not be a desired arrangement institutionally. The most important element of an intertie project is a communication link between the intertie agencies. This can either be a dedicated agency owned asset (fiber or copper wire) or some type of telco lease line technology (T1, ISDN or DSL). Another major element of an intertie project is the software, protocols, and interfaces that would allow for the exchange of information between different systems. Interties differ from data exchange networks (see Data Exchange Network fact sheet) in that interties focus on the "physical" communication link between agencies. Data exchange networks typically focus on the network conectivity and "logical" protocols of sharing data among several agencies. Both, interties and data exchange networks can form the basis and initial implementation of the "center to center" portion of a Regional Architecture.			X	**$300**		
			Total Estimated Capital Deployment Costs for All Potential ITS Projects Over 20 Years						**$33,560+**

Table 6.2: Summary of Regional ITS Projects

ID	Program Area/Project	Involved Agency	Brief Description	Project Initiation* N	Project Initiation* M	Project Initiation* L	Capital Cost Estimates 2001 (Thousands of $)** Total Phase 1	Total Phase 2	Total Phase 3
KERN COUNTY									
1.0 Traffic/Freeway Management Systems (ATMS)									
1.1KE	***EVP DEPLOYMENTS***	Bakersfield Urban Area Kern County City of Bakersfield	The project would implement Emergency Vehicle Preemption (EVP) along key arterials throughout the County for use by City and County fire departments. The implementation EVP at a traffic signal modifies normal signal operation to provide a nearly immediate green signal for an approaching emergency vehicle. This type of system is most often deployed on fire trucks because of the nature of the fire truck vehicle performance. The acceleration rate of fire trucks is rather slow due to their relatively low power-to-weight ratio. If fire trucks must slow down (and sometimes stop) when they encounter signalized intersections along their emergency run, the overall delay in responding to their emergency destination can easily exceed 1 to 2 minutes. For fire events, this delay can mean a significant difference in the level of destruction, the level of effort in suppressing the fire, the level of personal danger for firefighters at the scene, and the number and extent of injuries for victims. Depending on the level of congestion and the distance traveled, fire trucks can encounter many traffic signals, and heavy congestion. Driving in oncoming traffic lanes is a "last resort" maneuver, which fire departments rightly avoid. If the fire truck encounters a red signal, it can assert the right of way and go through, but only after gaining assurance that it can safely cross through the intersection. EVP isn't needed in every community. Only when traffic congestion is very significant, or only when long emergency vehicle runs are likely to encounter a large number of signalized intersections, would the provision of EVP be cost effective. Some cities in the Central Valley already have EVP in place, the 3M Opticom™ system being predominant. Priority request equipment would be installed in each fire truck and matching reception equipment would be installed at each signalized intersection where EVP is to be granted. Some larger agencies that have used EVP for many years have broadened the application to also equip ambulance vehicles and, in some cases, police vehicles with this on-board preemption request equipment. While these vehicles have much better acceleration characteristics, and the added delay at signals while on their emergency runs is much lower, granting EVP to these vehicles may provide another benefit. The crossing of very wide and very busy signalized intersections is very difficult in today's traffic. Each year, many such emergency vehicles are "totaled" after being T-boned when crossing a busy intersection. EVP helps reduce and prevent this occurrence. However, this project assumes only fire department vehicles would be equipped with EVP devices.	X			**$1,500**		
1.2KE	***BAKERSFIELD TOC EXPANSION, PHASE II***	City of Bakersfield	In order to accommodate Kern ITS with the City of Bakersfield TOC acting as the regional TOC for Kern (particularly for traveler information) certain aspects and elements will require improvements. Spatial requirements will include additional racks for the traveler information system server; a workstation for the traveler information system operator, including furniture; and all additional associated hardware, such as additional monitors. Live video feeds to the media will involve upgrades to the traveler information system, and, potentially, upgrades to the TOC. This component may include a monitor for each media feed, in order to verify the view being received by the news stations. Future expansion plans of the TOC should consider region-wide ITS needs, especially the traveler information system, in addition to City of Bakersfield needs. The upgrade can be achieved through one of the following alternatives: • Expanding the existing TOC if space is available • Moving the TOC to Control 5 • Moving the TOC to the Superintendent of Schools building in downtown Bakersfield • Moving the TOC to a new, dedicated building at a site to be determined at a later date The objective of the Bakersfield TOC upgrade component is to accommodate the traveler information system and future county-wide ITS functions. The following are changes identified in the City of Bakersfield Traffic Operations Center report to expand the opening day TOC should it need to function as a temporary regional TMC. These changes can also be used to temporarily convert the TOC to accommodate a traveler information system. • The TOC room can be enlarged to allow for console expansion • CCTV monitors can be added to the video wall • The console can be shifted and two additional workstations added • The "offline" desk can be re-oriented for partial video wall viewing • File cabinet space can be added for storage of TOC related files • The work space south of the conference room can be replaced by storage area The Equipment Room and racks should be able to contain the additional equipment associated with the expanded console and CCTV monitors. The racks, when purchased for opening day, should be, at a minimum, 6 feet in height and secured to the back wall to prevent movement. All equipment in the rack should be mounted on drawer slides that pull completely out of the rack for access to the back panel. Cable management will be important to this design. The City could also alter the location of each equipment rack, so that both the front and back of the rack are accessible. The phasing will involve the upgrades described above, to accommodate the region-wide ATIS in the short term. Eventually, permanent changes will be required to accommodate the long-term enhancements and upgrades. Live video feed(s) to the media should be planned for the short-term as well. Additional phases should be determined as new region-wide projects are introduced into the Kern ITS. Regional systems and technologies should be co-located with the City of Bakersfield TOC and the traveler information system as much as is reasonable. For example, rural ITS may eventually expand enough to warrant a rural TOC in the future. Until this time, the City of Bakersfield TOC should be considered the regional TOC, with all future systems planned for integration with the systems in the TOC.	X	X		**$500**		

Table 6.2: Summary of Regional ITS Projects

ID	Program Area/Project	Involved Agency	Brief Description	Project Initiation*			Capital Cost Estimates 2001 (Thousands of $)**		
				N	M	L	Total		
							Phase 1	Phase 2	Phase 3
1.3KE	***COMMUNICATION LINKS WITH BAKERSFIELD SONET NETWORK, PHASE II***	Kern County City of Bakersfield	The Bakersfield Communication Master Plan defined a fiber optic, SONET backbone for the City of Bakersfield, dedicated to ITS and other transportation needs. This backbone will need to be enhanced to be used as the network for Kern ITS. It is imperative that this backbone be constructed in a manner that will provide the central communications necessary for Kern ITS. Since the SONET is currently sized only for the City of Bakersfield needs, upgrades will be necessary and included as a part of this Communications Network Development Plan. This means that any additional fibers which are needed for Kern ITS over and above the current SONET design (which accommodates only the City of Bakersfield's projected future needs), will need to be funded as part of this Kern Communication Network Development Plan. Links to the SONET network will allow any connected agency to communicate with any other agency. Physical communication links will be either fiber, hardwire, or wireless. The microwave network owned and operated by the Office of the Superintendent of Schools in Kern should be analyzed and strongly considered to be used as the communication medium wherever possible. The cost effctive use of the Internet (specifically the world wide web) should be considered as well. An extranet, or private internet (as opposed to intranets) could be easily utilized to provide the links between the different jurisdictions and agencies. Communication will allow operators to share information and to discuss strategies, the exchange of weather and traffic information through the advanced traveler information system (to be described later), and, potentially, the sharing of field elements. Cooperative agreements will be necessary among all agencies in order to address control issues. Cooperative agreements are discussed further as a part of the Traffic and Incident Mangement Program. The overall objective of the Communication Link component of this program is to provide a means of communicating among all agencies involved in Kern transportation (and ITS) in order to allow for interagency coordination and cooperation, information sharing, and shared field element control. There is currently a link from Kern County's Control 5 Communication System to the City of Bakersfield via two-way radio. Since the City of Bakersfield will be an actual node on the SONET network, this is technically an existing link. This link should be replaced, however, with fiber, as is recommended in the Bakersfield Communication Master Plan. This will allow for communication with the traveler information system. No other links are existing. Through CMAQ federal funds, approximately 85% of the conduit (not the fiber) for the SONET network is programmed for installation. Caltrans District 6 should be the first link made. (Bakersfield is not listed as a location because it is an actual node on the network and, therefore, is not considered a link). Since the Smart Call Boxes (the second component of the Communication Network Development Program) will communicate with the system through Caltrans (by way of CHP), this link will be important in retrieving critical weather and traffic information, especially from the rural areas of Kern. This link should be obtained through leased services. If District 6 lays fiber down one of the major north-south freeways (I-5 or SR 99) in the future, the fiber should be considered for the connection to the SONET network. Kern County should be linked next, because of the number of traffic signals in the urban area. Multi-jurisdictional signal coordination will be facilitated by this link. The rural workstations and Kern COG should be linked next. (Rural traveler information workstations are described as a part of the Kern Informed Traveler Program later.) These links, each of which may be funded by different sources, will enhance the system by connecting the urban and rural portions of the region. The links will provide the urban-rural combination central to Kern's ITS vision. Incident management, traveler information, and traffic management will all be facilitated and enhanced by these links. Links will probably be achieved through leased services. Emergency services located at the County Communication Center should be linked through Control 5. Providing emergency response programs with real-time congestion and weather information will enable emergency response teams to better route vehicles for faster response times. The link can also be used for incident management coordination, for direct lines from the TMCs to the emergency sercvices which need to be dispatched. The City of Bakersfield Communication Master plan specifically allocates four of twenty-four fibers on the SONET network for Control 5. This leg of the network should be constructed as shown in the plan. The final links should be the Kern Regional Transit and GET connections. The transit agencies will benefit more from the traveler information system after the other links are in place, and the system is built and integrated. By providing each one of these systems a link to the network the two transit systems will also be connected. This, aside from providing traveler information, will enable coordination between the two transit systems for route scheduling and transfers.	X	X		**$6,500**		
1.4KE	***INTEGRATED SMART CORRIDORS***	Bakersfield urban area with Caltrans Kern County City of Bakersfield Caltrans District 6	This project would implement a package of ITS applications in a highway corridor consisting of at least one main route and one parallel route. The focus of the project would be to improve the level of coordination of traffic management activities on the main route and parallel route(s); in effect to conduct corridor-level rather than facility-specific ITS traffic management. The range of ITS applications that could be included in a smart corridor application include essentially the full range of freeway management, arterial street management (e.g., traffic signalization) and traveler information strategies, including surveillance and detection; incident management, including coordinated and dynamic traffic detouring strategies utilizing both the main and parallel route(s); changeable message signs; dynamic trailblazer signs; highway advisory radio; and integrated traffic signal operations, including coordination between ramp meters and adjacent traffic signals. The smart corridor project would feature implementation of a combination of ITS applications, with the emphasis being on linking operations across multiple facilities serving a defined travel corridor. Given the multi-facility nature of this project, the multi-jurisdictional coordination aspects of the project will be critical, including developing consensus on the specific objectives of the project and on the individual coordination procedures and technques. The first step in the development of this project would be to identify a candidate project corridor, based on accidents and congestion, travel patterns, availability of alternate routes and interest among the potential project partcipants.		X	X	**$1,917**		
1.5KE	***KERN COUNTY SMART STUDS DEMONSTRATION PROJECT***	Kern County City of Bakersfield Caltrans District 6	Smart Studs are an upgrade of the traditional reflective road studs used on most roads for delineating lanes. The Studs are solar powered and use a microprocessor for hazard sensing and processing. The Smart Studs can sense fog, blowing dust, surface water, ice, or any number of obstacles. The Studs can be used to provide weather warnings, lane guidance, and proximity warnings through colored, flashing lights within the reflectors. They can be mounted on the pavement (lane delineation) or on hazard posts (on shoulders). The objective of the Smart Studs is to reduce the number and severity of incidents due to poor weather and visibility on highways. In the San Joaquin Valley, the primary hazards are fog and blowing dust during the late fall and winter months. During wet years, fog will dominate during periods of non-frontal activity, decreasing visibilities over large areas for extended periods of time. Blowing dust occurs in all three regions. In the valley blowing dust usualy occurs during dry winter months when farm land is not under production.	X			**$ 2,500**		

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				N	M	L	Total		
							Phase 1	Phase 2	Phase 3
1.6KE	***ALTERNATE ROUTE SIGNING***	Bakersfield Urban Area Kern County City of Bakersfield	This project would include the installation of 70 static alternate route signs within the County for designated detour routes. This project would implement changeable message signs specifically sited, and primarily devoted, to detouring traffic onto alternate routes during incidents, including accidents and weather related road closures. These signs could differ from the large, permanent changeable message signs deployed by Caltrans at key decision points in several respects. First, they would be sited in conjunction with a specific alternate route/detour strategy developed for a particular route and alternate routes. Second, the signs could be smaller than the Caltrans signs. Third, the signs could include features, such as arrows or flashing beacons, that are not included on the traditional CMS. Finally, the alternate routes signs could be deployed as trailblazers along the alternate route, rather than merely in advance of the main route/alternate route decision point. The objective of this project would be to improve compliance with detours and reduce driver uncertainty along detour routes. If successful in reducing the volume of vehicles entering hazardous or congested roadway segments, this project holds the potential to reduce congestion, delay and accidents. In order to be successful, it would be critical that this project include development of an alternate route plan and procedures to support the usage of the signs, and that this plan be effectively linked to an overall multi-agency coordinated incident management strategy. This project would also require a commitment on behalf of the operating agency to devote the time and attention necessary to utilize the signs effectively. Even more so than a single CMS, keeping the dynamic message signs current and accurate would be critical		X	X	**$ 3,000**		
1.7KE	***ROADSIDE WEATHER INFORMATION STATIONS (RWIS) WITH CCTV***	Kern County City of Bakersfield Caltrans District 6	This project would extend coverage of weather stations for the entire Kern region. The objectives of the weather stations and CCTV cameras are to obtain and verify adverse weather conditions in the rural areas of Kern. In the San Joaquin Valley, the primary hazards are fog and blowing dust during the late fall and winter months. During wet years, fog will dominate during periods of non-frontal activity, decreasing visibilities over large areas for extended periods of time. Blowing dust occurs in all three regions. In the valley it usually occurs during dry winter months when farm land is not under production. Associated with blowing dust is the hazard of high winds, which can occur in all three regions, but is most prevalent in the desert and mountain areas. Rain, snow and ice are precipitation hazards which exist in the mountain region during the winter months, affecting the two main interstate routes, I-5 and SR 58. Existing weather stations which are not within sight of the monitoring agency, should be outfitted with CCTV cameras for verification of weather conditions.Weather stations which combine a variety of technologies, coupled with CCTV cameras for verification (especially in rural areas), can provide an accurate picture of weather conditions region-wide in real-time. Available technologies include visability sensors, precipitation intensity and type sensors, wind speed/direction sensors, and pressure transducer sensors. Visibility sensors use infrared technology to measure visibility constraints as the result of various sources such as preciptation, fog, haze, dust, and smoke. Precipitation intensity and type sensors use infrared technology to measure and classify precipitation. Humidity/Air Temperature sensors measure relative humidity and temperature. Wind Speed/Direction sensors monitor wind speed (mph) and direction (bearing). Pressure transducer sensors detect water levels in flood channels. Caltrans operates five weather stations in Kern: two on I-5 and three in Tehachapi on SR 58. These stations are linked via cellular phone service to the TMCs in Fresno and Bishop. Caltrans currently has no plans for additional weather stations in Kern. Kern County operates a system of twenty-five rain gauge stations located throughout the County. Some of these stations have additional capabilities for measuring wind, temperature and humidity. In addition, the County gathers data from remote weather stations owned and maintained by private corporations. These remote weather stations automatically transmit information to a dedicated weather data computer located at the County communication center. Daily weather data is also collected manually at each County fire station and called in to the County communication center, where it is placed in the weather computer database. The database of weather information is accessed by the national weather service and various water and other agencies. The national weather service disseminates this information, along with weather forecasts, to the CHP and Caltrans. This project assumes the installation of 5 RWIS in Kern County, in addition to the 30 RWIS being installed as part of the Valleywide ITS project.	X	X		**$ 375**		
2.0 Incident Management/Emergency Services									
2.1KE	***KERN COUNTY COORDINATED INCIDENT MANAGEMENT PROCEDURES***	KernCOG	Whether the incident management within Kern is done manually or automatically (with the assistance of a DSS) coordinated incident management procedures will be necessary. Since there will be several agencies involved in the incident management in Kern (County of Kern, City of Bakersfield, Caltrans, CHP, and rural cities), it will be most efficient and beneficial to all if strategies are coordinated among the agencies. All agencies will agree upon the strategies to be used. Strategies will include signal and ramp meter timing plans (when applicable), text for display on CMSs and Trailblazers, messages to be recorded on HARs, and other responses to incidents. Emergency response teams and, potentially, commuter services (similar to the Freeway Service Patrol in other areas) for different geographic areas of the region should be established as a part of this component. Policies will also be developed which outline the responsibilities and limits of each agency under differnet scenarios. If field devices are to be shared as a part of traffic and incident management, details of the control agreements (standard operating procedures) will be logged along with the cooperative agreements. These operating procedures outline details such as: which field elements may be controlled by which agencies, and under what circumstances. Standard operating proceures also define after-hours operations of entire systems by other agencies (e.g. Caltrans District 6 operating the County of Kern's system after hours to enable monitoring on a 24-hour basis). The objective of establishing coordinated incident management procedures is to ensure that incident management in Kern is coordinated among and agreed upon by all agencies. Caltrans District 6 TMC has incident management procedures established. Since these procedures cover various jurisdictions, including surrounding counties (Fresno, Kings, Tulare, and Madera) they should be used as a starting point for the establishment of region-wide, multi-jurisdictional agreements.			X	**$30**		
3.0 Transit Systems									
3.1KE	***DEMAND-RESPONSIVE TRANSIT SYSTEM INTEGRATION STUDY***	KernCOG Golden Empire Transit (GET)	This project would fund a study of demand-responsive transit system integration strategies, culminating in a specific set of recommendations to implement strategies within specified transit agencies. The primary objective of integrating multiple demand-responsive transit services is to improve operating efficiency by reducing service redundancies and sharing vehicles, staff and scheduling/dispatch technology among agencies. These improvements result in an overall better quality of service to riders, and riders may benefit directly through enhanced schedule and/or destination options enabled through the integration of services across agencies. Typically, especially in county-based or rural oriented demand respsonsive transit environments, a number of different agencies operate within a given geographic area, providing service to many of the same destinations but often serving a slightly different client base. One of the primary objectives of demand-responsive transit service integration strategies is to reduce these redundancies and associated inefficiencies. Demand-responsive service integration includes a wide range of potential specific activities, ranging from simple coordination to full integration. Examples of specific strategies include consolidation of scheduling and/or dispatch functions (where multiple agencies can share the cost of improvements and share access), agreements to share access to vehicles under specified circumstances, and consolidation of ride reservation systems.		X	X	**$750**		
3.2E	***COMMON FARE EQUIPMENT DEPLOYMENT***	Golden Empire Transit (GET)	This project would coordinate the fare payment systems of one or more transit systems, allowing riders to use the same fare media, such as a magnetic strip swipe card, interchangeably on any of the participating systems. The objective of this project would be to increase the convenience of fare payment for riders and promote transfers between systems. The introduction of electronic fare collection systems can also reduce fare-handling costs for transit operators. In addition to on-board fare collection equipment, this project would also include the computing and communications resources necessary to coordinate fare accounting among the participating agencies. This project could involve two or more agencies that do not have electronic fare payment systems (e.g., implement new equipment at all participating agencies), or expand upon a system already implemented by one or more agencies by equipping additional agencies.	X	X		**$2,000**		

Table 6.2: Summary of Regional ITS Projects

ID	Program Area/Project	Involved Agency	Brief Description	Project Initiation* N	Project Initiation* M	Project Initiation* L	Capital Cost Estimates 2001 (Thousands of $)** Total Phase 1	Total Phase 2	Total Phase 3
4.0 Traveler Information Systems									
5.0 Regional ITS Configuration Management/Coordination/Planning									
5.1KE	***KERN COUNTY REGIONAL COMMUNICATIO N LINKS***	Kern County City of Bakersfield	Communication links to other regions in California and surrounding areas, will enable coordination among agencies and will optimize information gathering and dissemination for incident and traffic management purposes. These links are all estimated for future deployment (ten to twenty years), but are listed here to emphasize the importance of establishing these links as soon as is feasible and cost-effective. Ultimately these links will become part of a statewide system. The objective of the statewide/regional communications links is to enable travelers to receive information from areas outside of the immediate region and to facilitate incident management and traffic control activities by sharing information among agencies. SR 58, which runs east-west through the Kern region, links with I-40 to the east of Kern. An Early Deployment Plan has recently been completed for this I-40 Corridor as it traverses northern Arizona. Traveler information systems will be implemented and enhanced for all segments of the route, including the segment through Kern County (SR 58) as a result of these EDPs. The high percentages of tourist and truck traffic on this route makes the integration of the various traveler information systems highly desirable to advise travelers of safety and road closure issues on this route.	X	X		**$50**		
			Total Estimated Capital Deployment Costs for All Potential ITS Projects Over 20 Years						**$19,122**
FRESNO COUNTY									
1.0 Traffic/Freeway Management Systems (ATMS)									
1.1F	***RAMP METERING AND COMMUNICATION S GAP CLOSURE***	Caltrans	There are three principle components to the ramp metering and communications gap closure project. First is the deployment of approximately 16 miles of fiber-optic communications along SR99, SR180, SR41, and to the Caltrans TMC. Another potential fiber-optics communications deployment has been identified for this project consisting of an additional 35 miles of fiber-optics along SR99, SR168, and SR180. Second is the deployment of approximately 18 ramp meter sites (4 initial and 14 future) as growth in travel demands dictate. Third is the installation and integration of the Caltrans Advanced Transportation Management System (ATMS) software into the District 6 TMC. The Statewide TMC Standardization Plan has identified District 6 as receiving this software in the Year 2013. This timeline could adversely impact the ability of District to integrate with other on-going ITS deployment efforts in the Region, and an interim integration effort has been identified. The project is divided into three phases. Phase 1 consists of16 miles of fiber communications, an interim software integration solution for the TMC, and deployment of 4 ramp meter sites (as determined by Caltrans D6). Phase 2 consists of 35 miles of fiber communications, an interim development/porting of ramp metering software, and deployment of 14 ramp meter sites. Phase 3 consists of the development/installation of the Caltrans ATMS software into District 6.	X	X	X	**$4,480**	**$10,920**	**$1,300**
1.2F	***MULTI-JURISDICTIONAL INTERCONNECTS***	Phase 1 • City of Fresno (supported by City of Clovis and the County of Fresno) Phase 2 • Caltrans • City of Clovis • County of Fresno	This project would provide fiber-optic communications interconnects between the City of Fresno, Clovis, and the County along Shaw, McKinley, Ashlan, and Peach Avenues (to the airport). Fiber-optics deployment was assumed to an approximate 12 miles in length. Deployment of communications and information devices along the Peach Avenue corridor to the airport has been noted as a priority focus area because of planned developments to airport access. Communications projects along this corridor should consider linkages directly to the airport for supporting traveler information devices such as airport status, etc. The project would include necessary hardware/software upgrades and installations to support the communications. These areas were identified as priority interconnection gaps by the ITS Subcommittee. In the last CMAQ funding cycle, the ITS Subcommittee was successful in obtaining some interconnect funds for communications gaps along local arterial streets. This should be viewed as an early success by the ITS Subcommittee. The funded interconnect projects are not included in this project. This project is divided into 2 phases. Phase 1 consists of 8 miles of local fiber communications, the deployment of centralized signal software at the City of Clovis and County of Fresno, the upgrade of outdated controllers, and network equipment & services for communications between signal systems & with remote cities. Phase 2 consists of 4 miles of local fiber communications, the deployment of 5 signal workstations to smaller cities, the upgrade of outdated controllers, and additional network equipment and expanded services.	X	X		**$2,190**	**$1,910**	
1.3F	***INTEGRATED SMART CORRIDORS (SR41/168/180)***	COFCG (representing the combined participating agencies)	This effort would establish an integrated corridor between SR41, SR168, SR180 and Blackstone and First Avenue using technologies such as Changeable Message Signs (CMS), Highway Advisory Radio (HAR), Closed-Circuit Television Cameras (CCTV), Vehicle Detection Systems (VDS), and enhanced signal timing. Overall, this project would represent an intensification of the ITS infrastructure deployments within the urban area of the Region. The project would allow for multi-jurisdictional sharing of information and control amongst these devices. An integrated workstation would be developed along with the necessary communications and supporting infrastructure. The project is divided into three phases. Phase 1 consists of 2.5 miles of fiber communications and 7 miles of smart corridor including appropriate (CMS, CCTV, HAR, and freeway/arterial integration) along SR168/180/41. Phase 2 consists of 5.5 miles of fiber communications and 9.5 miles of smart corridor along SR168/180/41. Phase 3 consists of 3 miles of smart corridor along SR41.		X	X	**$3,630**	**$5,270**	**$1,370**
1.4F	***RAILROAD/HIGH WAY INTERFACE TECHNOLOGY FOR RAILROAD CROSSINGS***	City of Fresno (potentially other cities as well)	This project would provide enhanced detection and location information on trains within urban areas of the Region, along with improved notification to motorists of an approaching train. Fourteen preliminary major crossings have been discussed, but not specifically identified. The focus of the project is to enhance traveler information and safety. It was conservatively assumed that leased communications would be necessary to the 14 sites, and that each site would include sensing and a CMS or similar device. Many options are currently being tested in this area in both the software and infrastructure areas. It is not yet clear which types of devices will prove to be the most successful, but some definitive answers should be available by the time deployment commences.	X	X		**$980**		
1.5F	***COMMUNICATION S INTERTIES***	Cities of Fresno and Clovis, County of Fresno, Caltrans	Whereas project 1.1 (Ramp Metering and Communications Gap Closure) would provide a significant communications backbone between Caltrans and freeway ITS elements, this project would establish/complete backbone wireline communications between the largest transportation players in the Region (City of Fresno, City of Clovis, County of Fresno, and Caltrans). Communications would likely utilize fiber optics, however other opportunities should be reviewed for the various needs. This project should consider the establishment of regional standards for fiber communications deployment, including consideration of modes, capacity needs, communications protocols, and perhaps equipment types. It is likely that the best communications solution from the regional perspective will include a combination of agency owned communications in the urban areas and a leased solution for outlying or rural areas. The focus of the interties will be on linking Transportation Management Centers (TMC). Development of the project should consider the Implementation Plan developed by the City of Fresno. The development of common communications standards and protocols will be critical, as will the development of common data definitions. The potential for linkages with CHP and other emergency service providers should also be considered, as should linkages with information service providers. This project is divided into 2 phases. Phase 1 consists of 12 miles of local fiber communications plus supporting communications equipment, leased communications equipment and services for 6 agencies, the development of the Regional Integrated Workstation (RIW) software, and the necessary device driver upgrades and computer equipment. Phase 2 consists of leased communications equipment and services for 6 additional agencies and additional RIW equipment for 6 agencies.	X			**$3,380**	**$160**	

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ID	Program Area/Project	Involved Agency	Brief Description	Project Initiation*			Capital Cost Estimates 2001 (Thousands of $)**		
				N	M	L	Total		
							Phase 1	Phase 2	Phase 3
1.6F	***INTEGRATED SURVEILLANCE STATIONS/CALLBOX DEPLOYMENT***	Caltrans/COFCG	This project includes the possible deployment of callboxes with the added advantage of remote sensing capabilities that callboxes have been proven capable of providing. Even if callboxes are not deployed, remote sensing stations with some form of wireless communications are clearly needed in many areas. This project is divided into 3 phases. Phase 1 consists of the study for location of remote sensors, Smart Callboxes, and callboxes, an answering center start-up & support, callbox program support, the deployment of 298 normal and 34 Smart callboxes/remote sensing stations along I-5 and SR99, as well as in some regional parks/trails, and the procurement of supporting software. Phase 2 consists of continued answering center support, a callbox support program, and the deployment of 500 normal and 56 Smart callboxes/remote sensing stations along Phase 2 facilities. Phase 3 consists of continued answering center support, a callbox support program, and the deployment of 126 normal and 15 Smart callboxes/remote sensing stations along Phase 3 facilities.	X	X	X	**$4,580**	**$6,550**	**$1,690**
1.7F	***REGIONAL INTERSECTION SAFETY AND ENHANCEMENT PROGRAM***	COFCG & County of Fresno (with support from cities as appropriate).	The general concept behind this project is to develop a series of low-cost systems that may be applied to urban and rural signalized intersections to enhance motorist and pedestrian safety. The near-term focus of this effort is likely to be on red-light photo enforcement due to the significant problem and accident hazard this represents in the Region. Problem locations will be identified and the appropriate equipment installed. Contractual relationships may need to be established with third parties to deal with red-light photo enforcement issues. In addition, pedestrian safety applications will be included in this effort. This effort will define regional standards for each of the independent intersection safety tools. Based on recent deployments of similar systems throughout the State it should be possible to display proven benefits. Eventual regional deployment was assumed to consist of 35 red-light photo enforcement locations (equipment can be moved) and 20 pedestrian safety deployments including high-visibility crossings and video detection. Problem intersections should be identified through recent accident records and based on the local knowledge of traffic engineers. Deployment costs for red light deployment was assumed to be $50,000 per intersection based on efforts in other Regions. Unit costs for pedestrian safety deployments were assumed to average to approximately $30,000 per location. The project will consist of a single phase to be deployed over five years. Deployment efforts should be prioritized based on the extent of the problem at individual intersections. No independent software development should be required for this effort.	X	X		**$3,050**		
1.8F	***ALTERNATE ROUTE SIGNING***	Fresno County Urban Traffic Corridors in: • Fresno County • City of Fresno • City of Clovis	This project would include the installation of 70 static alternate route signs within the County for designated detour routes. This project would implement changeable message signs specifically sited, and primarily devoted, to detouring traffic onto alternate routes during incidents, including accidents and weather related road closures. These signs could differ from the large, permanent changeable message signs deployed by Caltrans at key decision points in several respects. First, they would be sited in conjunction with a specific alternate route/detour strategy developed for a particular route and alternate routes. Second, the signs could be smaller than the Caltrans signs. Third, the signs could include features, such as arrows or flashing beacons that are not included on the traditional CMS. Finally, the alternate routes signs could be deployed as trailblazers along the alternate route, rather than merely in advance of the main route/alternate route decision point. The objective of this project would be to improve compliance with detours and reduce driver uncertainty along detour routes. If successful in reducing the volume of vehicles entering hazardous or congested roadway segments, this project holds the potential to reduce congestion, delay and accidents. In order to be successful, it would be critical that this project include development of an alternate route plan and procedures to support the usage of the signs, and that this plan be effectively linked to an overall multi-agency coordinated incident management strategy. This project would also require a commitment on behalf of the operating agency to devote the time and attention necessary to utilize the signs effectively. Even more so than a single CMS, keeping the dynamic message signs current and accurate would be critical		X	X	**$3,000**		
1.9F	***EVP DEPLOYMENTS***	Fresno FUA • City of Fresno • City of Clovis • Fresno County	The project would implement Emergency Vehicle Preemption (EVP) along key arterials throughout the County for use by City and County fire departments. The implementation EVP at a traffic signal modifies normal signal operation to provide a nearly immediate green signal for an approaching emergency vehicle. This type of system is most often deployed on fire trucks because of the nature of the fire truck vehicle performance. The acceleration rate of fire trucks is rather slow due to their relatively low power-to-weight ratio. If fire trucks must slow down (and sometimes stop) when they encounter signalized intersections along their emergency run, the overall delay in responding to their emergency destination can easily exceed 1 to 2 minutes. For fire events, this delay can mean a significant difference in the level of destruction, the level of effort in suppressing the fire, the level of personal danger for firefighters at the scene, and the number and extent of injuries for victims. Depending on the level of congestion and the distance traveled, fire trucks can encounter many traffic signals, and heavy congestion. Driving in oncoming traffic lanes is a "last resort" maneuver, which fire departments rightly avoid. If the fire truck encounters a red signal, it can assert the right of way and go through, but only after gaining assurance that it can safely cross through the intersection. EVP isn't needed in every community. Only when traffic congestion is very significant, or only when long emergency vehicle runs are likely to encounter a large number of signalized intersections, would the provision of EVP be cost effective. Some cities in the Central Valley already have EVP in place, the 3M Opticom™ system being predominant. Priority request equipment would be installed in each fire truck and matching reception equipment would be installed at each signalized intersection where EVP is to be granted. Some larger agencies that have used EVP for many years have broadened the application to also equip ambulance vehicles and, in some cases, police vehicles with this on-board preemption request equipment. While these vehicles have much better acceleration characteristics, and the added delay at signals while on their emergency runs is much lower, granting EVP to these vehicles may provide another benefit. The crossing of very wide and very busy signalized intersections is very difficult in today's traffic. Each year, many such emergency vehicles are "totaled" after being T-boned when crossing a busy intersection. EVP helps reduce and prevent this occurrence. However, this project assumes only fire department vehicles would be equipped with EVP devices.	X			**$2,000**		

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ID	Program Area/Project	Involved Agency	Brief Description	Project Initiation*			Capital Cost Estimates 2001 (Thousands of $)**		
				N	M	L	Total		
							Phase 1	Phase 2	Phase 3
1.10F	***URBAN AREA TRAFFIC SIGNAL COORDINATION PROJECT***	Fresno County-Remaining uncoordinated arterials in Fresno/Clovis metropolitan area	This project would implement local traffic signal coordination plans at specific urbanized locations along regionally significant arterials in the County not currently developed. The objective of this project would primarily be to reduce delays at traffic signals by improving coordination between adjacent signals, with improved safety a possible secondary benefit depending on the specific improvements made. The specific improvements to be made would vary by location, which could include intra- and inter-jurisdictional efforts. The types of improvements that are possible include upgrading traffic signal controllers and detection, adding or upgrading signal interconnects, and communications systems enabling centralized (i.e., remote) timing plan updating and maintenance and malfunction monitoring. Although providing emergency vehicle preemption, transit vehicle priority or automated enforcement would not be the focus or justification for these improvements, the equipment installed as part of this project may support these features. This project would be led by local agency traffic operations staff. The provision of traffic signal coordination for small communities is most often initiated with use of either time-based coordination (TBC) or a closed-loop system (CLS). Depending on the type of controller equipment now in place, and depending on the level of staffing support that the City (or County) is able to make in the maintenance of signal coordination plans, the initial cost and recurring effort to achieve signal coordination in Hanford would vary from a very low cost, to a moderate cost. A number of communication alternatives are possible to tie the intersection controllers to a supervisory computer at City Hall (in the CLS alternative). With a CLS, the capability is created to remotely monitor intersection operation and the capability to remotely change both basic and coordination timing. A first step in the signal coordination capability would be the design and implementation of TBC timing plans. A feasibility study on possible and appropriate upgrade plans for creation and installation of a traffic signal system could be completed at the same time. Any small community that has more than 10 traffic signals would probably benefit from having signal coordination implemented along its heaviest-traveled street(s) so that vehicles can progress through a series of signalized intersections without stopping. The initial effort to achieve this basic level of coordination is relatively low, especially if it is contracted out. The resulting basic timing plans (perhaps just 2 or 3 plans which run between 7AM and 6 PM) can be left in place with very little subsequent retiming effort required or needed. Traffic signal coordination typically has one of the very highest benefit-to-cost ratios of any public works activity.		X	X	**$4,000**		
2.0 Incident Management/Emergency Services									
2.1F	***WEATHER SENSING/ATMS INTEGRATION***	Caltrans with support from CHP, COFCG and other regional agencies.	This project includes two primary components to this project. First is the deployment of additional weather sensors to fill-in gaps in the existing weather-sensing infrastructure. Second is the replacement/upgrade of some existing weather sensing stations. Integration of weather sensing data into the Region's ATMS efforts including the Caltrans ATMS and the Regional Integrated Workstations identified in the Ramp Meter Gap Closure project and the Communications Intertie project respectively. The project is divided into threee phases. Phase 1 consists of a study for detailed location of remote weather stations and low-visibility sensors, the deployment of 5 full weather stations and 42 visibility sensors along 100 miles of freeway/highway facilities, weather systems software upgrade for Caltrans and integration with RIW, and communications support. Phase 2 consists of the deployment of 5 full weather stations and 71 visibility sensors along 170 miles of freeway/highway facilities and communications support. Phase 3 consists of the deployment of 2 full weather stations and 18 visibility sensors along 42 miles of facilities, the integration of weather information/functions into the Caltrans ATMS software, and communications support.	X	X	X	**$1,500**	**$1,790**	**$650**
2.2F	***VARIABLE SPEED SYSTEM/SMART OR INTELLIGENT ROADWAY STUDS***	Caltrans with support from CHP, COFCG and other regional agencies	This project consists of two separate components that both serve the same purpose of enhancing motorist safety by increasing their awareness of roadway conditions. Variable Speed Notification System - A fog/dust detection system with variable messaging and variable speed limit advisories should be deployed along stretches of regional freeways and highways that experience low visibility or poor weather conditions. Variable Speed Signs (VSS) would be placed together with visibility sensors identified in project 1.1 at key locations. The signs would display an advisory speed based on the visibility conditions detected by the nearby sensor. The speed is advisory and would not be enforced as a "legal" speed limit. The ability of drivers to recognize their speed becomes obscured in low visibility situations, and the purpose of the sign is to "remind" people to watch their speed. A similar system is in use near Chattanooga, Tennessee, and another system is planned for deployment in Duluth, Minnesota. They have not experienced any serious fog related accidents since it was installed. For purposes of this project definition, VSS deployments were assumed to occur on one side of a facility every three miles for those facilities. It should be noted that the variable speed signs in Tennessee and Washington is actually enforceable. The variable message signs are legal restrictive signs by state law. Obviously, during inclement weather, very little if any enforcement is done, but the key is if a driver has an accident, the speed calculations can be critical in assessing fault. Smart or Intelligent Road Studs (IRS) – In addition to recognizing speeds in low visibility, drivers' ability to recognize their roadway location is diminished significantly. Caltrans is currently testing the application of (IRS) technologies. Current options for vendors are somewhat limited. IRS roadway markers contain a microprocessor enabling them to detect low-visibility conditions. When poor conditions are detected the IRS markers illuminate with an LED light approximately four times more intense than the light reflected from standard passive markers. The IRS markers may also be utilized to pass on the location of poor visibility conditions to a management center when appropriate communications are provided. Power to the markers has been provided by either solar or through inductive loops. IRS systems are also be tested in Europe and have been deployed in Virginia since the 1980's. For purposes of this project definition IRS deployments were assumed to occur in ¼ mile increments along approximately 5% of the facilities. Together these two technologies offer some tested and viable solutions to the transportation problems caused by low-visibility conditions. Fresno County typically experiences some of the most dense ground (i.e. Tule Fog) in the nation between November and March.		X	X	**$680**	**$920**	**$280**
2.3F	***REMOTE SURVEILLANCE AND INCIDENT SCENE MANAGEMENT***	Caltrans, CHP, and fire emergency services (Hazardous Materials response personnel).	This new experimental program involves a video system capable of sending images via cellular or microwave technology to a TMC or dispatch center. The images are then put on the internet and key experts who could provide technical advise to the responders at the scene can access the pictures with a password. This process would allow the expert to talk to the scene by telephone, look at the problems on the internet, and help devise solutions for safe and timely resolution. This technology has been purchased for the Washington State DOT and is being installed on their incident response trucks. There is also a handheld unit for getting close up images of truck equipment and other details. Trauma center doctors, hazardous materials specialists, recovery companies, and investigative specialists are some of the resource personnel that will be able to look at problems and give advice. This type of system has significant application for rural interstates. Problems that require special knowledge can now close roads for several hours while the experts respond to the scene. The two-way communication link with video going to the experts can potentially save hours of delay for motorists. The project would include the procurement of three remote incident surveillance equipment sets, the suggested deployment with regional hazardous materials groups, and the associated software and communications.	X	X		**$280**		
2.4F	***COMPUTER AIDED DISPATCH INTEGRATION***	CHP, emergency services, Caltrans	Given the status of the CHP CAD the Region has two basic deployment options in terms of this project. First would be to integrate certain CAD functions into the Regional Integrated Workstation (RIW) project, Communications Interties. This may provide the necessary exchange of incident information between emergency services, but is likely to offer somewhat limited capabilities when compared with a true CAD integration effort. Second is to deploy a separate series of CAD integration workstations similar to InterCAD. This would provide simple CAD functions to an agency that either does not have a CAD or does not wish to directly integrate with its existing CAD system. This would also offer the opportunity to integrate a CAD system if desired. In either event, if the FIRST project prototype is approved for use by CHP then the possibility of exists for using FIRST in the Fresno area to access CHP CAD information and place it in either the RIW or a separate system.	X	X		**$1,200**		

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							Phase 1	Phase 2	Phase 3
2.5F	***INTEGRATION OF COMMUNICATIONS CHANNELS***	CHP, Police Depts., Fire Depts., Sheriff, Others.	There are currently common channels for State agencies to talk to each other. There are channels for County agencies and for city agencies to talk to others within their own government, but they can't always communicate with outside government agencies. Technology exists to allow cross communication for major incidents and consideration should be given to establishing a link to be used in case of large multi-agency incidents. This project could follow two basic deployment paths. Enhancement of communications at dispatch centers to provide or enhance "link" positions- These positions include those individuals within a dispatch center responsible for interagency communications. This path may also include various communications patching equipment. The disadvantage of this approach is that all communication between different agencies must be "patched" through a dispatcher, which slows or complicates communications efforts. Provision of a simple on-site communications system for on-site communications – Perhaps the simpler of the two paths, this effort would provide hand-held communications devices to common incident commanders and responders within the Region. Caltrans has utilized cellular two-way radio equipment in some regions for this type of communications. The disadvantage of this approach is that some personnel may have to use more than one radio/communications device. Advanced satellite and other cellular options are available with excellent coverage capabilities and advanced features.	X	X		**$740**		
2.6 F	***INCIDENT MANAGEMENT/ RESPONSE COORDINATION TASK FORCE***	CHP, Caltrans, COFCG with heavy involvement from all other emergency service agencies.	This project would develop, for a specific focused area within the County, an interjurisdictional and cross-agency teaming arrangement that would be mobilized to respond to any major traffic related incident in the team's coverage area. Once a specific geographic area has been selected for this project (due in large part to the presence of a project champion), an ad-hoc working group would be established to bring this Incident Management Team into existence. In order to be self-sustaining, such a Team would need to be activated, on average, at least 4 times per year. Therefore, the coverage area should be large enough so that this would be achieved. The Team would need to have authority to activate itself. That is, within each organization where a Team member is employed, that Team member should have the capability to cease his/her routine and respond to a Team-declared incident when needed. The Team should be equipped with adequate and sufficient person-to-person communication devices (most likely cellular telephones with 3-way and/or conference calling capability) to contact other Team members as needed. Finally, a rigorous and extensive agency and staff networking outreach capability should be developed for use in this Team. The Team itself may or may not have independently owned and controlled traffic control devices for use in deployments responding to incidents. Each agency's own devices should be accessible if the Incident Management Team is created effectively. This Team creation would be a initiated as pilot project for duplication throughout all other areas of the Valley. The use of a contracted facilitator should be employed on this pilot project, with plenty of documentation, lessons learned, and formats to be followed for institutional acceptance of the IMT Team concept. Other areas within the Valley would then be able to model their own Team on the findings and documentation provided in this project. The project would include the development of a Regional Incident Management Plan for large scale interagency incidents, the funding of appropriate site visits to regions with desirable IC-EMS deployments, inter-agency training support (the importance of this element should not be underestimated), and the IC-EMS program management by agency/other staff.	X			**$130**		
3.0 Transit Systems									
3.1F	***COORDINATED TRANSIT DISTRICT OPERATIONS***	COFCG (supported by FAX, FCRTA, Clovis Transit)	This project would improve transit agency coordination throughout the Region to provide more seamless service to patrons and maximize economies of scale. The project would include the development of a Coordinated Transit Operations and ITS Deployment Plan, and agency administrative and coordination support.		X		**$80**		
3.2F	***TRANSIT OPERATIONS/DISPATCH CENTERS INTEGRATION***	FAX, FCRTA, Clovis Transit, COFCG	This project would fund a study of demand-responsive transit system integration strategies, culminating in a specific set of recommendations to implement strategies within specified transit agencies. The primary objective of integrating multiple demand-responsive transit services is to improve operating efficiency by reducing service redundancies and sharing vehicles, staff and scheduling/dispatch technology among agencies. These improvements result in an overall better quality of service to riders, and riders may benefit directly through enhanced schedule and/or destination options enabled through the integration of services across agencies. Typically, especially in county-based or rural oriented demand respsonsive transit environments, a number of different agencies operate within a given geographic area, providing service to many of the same destinations but often serving a slightly different client base. One of the primary objectives of demand-responsive transit service integration strategies is to reduce these redundancies and associated inefficiencies. Demand-responsive service integration includes a wide range of potential specific activities, ranging from simple coordination to full integration. Examples of specific strategies include consolidation of scheduling and/or dispatch functions (where multiple agencies can share the cost of improvements and share access), agreements to share access to vehicles under specified circumstances, and consolidation of ride reservation systems. In conjunction with the coordinated transit district operations, this project would integrate the various transit dispatching operations. Some dispatch centers may be co-located, while others may be remotely integrated. Integration would allow for improved coordination and improved efficiencies along routes where transit patrons must transfer from one system to another. At the current time, it seems likely that FAX and FCRTA dispatch operations could be co-located, while Clovis Transit dispatch services would operate from another location. The dispatch centers could be coordinated through deployment of enhanced dispatch capabilities centering on upgrades and expansion of the existing systems. Coordinated dispatch operations could work in coordination with the Transit Management System Completion/Expansion project to provide highly effective coordination between the various transit agencies in the Region. While a combined dispatch center could provide some economies of scale and may increase coordination of transit services in the Region, it became clear that significant institutional issues are involved with the combined dispatch concept. For this reason, the focus of this Plan, and more specifically, this project is on enhancing communications and coordination between transit services without requiring a combined dispatch operation. This concept of coordinated dispatch operations has been applied to transit operations in the Denver and Detroit regions, as well as at other locations throughout the nation.	X	X		**$1,630**		
3.3F	***TRANSIT INFORMATION SYSTEM (REGIONAL)***	FAX, Clovis Transit, COFCG	FAX has clearly come a long way in the deployment of its Transit Management System (TrMS), which includes AVL on 20+ of its vehicles and the necessary MIS components. As indicated in project 3.4, the deployment of a regional TrMS is planned. The transit agencies would like to make the improved information, currently only available to its staff, also available to its customers. Of course, this information would have to be in a simple format easily digested by the transit patrons and readily available to them. The near-term focus of the project would include deployment of real-time information displays at transit centers. This project should include an evaluation of various information dissemination alternatives, as well as careful review of Seattle's SmartTrek efforts towards improving real-time transit information at stops and centers. This project definition assumes the deployment of real-time transit information displays at ten locations throughout the Region. These displays would most likely be located in transit centers and at transfer locations. Some additional software development would be required to provide appropriately formatted data and communicate the transit status information in a format easily digested by the public. It was assumed that leased communications would be required to each of the ten transit information sites.	X	X		**$850**		

Table 6.2: Summary of Regional ITS Projects

ID	Program Area/Project	Involved Agency	Brief Description	Project Initiation*			Capital Cost Estimates 2001 (Thousands of $)**		
				N	M	L	Total		
							Phase 1	Phase 2	Phase 3
3.4F	***TRANSIT MANAGEMENT SYSTEM COMPLETION/ EXPANSION***	FAX, FCRTA, Clovis Transit, COFCG	This project would look at the most effective options for continuing FAX's TrMS deployment efforts by deploying AVL on uninstrumented rural and urban transit vehicles. Additional TrMS functions should be deployed with a view towards eventual regionwide deployment. Options for deploying compatible components across all vehicles should be sought. FAX's system is J1708 compliant, and this is an important standards consideration. The example provided was that fare equipment in a large bus might not be appropriate to a small rural service vehicle. Different devices may be used, but they should operate across a common software/system with completely compatible standards. The project would be divided into 2 phases. Phase 1 would consist of performing a focused transit communications study to determine the specific communications needs of TrMS expansion, deploying 50 transit vehicles (apx. 1/2 of FCRTA - including fixed route & paratransit) with standard AVL/GPS equipment, deploying 15 vehicles with enhanced equipment (passenger counting, etc.), developing /procuring software upgrades for TrMS to support regional needs and paratransit services, installing radio/communications system upgrades for FCRTA, and procuring additional workstations. Phase 2 would consist of deploying 30 standard vehicles (FCRTA/Clovis Transit), a radio system upgrades for Clovis Transit., and a procurement of additional workstations.	X	X	X	**$1,590**	**$680**	
3.5F	***COMMON FARE EQUIPMENT DEPLOYMENT***	FAX, FCRTA, Clovis Transit	This project would establish a regional fare standard and deploy appropriate fare equipment and software. The potential for flexible fare media and smart cards should be reviewed. As with the expansion of the TrMS, the specific equipment needs of agencies may vary, but a common standard is important to inter-compatibility and economies of scale. The project would be divided into 2 phases. Phase 1 would include performing a needs definition and installation plan, the deployment of new fare system on 146 vehicles (FAX/FCRTA), and the procurement of fare management software, workstations, and interface equipment. Phase 2 would include the deployment of new fare system on 25 vehicles (Clovis Transit), and the procurement of fare management software, workstations, and interface equipment.	X	X		**$1,500**	**$320**	
4.0 Transportation User Information Systems									
4.1 F	***REGIONAL TRANSPORTATIO N USER INFORMATION SYSTEM***	COFCG and Caltrans	This project focuses on TUIS needs within the Fresno County Region, consisting of four primary TUIS components .The first is freeway/highway CMS deployments. This includes additional deployments of freeway and highway CMS for specific traveler information purposes rather than traffic management. These signs would be deployed on key routes throughout the Region and controlled by Caltrans or through the RIW. A specific application of special traveler information CMS devices noted by stakeholders was potential deployments of airport information signs along the Peach Avenue and other airport approach corridors. Deployment at these locations should be considered a priority for this project. The second is the Internet application of the Regional Integrated Workstation (RIW). This would take filtered information from the RIW network and make it available to the public over the internet. Third is the Highway Advisory Radio upgrade. This would upgrade Caltrans and regional HAR systems to provide digital/remotely-updated equipment. Fourth is the additional deployment of RIWs, which would deploy addition RIW at radio and television stations broadcasting traffic information to the public. The project would deploy 12 freeway/highway CMS signs for TUIS purposes, develop Internet integration component for RIW data, upgrade/procure 10 HARs, and deploy 5 additional RIWs to regional TV and radio broadcast services.		X		**$3,920**		
4.2 F	***COORDINATION WITH VALLEYWIDE/STA TEWIDE INFORMATION SYSTEMS***	COFCG and Caltrans	This project was added to assist the Fresno County Region in maintaining consistency with Statewide and valleywide TUIS efforts. It is anticipated that the State will be providing support and funding for several TUIS deployment efforts, and that funds may be distributed to each Caltrans District. The Region should be prepared to capitalize on this potential by conducting Planning/Configuration Management Efforts and Performing Appropriate Software Modifications to the RIW. Planning/Configuration Management Efforts would integrate with Statewide and valleywide efforts will take planning and coordination with agencies outside of the Region. This element of this project accounts for travel, planning, and meeting costs associated for the Region to participate in these efforts. Performing Appropriate Software Modifications to the RIW would make modifications to the RIW to allow integration based on valleywide and Statewide TUIS standards.		X		**$260**		
5.0 Regional ITS Configuration Management/Coordination/Planning									
5.1 F	***VALLEYWIDE/STA TEWIDE COMMUNICATION S LINKAGES***	Caltrans and COFCG	This project would coordinate and provide for communications linkages between the Fresno County Region, neighboring regions, as well as the State. Theproject would include staff time to coordinate with Statewide communications efforts, and additional communications equipment for connecting the RIW network to the Statewide network.		X		**$10**		
5.2F	***REGIONAL CONFIGURATION MANAGEMENT***	Caltrans and COFCG	This project provides for Regional Configuration Management of ITS projects being deployed in the Fresno County Region. The majority of this project represents either an agency staff or contracted effort. The person(s) responsible for the configuration management activities should be performed by someone familiar with systems and standards development. The goal of the effort should be to generate clear and concise materials that assist agencies in maintaining conformity with the regional standards and guidelines suggested by the various Workgroups. The importance of configuration management to regional deployment efforts cannot be understated. It is not enough that the regional architecture has been developed and included in this Plan. The system architecture occurs at many levels, of which the national and regional architectures represent only one. Actual deployment of systems at a level that allows proper integration and data exchange requires the use of common specific standards, protocols, and translators between standards and protocols. All of these issues cannot be addressed prior to the detailed design phase of a project. Configuration management represents the combined efforts of agencies working together at a technical and institutional level to occur upon the use of certain standards and protocols available through the national, statewide, and regional architectures.	X	X		**$30**		
5.3 F	***COMMON/STANDA RD REGIONAL/COUNT Y MAP***	County GIS Group, COFCG	This project would review options for development of a regional standard map for AVL applications. Potential sources to be reviewed include the Fresno County GIS files, American Ambulance GIS files, etc. At a minimum the potential for a common mapping standard should be reviewed, and funds potentially sought for update, creation, and/or correction of a regional AVL map. This project would provide for County staff or contracted staff time, as well as needed surveys to improve the regional GIS map for ITS purposes. The focus of this effort should be enhancing the accuracy of rural areas for AVL/GPS purposes, as well as working with emergency services to establish a common inter-agency grid system for emergency services. Fresno County has a GIS department and a GIS working group, which can serve as a core resource for Region in its mapping efforts. The development of more accurate maps should strike a careful balance between level of detail required and the costs involved in developing the maps. Emergency service personnel should be involved in map development efforts to ensure that their needs for a common grid/coordinate system are met. The project would perform appropriate surveys necessary to enhance the regional GIS map as directed by County of Fresno GIS staff, and provide for 1.5 full time employee equivalents for two years to perform necessary support tasks.	X			**$360**		
			Total Estimated Capital Deployment Costs for All Potential ITS Projects Over 20 Years						**$79,860**

Table 6.2: Summary of Regional ITS Projects

ID	Program Area/Project	Involved Agency	Brief Description	Project Initiation* N	Project Initiation* M	Project Initiation* L	Capital Cost Estimates 2001 (Thousands of $)** Total Phase 1	Total Phase 2	Total Phase 3
MADERA COUNTY									
1.0 Traffic/Freeway Management Systems (ATMS)									
1.1MA	***CURVE WARNING SYSTEM ON COUNTY ROADS***	MCTC	The purpose of this project is to deploy a more visible, "smart" warning system on county roads at locations identified potential rollover spots. The curve warning system, referred to by Caltrans as Truck Activated Rollover Warning System (TARWS), is primarily intended to increase the level of safety on this section of roadway, resulting in fewer rollovers and associated injuries. Several truck rollover accidents have occurred throughout the San Joaquin Valley, including Kings County. These accidents have been attributed to excessive speed and sharp curves that exist. While there is posted speed limits, many trucks do not slow down enough to safely negotiate curves. The curve warning system will consist of a static warning sign located well in advance of the curve which reads "CURVE AHEAD". A speed detection system will be installed to determine vehicle speed. If a vehicle's speed indicates that safe curve negotiation is not likely, an LED display, attached to the static sign and reading "REDUCE SPEED" would be illuminated. Curve warning systems are available from a variety of manufacturers. Specifications, technologies and products will be detailed in the Technology Assessment and developed throughout the preliminary engineering process.	X			**$100**		
1.2MA	***TOS EXPANSION INTO COUNTY***	Caltrans District 6	Caltrans considers most field elements that aid in traffic surveillance and management activities to be part of the TOS. The most common field elements deployed as a comprehensive TOS in urbanized areas include, but are not limited to: traffic detection (inductive loops, video, acoustic), closed circuit television (CCTV) cameras, changeable message signs (CMS), highway advisory radio (HAR), communications systems and centralized command and control systems/centers with expert systems to aid in incident detection and response as well as automated ramp metering operations. Additional elements that are typically added to rural settings include, but are not limited to: road weather information systems (RWIS) and other systems that aid in improved emergency response times and dissemination of travel advisory information.		X		**$2,000**		
1.3MA	***DYNAMIC WARNING SYSTEM***	MCTC	In response to a history of commercial vehicle accidents, Caltrans District 2 has implemented an interactive signing project at five locations on Interstate 5 in Shasta County. During the five years prior to installation of the five signing systems (May 1994 to April 1999), the five locations experienced a total of 32 truck crashes. During the 18-month period immediately following the installations (April 1999 to October 2000), only one truck crash was reported. A longer evaluation period would likely yield a more sound statistical finding, however, the project appears to have improved safety concerns at the project locations during the initial evaluation period. The system consists of interactive changeable message signs equipped with radar and closed circuit TV (CCTV) cameras at each location. When the radar units detect vehicles exceeding the curve advisory speed, the changeable message sign automatically activates a warning message displaying the speed of the vehicle followed by the recommended speed for the curve. The curve warning system described above could be adapted into weather related speed advisory system by the addition of a road weather information station/system (RWIS). The weather parameters from the RWIS (temperature, visibility, pavement condition, etc.) would be incorporated into the dynamic signing system as an additional input. The system would then display to the driver an appropriate advisory message, such as a suggested safe speed, for the prevailing weather and traffic conditions. The system could be implemented anywhere in the San Joaquin Valley there is a concern about weather related speed safety issues. Ideally, the system would have some type of remote access capabilities so that agency operators could remotely check system diagnostics and operations. Caltrans District 10 has identified 93 locations in the district TOC study.	X			**$500**		
2.0 Incident Management/Emergency Services									
3.0 Transit Systems									
3.1MA	***DEMAND-RESPONSIVE TRANSIT SYSTEM INTEGRATION STUDY***	MCTC	This project would fund a study of demand-responsive transit system integration strategies, culminating in a specific set of recommendations to implement strategies within specified transit agencies. The primary objective of integrating multiple demand-responsive transit services is to improve operating efficiency by reducing service redundancies and sharing vehicles, staff and scheduling/dispatch technology among agencies. These improvements result in an overall better quality of service to riders, and riders may benefit directly through enhanced schedule and/or destination options enabled through the integration of services across agencies. Typically, especially in county-based or rural oriented demand respsonsive transit environments, a number of different agencies operate within a given geographic area, providing service to many of the same destinations but often serving a slightly different client base. One of the primary objectives of demand-responsive transit service integration strategies is to reduce these redundancies and associated inefficiencies. Demand-responsive service integration includes a wide range of potential specific activities, ranging from simple coordination to full integration. Examples of specific strategies include consolidation of scheduling and/or dispatch functions (where multiple agencies can share the cost of improvements and share access), agreements to share access to vehicles under specified circumstances, and consolidation of ride reservation systems.		X		**$400**		
3.2MA	***TRANSIT INFORMATION SYSTEM (WEBSITE)***	MCTC	This project would implement a system for collecting, processing and disseminating transit information, including "static" information such as routes and schedules, and in the cases of those operators with vehicle tracking systems, real-time information such as estimated vehicle arrival times at specific locations. The objective of the project would be to improve the availability and accessibility of transit information, thereby making transit more convenient and increasing transit utilization. Uncertainty about transit schedules, stops, fares and the timing of arrivals at specific stops are often cited by transit non-users as impediments. This project would establish a centralized transit information database, residing in a computer that would probably be housed at one of the San Joaquin Valley transit operations, or perhaps at a location, such as a Caltrans traffic management facility, where other traveler information is compiled. The project would include procedures and supporting communications infrastructure that would allow participating transit operators to submit information to the system. For static information, the communications system could be very minimal, such as via e-mail or Internet file transfer. The communications necessary to support real-time information would be more costly and elaborate and could include a dial-up or dedicated phone connection. The project would also include dissemination tools to make the information available to travelers. These tools could include an Internet web site, telephone information system, and kiosks.		X		**$200**		
3.3MA	***BUS ARRIVAL SYSTEM MERCED COUNTY NEXT BUS ARRIVAL SIGNS***		This project would deploy dynamic message signs at selected higher-usage bus stops equipped with bus shelters. Currently, only one firm (NextBus) is providing this kind of service. Their equipment is placed on board transit vehicles, and GPS-derived current location and speed information is transmitted to NextBus computers at a remote location where the information is processed, and bus arrival prediction is then published to an Internet IP address. The IP address corresponds to a particular dynamic message sign. NextBus has a patent for this "arrival prediction using GPS coordinate data scheme, and their equipment combination uses a CDPD data modem to transmit the information from the bus to the NextBus servers. Their current coverage area does include the Merced area, but not with the CDPD provider that they have currently use (AT&T Wireless). Nonetheless, CDPD coverage is available in Merced, and the NextBus concept therefore may be workable there. The cost for the CDPD "air time" may make this more expensive than in AT&T's coverage area. Also, once an initial installation is completed (using capital funding from some source), then the agency would need to continue the payments for CDPD air time (currently ~$60 per month per bus, and $30 per month per dynamic message sign. Once the service is in place, transit patrons would be able to determine real-time bus locations and expected arrival times at their bus stop. The dynamic message sign at the bus stop would be one source of this information, but NextBus also publishes the information in map form to an internet website, and in WAP form to hand-held PDAs. The information would therefore also be accessible to transit dispatchers as well as agencies that oversee and/or fund transit operations. NextBus can provide a broad cross-section of transit operations data that would be useful to these 2 management groups as well.		X	X	**$400**		

Table 6.2: Summary of Regional ITS Projects

ID	Program Area/Project	Involved Agency	Brief Description	Project Initiation*			Capital Cost Estimates 2001 (Thousands of $)**		
				N	M	L	Total		
							Phase 1	Phase 2	Phase 3
3.4MA	***AVL/ SILENT ALARM SYSTEM***		This project would equip transit vehicles in the Madera area with ITS equipment to both track vehicles and give the bus operator the capability to send a silent alarm for an emergency condition. Automatic Vehicle Location (AVL) equipment generally utilizes satellite technology for pinpointing the exact (to within 20 meters) location of the tracked vehicle. Such tracking is ongoing all the time, and is not limited to the Merced area. If a bus were removed from the area, it could still be located using the AVL equipment. Providing the bus operator with a silent alarm capability will increase the security level of both bus operators and transit patrons. Bus tracking would be viewed by transit dispatchers in the dispatch office. In many cases, the tracking information can be integrated into the same workstation that the dispatchers use in supervising and managing the transit vehicles.	X	X		**$1,000**		
4.0 Traveler Information Systems									
5.0 Regional ITS Configuration Management/Coordination/Planning									
			Total Estimated Capital Deployment Costs for All Potential ITS Projects Over 20 Years						**$4,600**

Notes:

* Project initiation timeframes - N = Years 1-5, M = Years 6-10, L = Years 11+

**All capital costs are approximate and rounded for purposes of this table.

This Section outlines a regional deployment concept, which provides guidance on reaching planned ITS deployment levels.

7.0 Deployment Element

7.1 Purpose

The purpose of this Section of the SDP is to provide an overall view of ITS deployment in the San Joaquin Valley. Each of the ITS projects described individually in Section 6.0 of the SDP are reviewed collectively by program area in this Section of the Plan. This collective review provides the "big picture" of ITS deployment in the Region, as well as unconstrained cost estimates and timelines. In addition, this Section outlines a regional deployment concept which provides guidance on reaching planned ITS deployment levels.

It is important to note that this Section only reflects those projects identified through the SDP development process. It is almost certain that new project concepts will be developed over time that were not originally envisioned as part of this SDP. The fact that a project was not considered in the original SDP should not weigh against it in any future programming or funding process. As the regions ITS program evolves, a project may become part of the Regional Architecture and eligible for funding.

The information provided in this Section should be periodically modified to include significant changes in the regional ITS deployment picture. All cost estimates and timelines should be considered valid for planning purposes, and serve as a useful starting point for programming and funding application efforts. Cost estimates and timelines are not valid for detailed design or deployment purposes, and agencies sponsoring projects should develop detailed estimates which relate specifically to the project or component of a project that they are deploying. Many of the projects outlined in this SDP represent large-scale efforts. Many deployment efforts will actually be a smaller piece of one of these larger efforts, and the SDP can be a useful tool for maintaining consistency of deployment efforts over time.

7.2 Regional Deployment Concept

Deployment of regionally effective and integrated Intelligent Transportation Systems is a complex and evolving process. Deployment priorities are likely to change over time. Technical difficulties will vary from area to area and project to project. New and unique institutional arrangements are often required. Given the potential complexities it is often useful to view deployment at a regional level. At a regional level ITS deployment can be divided into infrastructure and systems components:

- **Infrastructure** – is the most visible form of ITS deployment and includes field devices, sensors, and communications such as:
    - Closed Circuit Television (CCTV) Cameras

- Changeable or Dynamic Message Signs (CMS/DMS)
- Extinguishable Message Signs (EMS)
- Highway Advisory Radio (HAR)
- Ramp metering
- Fiber-optics and wireless communications
- Roadside Weather sensing stations (RWIS)
- Smart buses/vehicles
- Traffic Management Team (TMT) trucks
- Special incident response equipment
- Many other types of infrastructure

As ITS deployment proceeds, expenditures on infrastructure should far exceed the costs of systems and software integration efforts. Infrastructure is the where the benefits of ITS meet the roads and networks people travel. Infrastructure deployments are nothing new for the transportation agencies in the San Joaquin Valley, however interagency cooperation in the setting of infrastructure standards and deployment guidelines does need to be enhanced within the Region.

One issue often overlooked in ITS deployment is that each new model or brand of infrastructure equipment purchased often requires modifications to the operating systems that control the equipment. For example, purchasing a new printer often requires that new software, often called "drivers", be loaded onto the computers that will use the printer. This is usually simple enough in an office environment. Unfortunately, this is not as simple a matter in terms of transportation management infrastructure and software. Careful consideration of each equipment purchase and infrastructure deployment is the only effective guard against this problem.

- **Systems** – are the heart of any ITS deployment. They range from the very simple, such as signal field controller software, to the very complex, such as the air traffic control system. Systems are generally comprised of software, computers, some communications, and most importantly, the people who operate the system. Unfortunately, systems are not very visible to the public or political interests, and they often are overlooked in deployment efforts. Inadequate systems often lead to inadequate control of the field

infrastructure and limit the benefits received from ITS deployment. Some examples of systems are:

- CMS control systems
- CCTV control systems
- Automatic Vehicle Location/Tracking Systems
- Computer Aided Dispatch systems
- Ramp metering systems
- Signal control systems
- Advanced Transportation Management Systems (ATMS)
- Many, many other systems.

The Region has begun deployment of some systems, and has a handful of others in place. The City of Stockton, Modesto, Fresno and Bakersfield have installed centralized signal control systems. The CHP, and some other emergency services in the Region, have their long established Computer Aided Dispatch (CAD) systems that are the core of their dispatch operations. SMART, FAX and GET have deployed Transit Management/Vehicle Tracking systems. However, the majority of ITS infrastructure in the Region is running on outdated or inadequate control systems. Sometimes these systems are sufficient to perform a single dedicated purpose, such as controlling a CMS.

Taken together at the operator level; where a single person may need to control dispatch equipment, CMS, CCTV, ramp meters, and phone systems, many of the existing systems begin to display obvious weaknesses. Many of the agencies in the Region recognize the limitations of their existing systems and are attempting to program replacements. Unfortunately, funding can sometimes be difficult to obtain for systems because they are not always well understood by those responsible for the allocation of funds.

Effective ITS deployment will not be based alone on a single system or series of systems. At a regional level, ITS represents the whole of transportation systems and supporting communications linkages. ITS deployment in the San Joaquin Valley should be based upon a balanced approach which considers base infrastructure needs in addition to system requirements.

Figure 7.1 displays the recommended deployment concept for the San Joaquin Valley. The regional deployment concept considers moving from a level of no ITS deployment to the planned ultimate level of ITS deployment within three general categories of deployment:

- **Existing ITS Infrastructure Deployments** – The San Joaquin Valley has already deployed a solid base of ITS infrastructure in many areas of the Region. This means that the Region does not need to start from "ground zero." It also means that there are investments in "legacy" or older systems that must be reasonably protected as new systems are deployed. Most of the existing ITS deployments are in the areas of signal, freeway management, and transit management systems. Caltrans has the largest deployment base including CMS, CCTV, weather stations, HAR, and ramp metering installations. Through the development of the SDP however, it is quite clear that the desired regional level of ultimate ITS deployment far exceeds existing deployments, and additional ITS infrastructure is needed. Finally, most of the agencies operating existing ITS systems lack adequate systems to properly operate and maintain their ITS infrastructure at the desired levels. This means that in addition to infrastructure deployments, systems deployments are critical as well.

The San Joaquin Valley should look for opportunities to effectively deploy ITS systems in cooperation with neighboring regions to enhance coordination valleywide and increase economies of scale.

- **Urban Area Deployments** – Urban area deployments are likely to represent the bulk of ITS deployment in the Region. Taken from existing levels to the ultimate goal of ITS deployment throughout the Region, urban deployments will be comprised of a mixture of infrastructure and systems projects. Often it is an effective approach to procure infrastructure and system components simultaneously, however the deploying agencies should be careful not to short-change the systems component of a project as is frequently the case. Deployments in the urban areas should take the lead in establishing the core of systems integration efforts in the Region, and should maximize the use of systems and standards from other regions with existing similar ITS deployments. The focus of ITS deployment in the Region should be the maximization of the benefits and capabilities available through deploying a project rather than "re-inventing the wheel" from what has already been accomplished in other regions. The San Joaquin Valley should look for opportunities to effectively deploy ITS systems in cooperation with neighboring regions to enhance coordination valleywide and increase economies of scale. When systems integration efforts are undertaken, adding the capability to deal with rural ITS needs should be considered. The required additional functionality to support remote operations in smaller cities or rural areas through a larger urban system can most likely be added at a small incremental cost. Urban deployments should also consider statewide activities that may provide useful information, standards, funding opportunities, and/or deployment

tools. As the regional stakeholder for ITS deployment, the Valley's COG's should take the lead in the distribution of information on ITS deployments throughout the Valley and state.

- **Rural Area Deployments** – The San Joaquin Valley Region is dominated by rural areas with widespread agricultural uses. Cutting through the County's rural lands are the important state corridors of SR-99 and I-5. Regional stakeholders identified the lack of remote sensing, incident detection, and traffic/freeway management in the rural areas of the Valley as a key problem. Several projects are identified in Section 6.0 of this Plan that will assist in alleviating this problem. However, stakeholders also noted that political interests may want to focus on deployment efforts in the urban core of the Valley where the majority of the population resides. The Region should attempt to maximize the effectiveness of ITS deployment efforts by combining some of the needed rural functionality into the urban deployment efforts. In most cases, the functionality desired for rural and urban areas will overlap significantly, and rural areas may be able to utilize remote connections to the urban systems. This combined approach where urban deployments support rural deployments is especially important for systems integration projects that may be cost prohibitive for rural areas. Finally, this approach lays the groundwork for supporting the anticipated expansion of the urban environment further into the more rural areas of the Region.

- **Supporting Inputs** – As mentioned above, the efforts of neighboring regions and the State have a significant impact on ITS deployment in the San Joaquin Valley Region. Largely this impact should be positive in terms of providing funding opportunities and lowering system deployment costs.

  - Neighboring Regions Systems and Architectures – The Region should consider utilizing system architecture and integration components from regions that have already expended the funds and effort to develop these components. For example, the Southern California Priority Corridor has developed the Showcase architecture to allow agencies with different management systems to share information. Connections for the Caltrans Advanced Transportation Management System software to Showcase are being developed, and Caltrans District 6 and 10 is slated to eventually receive the upgraded ATMS software. Orange County, Los Angeles, and San Diego are also developing connections to Showcase. The Region may choose to use this architecture to build on the efforts already conducted by Southern California. Other options include the Bay Area architecture for the TravInfo project and the self-describing data concept being used in Seattle.

Figure 7.1: Regional ITS Deployment Concept

The Region may benefit from working closely with neighboring regions and developing inter-regional deployment projects.

- Another option is for the San Joaquin Valley to follow its own path by using standards out of the National Architecture and maintaining a specified common architecture for communications and data definitions. Finally, the Region may benefit from working closely with neighboring regions and developing inter-regional deployment projects. These projects should achieve higher visibility and greater political support at the state level and would connect the Valley with the neighboring regions of the Central Coast, Sierra Nevada and the Sacramento/Bay Area. Our proposed system architecture addresses these issues and proposes to use the National Architecture and standards to connect between regions.

- Statewide Efforts – Through the Statewide ITS Deployment Initiatives project, a statewide system architecture has been developed. It is focusing on traveler information and commercial vehicle operations efforts, and try to establish standards for the State. This effort may represent funding opportunities for the Region, and it may also set standards that the Region will choose to follow in its deployment efforts. Other statewide efforts include the Caltrans development of its ATMS software. The goal is the eventual statewide deployment of a common ATMS software within Caltrans. The Region should follow this effort closely to determine what standards and systems are likely to be utilized by Caltrans, District 6 and 10. There are local agencies in the Valley that are interested in the procurement of a software that is compatible with Caltrans.

There are some overarching deployment principles that should be considered in addition to the deployment concept. These are discussed separately below.

- **Consider the long-term impacts of deployment** – What role will the proposed deployment play in the bigger regional deployment picture? If the deployment is an infrastructure project then how will it fit into on-going, planned, or potential future systems and regional integration deployments. If it is a system deployment in an urban area, might there be broader applications within the greater Region?

- **Think regionally** - Deployment efforts should be based on the concept of "design once – deploy many times" as much as possible. It would be wasteful to design and deploy an ITS system in one portion of the Region, only to go through the whole process over again in another portion of the Region. It is best to start deployment concepts and designs on a simple replicable premise

that can be easily transferred to other areas of the Region. This is especially true of systems and software integration efforts.

- **Consider the ultimate goal** - Deployment efforts should always consider the regional ITS vision and goals. In other words, how will the deployment improve transportation efficiency, regional productivity, and reduce negative impacts?

- **Build flexible and open systems** –The region should work together to establish reasonable standards and promote cooperation, as well as the integration of transportation management systems.

These principles may seem self-evident, however, failure to follow these basic principles of ITS deployment has been a leading cause of ineffective ITS deployment efforts across the nation.

7.3 Suggested Deployment Process

Figure 7.2 displays the suggested regional deployment process for the San Joaquin Valley. This process is comprised of seven basic steps. This view of the ITS deployment process focuses on deployment of the overall regional ITS program, rather than any specific project. Section 9.0 of the Plan looks at the individual project deployment process from the perspective of a project proponent or champion.

1. **ITS Deployment Concept** — Each deployment opportunity should be reviewed for compatibility with the regional deployment concept. The Region should strongly consider not pursuing or supporting a project that does not allow for linkages with other ITS deployments in the Region.

2. **System Champion (Agency & Political)** - A champion is an individual that strongly supports the deployment of a specific project or series of systems and is willing and able to exert the effort and influence necessary to follow through from the early deployment design to project funding and actual deployment. A champion is critical and must be sought for each system or project. The role of a deployment champion is discussed in further detail in Section 9.0.

3. **San Joaquin Valley ITS Strategic Deployment Plan** - The SDP in its entirety represents a "tool box" and framework for ITS deployment. It provides for consistency with other regions in terms of system architecture and data exchange. It should be the informal policy of the Region to reference pertinent sections of the Plan prior to proceeding with funding application or design processes. Deployment champions may use the Plan to further the

Figure 7.2: Suggested ITS System Deployment Process

acceptance of their projects if the project is consistent with the Plan in terms of vision, policies, and architecture. Appropriate components and/or projects from the SDP should be incorporated into the Regional Transportation Plan (RTP), Transportation Improvement Program (TIP), and the State Transportation Improvement Program (STIP). The RTP is a long range transportation plan prepared by each of the eight counties on a bi-annual basis to outline existing and projected transportation conditions and improvement projects. Most regions have incorporated ITS as a special section in the RTP, however the Valley should consider direct integration with other projects given the growing emphasis on "mainstreaming" ITS into the transportation planning and programming process. The TIP and STIP are largely programming documents which outline programmed transportation improvement projects for the Region and the state. This information is collected from member agencies by the COG and moved up to the state level for incorporation into the STIP. Ensuring that appropriate ITS projects are included in the TIP and STIP is critical to obtaining funds. Also available at the state level are State Highway Operation and Protection Program (SHOPP) which has become an increasingly important funding resource for ITS projects, especially for Caltrans.

This SDP must assist the region in preparation for opportunities that will come out of the reauthorization of TEA-21.

4. **Funding Sources** – Funding is perhaps the most crucial concern to deployment champions. Funding is competitively obtained from federal, state, private, and other resources. Funding should be aggressively and consistently pursued by project supporters. Regional and local funds are a critical component to funding ITS projects and can be used to leverage additional federal and state funds. The Plan acts as a framework for pursuing funds by defining systems, projects, issues, and preliminary costs. Funding opportunities are discussed in greater detail in Section 8.0.

   Where possible funding should be sought for a type or classification of project rather than individual projects. For example, it may be more appropriate to seek funds for a Remote Sensing and Surveillance System which will be deployed across the region over time rather than seeking funds independently for each geographic portion of the Region. While each agency within the Region may have its own system, funding and deploying the project by considering a regional deployment first and then breaking it down as funds become available leads to more effective integration at the regional level. This approach simplifies the deployment process by increasing regional support for a type of project. The project type is then phased over time to provide the specific individual deployments desired within a regional framework.

As noted in item 3, it is critical that ITS projects be included in the regional planning and programming documents such as the RTP, TIP, and STIP. These documents, along with Caltran's SHOPP, represent a significant portion of the funding opportunities for ITS projects and are critical to "mainstreaming" ITS as discussed in Sections 8.0 and 9.0 of this Plan.

5. **Specific System/Project Work Plan** – This Plan does not generally provide the level of detail necessary to proceed to detailed design of a project. Deployment champions must work to further define their projects to address special institutional relationships, operational concepts, specific project sponsors, deployment schedules, etc.

6. **Specific System/Project Deployments** — As individual projects are deployed, consideration should be given to regional concerns as well as local issues. Deployment of multiple similar systems, given proper consideration of regional integration needs, allows for the regional deployment of ITS capabilities.

7. **Regionwide Deployment of Systems/Projects** – Regional deployment of ITS capabilities may require going one step beyond simply building multiple systems with common architectures. Regional user needs differ somewhat from local needs. Regional deployment should be considered when the level of specific project/system deployments is sufficient enough to support integrated operations across the Region.

These seven steps are critical to effective regional ITS deployment. The specific deployment process followed will vary from system to system, but these seven primary steps will always be present.

7.4 Regional Deployment Timeline and Budget

Figure 7.3 displays the overall regional ITS deployment timeline. Projects (identified in Section 6.0) are grouped by program areas, and the proposed deployment timelines for each project is listed. At the bottom of Figure 7.3, overall annual ITS deployment costs are listed. Timelines are based on information provided by the ITS Technical Advisory Committee and various transportation stakeholders. It is important to note that the deployment timeline is not fiscally constrained due to unknowns in the funding situation.

Figure 7.3: Regional ITS Project Deployment Timelines

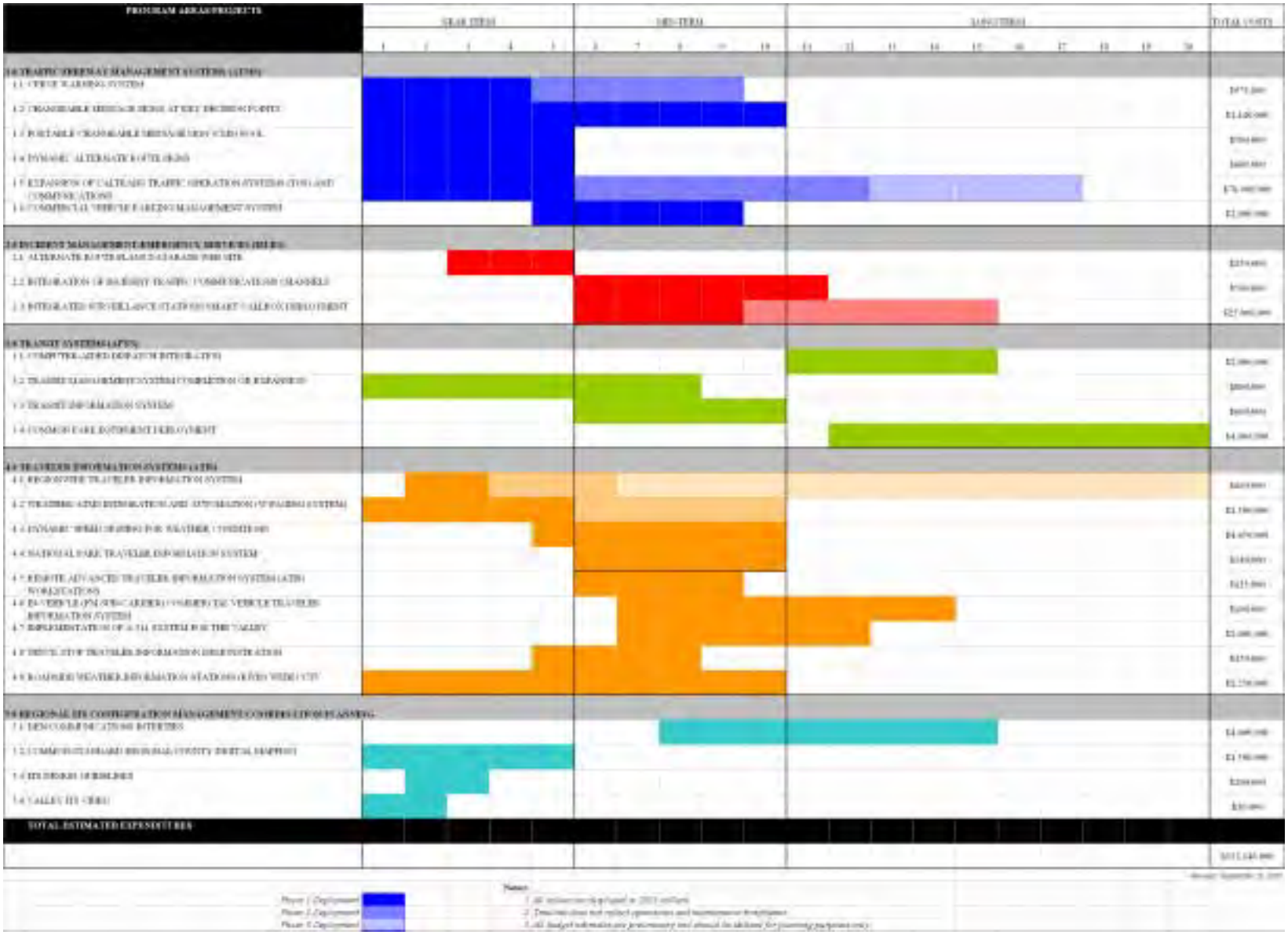


Figure 7.3 displays the overall deployment budget for the proposed projects between Year 1 and Year 20. The budget estimates for each project are based on a variety of factors including information from the ITS Technical Advisory Committee, vendors, and similar projects deployed elsewhere in the nation. Budget estimates are generated by combining known unit costs, project descriptions, and design and contingency adjustment factors. Table 7.1 displays the adjustment factors used for budget estimation. All values are shown in 2001 dollars, and all budgets should be considered preliminary. These estimates may be useful for planning, funding applications, and regional programming, but should not be used for design or deployment purposes.

Table 7.1: Budget Estimate Adjustment Factors

Factors	Traditional Infrastructure Project	Software Development Project	Comments
Design Costs	15% of capital costs	15% of capital costs	None
Contingency Factors	15% of capital costs	30% of capital costs	Software development carries a higher contingency due to greater risk and variability in costing.
Operations & Maintenance, Replacement Costs	5% of capital costs	5% of capital costs	For simple projects 5% was used, where applicable communications costs and other factors were added as well.

Taken together, Figure 7.3 provides a comprehensive picture of planned major ITS deployments within the Valley. It is important to note that none of the costs or timelines were constrained based on potential outside factors, and it is certain that these budgets and timelines will change over time. The information in the two figures should be considered similar to a snapshot in time.

Given the information provided in Figures 7.3 it is very likely that the desire for near-term ITS deployment will exceed the ability to fund this level of deployment. However, it is not necessary to re-prioritize the projects at this time. The projects contained in this Plan represent a menu of options. Those projects listed for near-term deployment represent what is available on the menu within that timeframe. Depending on the outcome of funding opportunities, the Region may choose to deploy some of the projects on the menu for any particular timeframe and adjust the others until funds become available. Projects should not be removed from the menu (i.e. adjusted on the timeline) until it is very clear that they will not receive funds for the originally planned timeframe.

7.5 Developing Memorandums of Understanding

Most of the ITS deployments in this Plan call for cooperative deployment and operations efforts between multiple jurisdictions. These types of deployments most often require some sort of inter-agency agreement such as a bi-lateral letter of agreement or a Memorandum of Understanding (MOU). Regardless of the specific institutional tool decided upon by agencies, the agreement should attempt to achieve the following purposes:

- Establish roles and responsibilities for the smooth operation and maintenance of system components that affect management of regional traffic and traveler information on a day to day basis.

- Provide agencies with enough degree of freedom (as per agreement) so that motorist needs are met irrespective of the agency that has jurisdiction over the system components.

- Develop operational guidelines to regional agencies such that they follow consistent and common methods of operations, which benefit both motorists and the system operators.

- Set forth and mutually agree upon standard operating procedures and strategies for various components of the system.

- Serve as a standard reference document for partnering agencies for day to day operation and during staff turnovers.

- Establish contact personnel during and after hours of business to manage emergency situations.

- As part of the standard operating procedure identify:

  - Type of information to be shared (type and content) between agencies,

  - Resources to be shared between agencies and how, where, and to whom the information from the system can be distributed, and

  - How operating costs for the system will be distributed.

7.6 Procurement Alternatives

The traditional procurement and contract procedures used by agencies vary and may not always be well suited to the unique characteristics of ITS projects. ITS projects generally require extensive interagency cooperation, private sector personnel may need to be hired to support public facilities, public/private partnership agreements need to be determined, and privacy issues need to be resolved. ITS projects also

involve the acquisition and placement of high-tech equipment that may require special procurement considerations. Therefore certain aspects of traditional procurement and contract procedures of the public agencies may have to be changed to accommodate ITS projects.

Many ITS projects will have their own unique characteristics that will need to be addressed. This section identifies some of the options and issues relative to procurement and contracting procedures of ITS projects and services.

7.6.1 Procurement Options

The implementation of ITS projects will require the system components of each project to be designed, developed/manufactured and installed. Unless the implementation phase is correctly planned and managed, long delays may occur in implementation.

Procurement Methods

Five (5) basic procurement options have been identified.

- Engineer/Contractor
- Systems Manager
- Sole Source
- Design/Build (operate)
- Public/Private

The first two methods are traditionally used by public agencies. The latter three (3) methods may require education of agencies for utilization of these techniques for implementing ITS projects. Each method is discussed in greater detail on the following pages.

- Engineer (Consultant)/Contractor Approach

  The Engineer (Consultant)/Contractor method represents the traditional procedure used by public agencies. Based on project requirements and preliminary studies, the Engineer (Consultant) prepares the final study and/or design plans, specifications and estimates (PS&E) for the proposed project. An agency employee or a consultant can act as the Engineer. The completed PS&E are then presented to the Contractor community and receive bids in accordance with established procedures.

  The Contractor bids on the PS&E and agrees to provide a complete system consisting of hardware and software - procured, installed and implemented by the Contractor.

Hardware may be manufactured by the Contractor's organization and/or subcontracted within the conditions imposed by the contract. The Contractor may also be responsible for system startup assistance. In the case of traffic control systems, the calibration of the system and the development and implementation of timing plans and other database elements may be required.

The Engineer (Consultant) is responsible for inspecting and acceptance of project components and the entire system.

- Systems Manager

The Systems Manager option requires the pubic agency to select a single firm or consulting team as Systems Manager. The Systems Manager is responsible for system design, PS&E preparation, systems integration, documentation and training.

The project is divided into several sub-projects and each sub-project is contracted by using the agency's normal bidding processes. The Systems Manager oversees all work by the various contractors. The sub-project contractors can be selected on the basis of specific sets of skills required for each sub-project. This permits the selection of experts for various steps of the system. The Systems Manager is responsible for integrating the sub-projects into an overall operating system.

The contract between an agency and the Systems Manager is typically a negotiated contract that allows contract flexibility when projects are refined. This procurement method assigns responsibility of total system success to one entity and creates an environment to more easily meet project requirements.

- Sole Source Approach

This form of procurement is used when there is documented existence of one technical or cost effective solution to the requirements of a certain project. Sole Source procurement is most often used when compatibility with existing equipment and/or systems is required.

In the early stages of establishing components of an ITS system, Sole Source procurement should not be necessary. During the later stages of development, Sole Source procurement may need to be employed to ensure system-wide compatibility in certain circumstances.

- Design/Build (Operate) Approach

  The Design/Build approach requires the selection of a single responsible entity to perform all work associated with the deployment of the system and its components. The selected entity may also be responsible for ongoing operation of the system. The public agencies are responsible for monitoring the activity of the Design/Builder. The Design/Builder performs all design work, contracts and/or constructs the system elements and systems and turns over the operating system to the public agency. In some instances the Design/Builder will operate the system with oversight and monitoring maintained by the public agency.

  A limitation of this approach is that the public agency loses some control over the design of the project. The agency's sole role is reduced to oversight and monitoring of the Design/Builder and does not involve any of the design details that may impact the operational needs of the agency.

- Private/Public Approach

  The Private/Public approach is a newer procurement system that establishes a Public/Private partnership for financing and implementation of a project. Each project proposed as a Public/Private partnership would need to be investigated individually to determine that there are not issues such as conflict of interest, unfair advantage given to one competitor over another, etc. Many projects may appear to be good candidates for Public/Private partnership, but may be eliminated due to local, state and federal laws. Creativity and close study of regulations will be needed to insure Public/Private partnerships are viable projects that have benefits for all involved parties.

7.6.2 Suggested Procurements Options

Table 7.2 displays the suggested potential procurement processes for the various projects identified in the San Joaquin Valley ITS Strategic Deployment Plan. The specific procurement process selected for a particular deployment effort should be decided upon during the project development process as discussed in Section 9.0. Table 7.2 does not represent an all-inclusive list of potential procurement procedures and processes and is only meant to serve as a helpful guideline.

Table 7.2: Suggested Procurement Options

Projects	Engineer/ Contractor	System Manager	Sole Source	Design/ Builder	Public/ Private
1.0: Traffic/Freeway Management Systems (ATMS)					
1.1 Curve Warning System	●	●		●	
1.2 Changeable Message Signs at Key Decision Points	●	●		●	
1.3 Portable Changeable Message Sign Pool		●	●		
1.4 Dynamic Alternate Route Signs	●	●		●	
1.5 Expansion of Caltrans Traffic Operations Systems (TOS)	●	●		●	
1.6 Commercial Vehicle Parking Management	●	●			●
2.0: Incident Management/Emergency Services					
2.1 Alternate Route Plans Database/Website		●	●	●	
2.2 Incident Management Teams w/ Freeway Service Patrol (FSP) Equipment		●	●	●	
2.3 Integration of Incident/Traffic Communication Channels		●	●	●	
2.4 Integrated Surveillance Stations/Smart Callbox Deployment		●		●	
3.0: Transit Systems					
3.1 Computer Aided Dispatch Integration		●	●	●	
3.2 Transit Management System Expansion or Completion	●	●	●	●	
3.3 Transit Information System	●	●		●	●
3.4 Common Fare Equipment Deployment	●		●	●	
4.0: Traveler Information Systems					
4.1 Regional Transportation Information System *		●	●	●	●
4.2 Weather/ATMS Integration and Automation (w/ Paging System)	●	●	●	●	
4.3 Dynamic Speed Signing for Weather Conditions	●	●		●	
4.4 National Park Traveler Information System		●	●	●	●
4.5 Remote Advanced Traveler Information System Workstation		●	●	●	●
4.6 In-Vehicle (FM Sub-carrier) Commercial Vehicle Traveler Information System		●	●	●	●
4.7 Implementation of a 511 System for the Valley	●	●		●	
4.8 Truck Stop Traveler Information Demonstration		●	●	●	●
4.9 Roadside Weather Information Stations (RWIS) w/ CCTV	●	●		●	
5.0: Regional ITS Configuration Management/Coordination/Planning					
5.1 DEN/Communication Interties		●	●	●	
5.2 Common/Standard Regional/County Digital Mapping **		●	●	●	●
5.3 ITS Design Guidelines	●	●			
5.4 Valley ITS Video		●	●		

"Operations and Maintenance is a critical component of an ITS Plan to ensure that the system continues to provide benefits for years after implementation"

7.7 Operations and Maintenance Considerations

The acronym "O&M" is commonly known as operations and maintenance. Traditionally, operations and maintenance are focused on conventional roadway elements such as pavement, structures, safety appurtenances, signs and markings, and others. The definitions of operations and maintenance were built around the concepts that related to fairly low-tech, static, long-life, capital-intensive facilities and equipment. The traditional O&M definitions are inappropriate for Intelligent Transportation Systems (ITS) since many of the traditional maintenance items are, in reality, operations items for ITS. For example, a freeway management system cannot operate if the central computer in the control center or the devices in the field are not in a state of readiness. Similar analogies could be presented for traffic signal systems and other ITS elements. Readiness for ITS includes many of the traditional maintenance items and determines whether the ITS is operational. Without sufficient resources to provide the ITS program with an O&M Plan, the system will quickly become obsolete and ineffective.

7.7.1 System Management

There are several key considerations for ITS system management.

- A key to operating and managing regional ITS projects is the establishment of strong and effective working relationships among all participating agencies. These working relationships can extend to include such operations as the shared control of traffic management systems across jurisdictional boundaries. Techniques to establish and maintain these relationships may include regional steering committees, traffic management teams, incident and/or emergency response teams, or other techniques.

- Interjurisdictional committees to coordinate traffic management centers (TMCs) and other types of control centers should be established. These groups would be multidisciplinary, multijurisdictional, and staffed at the appropriate level to assure commitment from the participating agencies. They would be formed to deal with regional issues, management of the network, and specialized topics appropriate to the area. User's groups to share experiences are also recommended in larger metropolitan areas.

- The credibility of a TMC must be maintained to ensure that the system has the confidence of its operators and the traveling public. Ensuring reliability is one of the most effective ways of instilling credibility in the system.

- Incorporation of an industry standard network management system is important for the early detection of system malfunctions to

assure data integrity. The implementation of an integrated and industry standard network management system will allow detection and identification of network system problems at the earliest moment.

- Conduct regular operations and management briefings with key agency personnel. The O&M requirements of a complex ITS are best addressed as early as possible. As a system grows and matures, issues can change drastically from day to day. Staff and management personnel should meet regularly to discuss and establish priorities.

- It is important to measure and report system performance and benefits known as measures of effectiveness (MOES). Within budgetary constraints, necessary data should be systematically collected for periodic reporting of the MOEs. This helps for budgeting and public relations purposes, and it can be linked to other planning needs. Possible MOEs include:

  - Delay: total hours, average total daily hours, average delay per person over a period of time, stop delay, or other;
  - System or corridor throughput: vehicles per hour, persons per hour, vehicles or persons per lane, or other
  - Air quality: pollution reduction, fuel consumption savings or other;
  - Malfunction response times: emergency repairs, final repairs, or other;
  - Incident response times: initial response time, incident clearance time based on severity of conditions, duration of delay from incidents, or other;
  - Customer satisfaction.

Additional MOEs and their applicability to the Region are described in the supporting Performance Criteria document to this Plan.

- Establish appropriate hours of operation for the TMC. For example, regional TMCs operated by State DOTs or regional governments could follow a policy of operating 24 hours a day, 7 days a week; city or county TMCs could follow a policy of operating two shifts a day, covering at least both peak periods, five days a week, and at special times for planned events. The exact hours will depend on the systems covered in each center and the available resources.

- Management support for ITS in general and O&M in particular is critical to the success of ITS. Identify and estimate budgetary resources to support long-term operations and management of the

ITS program. Identification of operations and management budgets is crucial to the long-term success of any ITS. The use of industry standard equipment with a proven track record allows the ITS manager to develop a comprehensive system plan. This can be accomplished by using an in-house staff in combination with competitively bid contracts.

- Identify and estimate budgetary resources for modifications to the original system. ITS management must be prepared for the discovery of necessary and/or desirable software and hardware modifications following the initial implementation of the system. This can be accomplished through a requirement that the system integrator provide support and enhancements for a period of months following acceptance of the system or by using dedicated funds.

- Provide the necessary personnel resources needed to manage, operate, and maintain ITS. Trained staff dedicated to the management, operation, and maintenance of ITS systems and components are needed to ensure an effective system. Special skills are needed and individuals with these skills should be dedicated to the ITS functions so that the competing priorities will not compromise the effectiveness of the system. The prompt, preventative support and repair of the field communications and other equipment linked to ITS is essential to the effective real-time and efficient functioning of the system.

Management should consider the training requirements for all ITS personnel when preparing plans and budgets.

Management should support and require training for personnel involved in ITS in all applicable disciplines, including design, construction, operations, and maintenance. Management should consider the training requirements for all ITS personnel when preparing plans and budgets. Recognizing and considering the requirements of the system will assist design and construction personnel to provide a better system for operations and management personnel. Training in O&M procedures will provide design and construction personnel exposure to those requirements.

Management should place the ITS and TMC functions at a visible, responsible level within the organization. Managers of the TMC and related ITS functions should have the authority to make day to day decisions regarding the operation and management of their systems. The most typical arrangement is to place the TMC within the traffic operations part of the agency. However, at times, it is placed at an equal level with the traffic operations function.

7.7.2 Other O&M Considerations

System management is the primary consideration which will bring the Region the full benefits of ITS. However, there are many additional O&M considerations which should be considered in the deployment of ITS.

System Design

The Region should use a system plan to guide the development and deployment of each system identified in the ITS Strategic Deployment Plan. The system plan should build off the conceptual design, which is identified as part of the ITS Strategic Plan or as a separate feasibility study completed for the system. This state in the system development process should be followed to develop a system plan and subsequent project designs. It should involve all of the appropriate agencies and service providers within its proposed geographic area of operational influence. The specific methods utilized should vary based on the type of system, functional capabilities, and responsibilities identified specific to the operational needs or related provision of services.

A detailed review and assessment of the operations and management strategy identified in the ITS Strategic Deployment Plan should be added in the initial stages of preliminary design of a system or project. This assessment should include a detailed analysis of the transportation problems and deficiencies upon which the system is based. This should allow for any adjustments to be made, ensuring that the required functions and performance criteria are satisfied. The assessment may reveal gaps or overlaps in the proposed functions to be supported by the system. This assessment could also include the identified subsystems, components, communication media, and interfaces with other systems.

The development of a system plan, individual systems, and subsequent project designs should all follow a systems engineering process. The iterative process to develop the preliminary design should consider addressing and analyzing the following issues:

- Functional requirements
- Operational and management functions
- Performance, design, support, and effectiveness requirements
- System and subsystem trade-offs, evaluation and analysis of alternatives
- Performance requirements, configuration, and detailed specifications of selected subsystem and individual components.

The iterative process to develop the detailed design should consider the following issues:

- Design of computer hardware, field equipment, communication media, databases and software, and control central components
- Design of logistical, operations, management, and administrative support elements
- Analization, evaluation, and documentation of all design decisions
- Procurement of system implementation, operations and administrative support requirements,
- Preparation of specifications identifying all equipment, communication and software testing, start-up procedures, and performance requirements.

A detailed system plan should be developed that includes a detailed analysis of the functions, components, and other required implementation issues for each of the proposed systems identified in the ITS Strategic Plan. The system plan should also include a roadmap identifying the development of system components, individual projects, and geographic deployment. Each system plan should include its own detailed system architecture, description of interfaces with other systems in the region, identification of operations concepts, functional requirements, and phased implementation strategy.

A detailed technology assessment should be completed on the near-term projects identified for the phased implementation of the system. The review of each specific type of technology application should identify the most cost-effective approach to meet the identified functional, performance and reliability requirements identified for the particular system component. As the staged development and deployment of the system proceeds, this technology assessment should become an ongoing part of the design process of each individual project. The technology assessment should consider addressing the following issues:

- Include all identified hardware components, software components, communications media, operations and management strategies
- Interoperability and compatibility of individual technologies with other components identified in the architecture for a particular system,
- Assess the performance and reliability of alternative technologies compared to identified systems (functional and component) requirements
- Evaluate the impact of alternative technologies performance on other systems identified in regional architecture

- Assess future expansion capabilities of technologies with various system components
- Include the ability to satisfy NTCIP or other available national ITS standards in assessing technologies
- Include initial implementation costs, operational costs, management costs, and cost of future replacements in the detailed life cycle cost evaluation of technologies

The system plan and detailed project designs should be based on a detailed life cycle cost analysis. This analysis should consider variables such as procurement, installation, construction, initial cost, anticipated benefits, operations and management costs, product liability, product replacement values, and system expansion features.

The system plan should include a deployment strategy addressing the incremental development of various components and identified geographic coverage. This strategy should identify, in priority fashion, projects that would have the most immediate impact on operations and realize potential benefits of the system. The identified priorities should also consider including several early successes and projects that support operational strategies having the most beneficial impacts or visibility in the region.

A detailed deployment strategy should be developed as a part of the system plan. This strategy should address the staffing and resource requirements to meet the operating and management needs identifies to support the incremental development and implementation of the system and particular projects.

Generally, the design of each ITS project should:

- **Follow generally accepted engineering practices**
- **Incorporate standards-based systems and components**
- **Involve everybody**
- **Follow a systems engineering process**

The detailed design of each project should be specifically developed to support the operations needs and management practices identified for a particular system.

Design TMCs to facilitate the exchange of information among participating jurisdictions. The information interchange among networked TMCs and other transportation agencies may include telephone, computer data, and closed-circuit television camera (CCTV) images. In some systems, one agency can gain control of another agency's CCTV camera to view a highway segment of interest. Agreements as to the use and distribution of exchanged information will normally be required by the releasing agency.

The design of each project should ensure the provision of the appropriate data collection and processing capabilities identified for each system component. Project specifications should ensure that selected technologies support the automated monitoring, evaluation, and reporting of the systems and transportation network performance.

Plans and specifications for each project should include the appropriate NTCIP and other national ITS standards corresponding to various subsystems and components. The inclusion of the appropriate standards is necessary to ensure the identified system performance and equipment compatibility to communicate between systems and various subsystems. Based on the detailed project designs, the corresponding specifications should address the appropriate existing and evolving national industry communication standards, software standards, computer standards, database standards, NTCIP, Transit Communications Interface Profiles (TCIP), and other ITS standards.

The Cities of Stockton, Fresno and Bakersfield have followed this process admirably in developing their ATMS by preparing Traffic Signal System Master plans and/or ATMS Master Plans. Other agencies in the Valley should follow this lead where applicable.

System Procurement

The procurement contract for complex systems should be appropriate to ensure proper operations and management. In the procurement process, The Region should consider including provisions for training, equipment spares, transfer of property rights, use of testing and diagnostic tools, and other deliverables that will facilitate proper O&M. Procurement deliverables associated with the procurement phase of a system include:

- Training for job classifications that are involved in system O&M
- Delivery of spares to meet near-term O&M needs
- Establish a mechanism to readily and cost-effectively procure spares in the future
- Define adequate warranty considerations to meet issues associated with near-term failure of equipment and software
- Acquire adequate property rights to allow for the effective, long-term operations of the system
- Deliver adequate testing equipment and diagnostic tools (software and hardware) as required for O&M purposes.

If done through contract, the procurement process for operating and management services should incorporate clear performance measures associated with effective traffic management, not simply measures related to system downtime and staffing. Typical performance measures are oriented toward staff response times, staffing levels, preventative upkeep work orders, and the other control system process MOEs. For effective O&M, these MOEs should also include traffic system performance measures, such as adjustments to signal timings in

response to traffic "events", on-time progression of transit vehicles within priority systems, or other measures.

Integration of Systems

The integration of systems should be based on the need to share information among the Region in order to manage the regional transportation network and improve the operational efficiency of one system or a particular agency. The concept of integration is addressed in Section 5.0 and 6.0 of this ITS Strategic Deployment Plan for the region. The ability to support the operational concept for a particular system or agency should be the basis upon which interfaces and corresponding sharing of information should be justified, planned, designed, and implemented. The integration of systems and the sharing of information among the Regional agencies should be considered an incremental or evolutionary process. The need to advance or automate the interfaces between shared systems should be based on their ability to improve the efficiency of system operations, provision of services, or provide capability for multi-agency control of systems.

Integration between systems should be incremental, be considered logical extensions of existing system capabilities and support an agencies operational concept. The support of operations should be the concept upon which information and data are shared between agencies and the basis for identifying projects to enhance or develop new interfaces. This incremental development should strive to transition from the existing state of information sharing to systems with capabilities to automate the transfer of data between agencies and potentially provide the ability to share the control of systems or particular components.

All interfaces should be designed and developed with an "open" architecture concept, which utilizes nonproprietary protocols. This approach should allow for and facilitate future modular replacements and upgrades of individual component capabilities and technologies without adversely impacting other system components. The National ITS Architecture was developed based on this concept. Therefore, complying with the National ITS Architecture is mandatory.

The development of interfaces between different systems and any corresponding platforms to accommodate the sharing of information should be portable to allow the application to be transferred to other similar systems or agencies within a region. This concept promotes integration opportunities. The responsible agency should submit and carry out a comprehensive acceptance test plan appropriate for the configured system (both the initial system and major system upgrades). The test plan should be developed in the design phase and refined during software development. The ITS staff needs to learn the programs, actively participate in their testing prior to program

implementation, and interact with the system to ensure proper operation without unexpected results.

The agency staff who will perform system management and operations should be aware of and be a participant in the software development process. This practice helps provide the frame of reference that leads to communication and cooperation between the vendor and the client (a good overall project management practice).

Operating agencies should undertake a long-term program for the upkeep of software and hardware support and upgrades. Some systems projects have new operating systems that must be integrated into an existing operation. The integration of existing local ATMS functions into a new BiTrans ATMS software is a good example. The interaction of the newer system elements with the existing system can create unforeseen problems and require code changes in the existing application packages. Unexpected errors and data corruption can occur, requiring months of testing to discover the cause, resolve problems, and get the system back to proper operation. By having contract upkeep services on computers and the operating system, an agency can have the necessary support to resolve these problems.

As operating TMCs are modified over time, the manager should perform system configuration and change management coincident with every system change. Because an automated traffic management system is dynamic and ever changing, an effort should be made to periodically upgrade and document the system design or configuration. The documentation ensures that the design of system additions can be made logically and efficiently without an undue amount of backtracking to discover how the system is actually operating.

Resource Sharing/Joint Operations

Close coordination with all involved agencies should continue throughout every phase of the project. Successful systems include some form of resource sharing and joint operations. To gain consensus, ownership and support for resource sharing and joint operations, all affected agencies should be involved in not only this ITS planning process but also the system design process. Close coordination should be maintained throughout all phases of the project. This can be accomplished by implementing interagency traffic management and safety teams, incident response teams, and the Valleywide steering committee. Memorandums of Understanding should also be prepared.

Individual, operational needs should be identified before operational commonalties are assessed. Operational requirements need to be identified for each individual agency or discipline involved. After they have been established, mutual operational needs should be assessed.

To keep a common philosophy and motive among all participating agencies, mission statements, goals, and objectives should be identified and adopted from a consensus-building process, as agreement is easier to reach when differences are minimized. This encourages mutual cooperation and helps to establish trust and credibility among all agencies. Interagency coalitions with specific purposes should be developed to address common issues. This should be done incrementally to promote a nonthreatening process. When coalitions with clearly defined goals exist, participation will develop naturally from interested partners. These coalitions with little or no authority allow each agency to maintain access to shared resources while "turf controllers" do not feel threatened.

A diverse set of functional disciplines should be included in the initial stages of projects or program development. These disciplines (i.e., engineers, planners, police, fire, emergency management, or other) should be identified to include a diverse set of functional disciplines in the initial stages of projects and program development to meet local needs. Joint operations should be considered either through co-location or through communication connections.

Systems should be networked for joint operations with other regional ITS programs. Networking provides regional coverage of roadways, transit, and emergency operations. This has the advantage of maintaining some level of service in response to a non peak hour incident where a smaller TMC may not be operating. Computer communication network links and committees to coordinate TMCs and other types of control center should be established to effectively plan, implement, and coordinate the traffic management activities of various agencies located at different nodes of a network on a real-time basis.

The urban area metropolitan regions such as Stockton, Modesto, Fresno and Bakersfield should be encouraged to share use of the wide area network infrastructure being implemented as an ITS "information superhighway" inclusive of multiple agencies. An overwhelming cost to deploy ITS field devices is communications. Considerable savings for a whole region can be realized through a common communications backbone, such as a wide area network. The Region should be cognizant of potential legal issues associated with owning their own "telecommunications" system. A shared communication system should be considered for coordinated traffic signal systems and other devices among multiple jurisdictions. Traffic signals should be interconnected with a common communication system. Over a period of time, a more coordinated operation should be considered where one agency assumes responsibility as a result of their resources and abilities under mutually established guidelines.

It is planned to provide the ability for other agencies to access CCTV's, share images, and control cameras. Sharing the command and control of video across agencies provides greater functional capabilities for each agency without incurring duplicated infrastructure costs.

For agencies in the Region involved with incident management, the ability will be provided to allow operation of changeable message signs (CMS) by other agency staff through coordination with Caltrans, Districts 6 and 10.

User groups should be established to positively review or debrief operations on a regular basis. A positive team-building approach should be taken to complement and enhance each other's performance such that overall performance is improved. Understanding the capabilities and constraints of each agency or discipline can lead to a better response.

Computer Systems

The design and installation of computer systems should address standards, documentation, system configuration, security, and acceptance testing. Coding standards should be required and adopted for software enhancements and for generation of new programs. For effective software debugging, modification, and addition of enhancements, the adoption of coding standards simplify the effort. However, the Region should be cautious about requiring the specific standard that a software developer uses. Most software developers have adopted coding standards, in which case requiring different standards can be expensive and will usually be unnecessary. It is important to the quality of the end product to follow a standard, but the specific standard used is of less importance. The coding should be "understandable" so it can be interpreted and used consistently among all programmers. Examples of appropriate code include variable naming conventions, format for procedures, and others. The Region should also consider using their own information systems personnel as a resource. In addition to coding standards, agencies should consider the use of standard database programs to facilitate the sharing of information with both internal and external agencies. The system architecture adopted in Section 5.0 will help the region deliver the most appropriate systems.

7.8 Acceptance Testing

Conclusion of the acceptance test, if successful, represents a significant transfer of responsibility from the system design/deployer to the owner or controlling agency. Acceptance tests and associated testing procedures should always be fully documented prior to deployment of any system prototype. This is generally done through the development of the acceptance test plan. For more traditional infrastructure

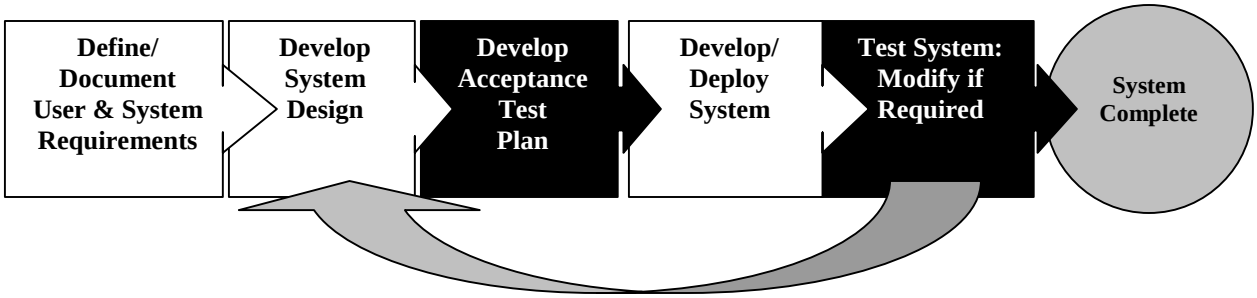
projects, a full acceptance test plan may not be necessary, as testing requirements are generally included with the specifications documents.

It is important to understand that if a system feature is not documented in an acceptance test plan, then the system designer/deployer may not have to prove that feature works or even exists in order to deploy a contractually "complete" system.

7.8.1 Acceptance Test Plans as Part of the Deployment Process

Acceptance test plans should be developed as part of the overall deployment of an ITS project. It may be necessary to have multiple test cycles depending on the complexity and duration of deployment. However, deployment generally follows a few basic steps as displayed in Figure 7.4.

Figure 7.4: Acceptance Test Plans and the Overall System Deployment Process



- **Define/Document User & System Requirements** – This phase includes the identification and documentation of the specific user and system requirements relating to the system, and should be performed as part of the preliminary design of a system. Generally, user requirements are outlined in less than 100 simple statements following the format of "A shall do B to C." For example, a user requirement might include, "the weather system shall provide wind speed data to the air traffic controller." Whereas user requirements focus on succinctly outlining the specific needs of users, system requirements focus on more technical issues. An example of a system requirement could be, "the weather system shall be capable of providing accurate wind readings in sustained winds of up to 100 mph." Requirements can be grouped or managed in different fashions, however every ITS system deployed should have some form of documented requirements. In the ITS field, acceptance testing is frequently done to the level of user requirements, but not to the level of system requirements. This is usually due to logical and budgetary constraints. In the above example, it would be easy enough to show that the weather system

provided the wind data, but it would be costly to provide a 100mph sustained wind to confirm that the system met the system requirement.

- **Develop System Design** – As the name implies, this phase includes the high level and detailed design of the system. It is important the near-term and long-term evaluation needs be considered in the design of the system.

- **Develop Acceptance Test Plan** – The acceptance test plan should provide an overview of the system, as well as the specifics of the functions to be tested and how they will be tested. There are several software packages that assist in developing test plans and procedures best on the requirements defined in phase 1.

- **Develop/Deploy System** – This phase may be a one-time deployment for a small system or a phased deployment with various builds and prototypes for larger systems. Each time a "build" or substantial improvement of a system is deployed it should be tested in accordance with a documented acceptance test plan.

- **Test System** – This phase simply represents the testing of the system in accordance with the acceptance test plan. Testing should be done in the presence of both the system designers/deployers and the eventual system owners/operators. It is important that the actual end operators of the system are involved in its testing; hopefully they would have been involved much earlier in the process as well. Every pass/fail of the system should be thoroughly documented for each individual test procedure. There should be no, "oh, don't worry about that we will fix it later." If the system passes all critical tests then it may move to operational deployment with minor updates/fixes remaining. However, should the system fail a critical test then it will be necessary to reiterate the deployment process, possibly going back to design.

- **System Complete** - If the system passes all critical tests then it may move to operational deployment with minor updates/fixes remaining. However, should the system fail a critical test then it will be necessary to reiterate the deployment process, possibly going back to design.

7.8.2 Components of an Acceptance Test Plan

Acceptance test plans vary greatly in size and complexity. One might imagine that the extent of acceptance test plan developed for systems on board a nuclear submarine might dwarf the plans typically utilized in ITS deployments. An effective test plan might only be a few pages long if the system functions are simple or limited enough. In general, an acceptance test plan will include the following components:

- **Test Plan Identifier** – The test plan should be clearly identified and possibly numbered to separate it from other test plans. If all responsible parties have approved the test plan then this should be noted on the cover in clear view.

- **Background** – The test plan should outline the purpose of the plan, as well as provide an overview of the primary purpose of the system, its development background, and general scope. Any important reference materials should be noted.

- **Test Items** – The items or components of the system to be tested should be clearly identified.

- **Features to be Tested** – Features of the test items which will be tested should be clearly indicated.

- **Features Not to be Tested** – Features that will not be tested either through mutual agreement or testing constraints should be identified. Frequently, some features of a system may be the responsibility of an outside third party. Features falling into this category should be noted to avoid confusion and delays.

- **Testing Approach** – The test plan should indicate the general testing approach that will be utilized. For example, the testing approach may include the designer and the end operator siting down in front of a system workstation and stepping through a series of pre-defined test procedures. If the system is simple enough, the detailed testing procedures could be included in the acceptance test plan. In more complex systems, testing procedures are often outlined separately. This is because the acceptance test plan frequently serves as a tool for discussions with people not totally familiar with the system, while the procedures tend to require solid understanding of the system.

- **Item Pass/Fail Criteria** – The test plan should clearly note those criteria which would results in the system being or not being accepted. The system must pass all “pass” criteria for it to be accepted. This is critical as a system may have some minor “bugs” that should not preclude it from being accepted and becoming operational.

- **Suspension Criteria/Resumption Requirements** – In more complex test plans, various guidelines for stopping and restarting testing may be provided. In other words, "how messed up does the system have to be before you stop testing and attempt fixes."

- **Test Deliverables** – The test plan should list any deliverables that will be part of the testing process. For example, testing worksheets that outline procedures and whether or not the system features successfully pass these procedures.

- **Testing Tasks** – The test plan should outline the basic testing steps to be completed.

- **Environmental Needs** – Any environmental needs in order to complete the testing should be noted. This may include hardware, software, or special testing facilities.

- **Responsibilities** – It is critical that the test plan clearly define who is responsible (including the individuals) for testing and acceptance of test results once they are completed.

- **Staffing and Training Needs** – The acceptance test plan offers an excellent opportunity to document any staffing and/or training needs associated with either the testing or eventual deployment of the system. Often it is necessary to train staff in the use of a system prior to acceptance testing.

- **Schedule** – A general schedule of the testing tasks to be performed should be indicated. This is also important in assessing staffing commitments.

- **Risks and Contingencies** – Any special risks or contingencies should be documented.

- **Approvals** – The approval process and responsible parties should be clearly documented. Acceptance of the test plan by responsible parties should be indicated on the test plan itself.

Acceptance test plans are often overlooked in ITS deployments. However, they are an important part of establishing a common understanding between the designers/developers of a system and the operators/owners. This holds true even if the designers and the eventual operators are part of the same organization. With any new system there are bound to be "bugs." An acceptance test plan allows all involved parties to identify which "bugs" are acceptable and which "bugs" are not.

7.8.3 Suggestions for Levels of Acceptance Testing

Table 7.3 displays some suggested levels of acceptance testing for each of projects proposed in this Plan. These suggestions are based on the potential risks associated with each of the projects, as well as the level of complexity involved with the project as outlined in this Plan. Also involved in the determination of testing levels is whether or not a project contains mission critical functions/components. A mission critical function/component exists where the reliable operation of the function/component is critical to the effective operation of the overall system or job functions of those using the system. For example, an ATM at a bank is not a mission critical component, however the computer system and network that handles all of the banks electronic transactions is. Testing levels range from very-low to very-high and are generally defined as follows:

- **Very-Low** – Almost no testing is needed other than turning the system/devices on and ensuring that communications are operational. This level generally only applies to purchases of equipment or systems that are simple expansions on previous efforts. A formal test plan is not necessary, however testing criteria should be contained in the specifications or procurement documents.

- **Low** – The agency is familiar with the system/device and no new technologies are present. This represents either an expansion on an existing system or a very well established piece of equipment. A formal acceptance test plan may not be necessary, however testing criteria should be contained in the specifications or procurement documents.

- **Moderate** – The system/device represents a new system or major change to the operating agency. A simple yet specific formal test plan should be developed that includes testing and pass/fail criteria.

- **High** – The system/device represents either a complex new system or a new system with mission critical components. It is somewhat to largely unfamiliar to the operating agency. It performs functions that directly impact the safety of the public. A full test plan should be developed and followed.

- **Very-High** – The system/device has clear safety and mission critical applications. A full test plan should be developed providing very specific and comprehensive details on testing and pass/fail criteria. Mission critical components/functions should be clearly identified in the test plan, and the dependability of both primary and redundant systems should be proven.

Table 7.3: Suggested Acceptance Testing Levels for Valleywide Project

Projects	Very Low	Low	Moderate	High	Very High
1.0: Traffic/Freeway Management Systems					
1.1 Curve Warning System		●	●		
1.2 Changeable Message Signs at Key Decision Points		●	●		
1.3 Portable Changeable Message Sign Pool	Not Applicable				
1.4 Dynamic Alternate Route Signs		●	●		
1.5 Expansion of Caltrans Traffic Operations Systems (TOS)			●	●	
1.6 Commercial Vehicle Parking Management			●	●	
2.0: Incident Management/Emergency Services					
2.1 Alternate Route Plans Database/Website			●		
2.2 Incident Management Teams w/ Freeway Service Patrol (FSP) Equipment		●	●		
2.3 Integration of Incident/Traffic Communication Channels			●	●	
2.4 Integrated Surveillance Stations/Smart Callbox Deployment			●	●	
3.0: Transit Systems					
3.1 Computer Aided Dispatch Integration				●	●
3.2 Transit Management System Expansion or Completion		●	●		
3.3 Transit Information System		●	●		
3.4 Common Fare Equipment Deployment			●		
4.0: Transportation User Information Systems					
4.1 Regional Transportation Information System *			●		
4.2 Weather/ATMS Integration and Automation (w/ Paging System)			●	●	
4.3 Dynamic Speed Signing for Weather Conditions				●	●
4.4 National Park Traveler Information System			●		
4.5 Remote Advanced Traveler Information System Workstation			●	●	
4.6 In-Vehicle (FM Sub-carrier) Commercial Vehicle Traveler Information System			●	●	
4.7 Implementation of a 511 System for the Valley			●	●	
4.8 Truck Stop Traveler Information Demonstration			●	●	
4.9 Roadside Weather Information Stations (RWIS) w/ CCTV			●	●	
Program Area 5.0: Regional ITS Configuration Management/Coordination/Planning					
5.1 DEN/Communication Interties			●		
5.2 Common/Standard Regional/County Digital Mapping			●		
5.3 ITS Design Guidelines	Not Applicable				
5.4 Valley ITS Video	Not Applicable				

As displayed in Table 7.3, most of the projects rank in the moderate to high testing levels. This is because many of the projects represent multiple components or phases with varying levels of complexity. If the deployment of the projects occurs in phases or pieces then the testing level would vary based on the complexity and mission critical character of the phase being deployed. Agencies should attempt to error on the conservative side by providing for more than sufficient levels of testing.

7.9 Incident Management Considerations

Incident management is one area of ITS offering the potential for the "biggest bang for the buck." Incidents are the cause of an increasing percentage of annual vehicle delay and associated fuel consumption and vehicle emissions. The incident management and emergency service agencies in the San Joaquin Valley held a workshop in conjunction with a monthly TAC meeting to discuss incident management issues as part of the development of this Plan. It was agreed that the existing Incident Command System (ICS) was working as planned and that interagency cooperation was good. However, it was also agreed that additional benefits could be gained through the development of local urban area Incident Management/Safety Task Forces to further promote interagency cooperation and the development of needed communications and management tools. The remainder of this section focuses on general incident management considerations stemming from the meetings held during the development of this Plan.

For any incident management, system to operate at peak efficiency requires real-time direction of incidents. That requirement is best met by having access to the initial reports of the incidents, which are usually received by 911 operators in emergency agencies. If ITS system operators must rely on calls from other emergency operators to implement appropriate actions, valuable time is always lost. Emergency operators routinely answer multiple calls for roadway emergencies. Large incidents on heavily traveled roadways often generate 80 to over 100 calls from cellular callers.

The dispatchers must answer each call, verify the details, determine the location, and send emergency responders. They also have other calls and responses to deal with. It is unrealistic to expect them to make additional calls or generate e-mail to other agencies until time allows. If the emergency 911 dispatchers are tasked with operating the ITS System after hours as some areas have done, it will be accomplished only after all other actions are completed. Delays in implementation of ITS systems also occurs when police or other responders locate incidents on roadways. Even if they are fully aware of the need to notify the appropriate transportation agency, it is not a priority and may take up to 30 or more minutes.

Agencies responsible for 911 calls that have implemented Computer Aided Dispatch systems (CAD) hold the key to truly integrated use of ITS technology. By establishing a data sharing system which includes "Fire Walls" to eliminate the release of sensitive information, these agencies can help make ITS applications work at optimum level.

ITS incident management applications are successful when multiple agencies can take advantage of the technology to get information to other response agencies and the public in a timely manner. Real time data transfer from 911 operators, screened and distributed to the media, is the best system available today for keeping motorists informed. Sharing CAD data is one of the most critical projects in this plan.

Incident management of serious roadway emergencies always involves multiple agencies. At the very least, it involves police, fire, transportation and towing. During larger incidents, it may involve numerous other agencies. Communications, especially during the response phase, are relayed, delayed, and often inaccurate. Responders are sometimes dispatched to inappropriate locations in incomplete or inaccurate information. This can result in delayed arrival, unnecessary equipment being dispatched, and congested incident scenes with resources stopped on both sides of a freeway when the incident is on one side only.

The rural areas of San Joaquin Valley deal with delayed response due to weather and long distances on a regular basis. By improving the ability to communicate between the actual responders, the response time can be reduced and the probability that the right response equipment reaches the right location can be increased. Responder safety and accident victim care are both enhanced when responders are confident they know exactly where the incident is. Direct communications from the responder to responder reduces delays, increases accuracy, and allows for "on the fly" coordination to take place while enroute. Regardless if it is radio or cellular based, this project is important for response improvements.

Integration of weather and ATMS information will reduce the number and severity of accidents in inclement weather. By adding a variable speed limit to this system, accidents that do occur will have less severity than those experienced in the past. The severity level is often related to the disparity in speeds traveled by motorists on the same roadway. These systems are being used in Washington and Tennessee with positive results. Washington has experienced reduced injury accidents on Interstate 90 in the mountains east of Seattle since implementation of the variable speed limit. Tennessee has not experienced a large fog related collision since implementing the "Tennessee Fog System" on I-75. Major weather related collisions can cause extremely long delays, for exceeding delays associated with

normal roadway incidents. These systems are not used on a frequent basis, but whey they are used, they are exceptionally effective.

Remote surveillance has the ability to provide critical information to responders and help eliminate long term closures. Incidents involving hazardous materials haulers have closed roadways for 12 to 36 hours while specialist were flown and transported to the scene. On a recent incident, a major freeway closed for 16 hours. When the expert arrived, he directed the tow company to upright the tanker while it was still loaded. That same city recently experienced a similar overturned tanker and up-righted it within 2 hours of the time it occurred. They had the advantage of knowing what the expert would recommend based on the first incident. Had there been any doubts, another long closure would have occurred while they flew in an expert again.

The video project allows the transmission of images through the Internet to the key experts. This allows them to make a determination on recovery needs without the delay associated with bringing them to the scene. Clearance can then be accomplished for significantly faster restoration of traffic to normal conditions.

Sending images from the scene can also assist medical personnel with preparation for patients inbound from serious accidents. This system is currently being used by “Lifeline” in San Antonio, Texas with excellent results. Patient “Triage” by trauma center doctors in San Antonio allows them to give better guidance to the medical technicians at the scene for more effective patient care.

Finally, multiple agency response to crashes is not new. Institutional issues such as who is really in charge have caused concerns for years. Multiple agency training to improve performance is rarely held and improved management of these incidents is sporadic. Incident response teams are an excellent tool to improve all aspects of managing incidents.

During the implementation of ITS programs, these teams can be extremely helpful in achieving success. Input from these response agencies gives the system planners an understanding of the responders needs, their concerns, and their priorities. They can also provide valuable tips for specific ITS applications that will be most effective. The support of the team can also help achieve approval for the funding necessary to implement the programs.

8.0 Funding Element

8.1 Purpose

This Section provides useful funding information in a relatively simple and concise format.

The purpose of this Funding Element Section is to outline various funding opportunities and strategies for ITS deployment in the San Joaquin Valley. Significant local, State, and federal funding sources and processes are summarized and discussed in relation to ITS. Regardless of the project being considered, this Section provides useful funding information in a relatively simple and concise format. It may be used as a prelude to additional research and more detailed consideration of specific funding opportunities. Finally, this Section provides some insight into the anticipated availability of funds for ITS deployment efforts.

8.2 Basic Funding Principles

The ITS Technical Advisory Committee (TAC) has noted that obtaining adequate funding for ITS projects will be difficult given the limited pool of funds and the serious demands placed on those funds. Certainly, funding is perhaps the most critical element of the deployment process, as without funds no significant deployment activities can proceed. Obtaining funds for any particular transportation project has never been and never will be easy. There are a few principles in pursuing funds for ITS projects that should be considered by project sponsors and deployment champions.

- **There is No "Magic Funding Bullet"** – Some regions of the nation have started their ITS deployment efforts thinking that there is a sort of "magic bullet" that will provide additional federal funds for ITS deployment. This may well have been the case early in the development of ITS, however it no longer holds true. The current federal emphasis is on "mainstreaming" or incorporating ITS projects into the traditional transportation regional, state, and federal funding processes. Much of the new federal funds set aside for ITS in the Transportation Equity Act for the 21st Century (TEA-21) have already been earmarked by political interests. The remaining funding pool is relatively small, and will most likely go to research or very unique ITS deployment efforts. The lack of a magic bullet requires that the San Joaquin Valley take the more practical approach to obtain funding.

- **Funding is Political in Nature** – By virtue of our process of government, the general allocation of transportation funds is almost entirely in the hands of elected local, state, and federal representatives. This allows the public to have greater influence and control over the distribution of public funds. Specific budgets, project concepts, accounting processes, etc. may be managed by agency staff, but the allocation of funds almost always requires approval by political representative groups such as City Councils,

Boards of Directors, State Legislature, and the Congress and President of the United States.

This fact of political involvement in ITS funding and deployment is not news to anyone in the San Joaquin Valley, however the implications of this fact are easy to overlook. Many ITS projects have proceeded from concept to preliminary design with fully defined technical details and the strong support of agency staff, management, and even private interests, only to fall short in the political arena. It is not enough to promote ITS as a concept. Each type of ITS project must be promoted early with the appropriate representatives. The project sponsors and deployment champions should address the questions and concerns of the political arena early-on, but communication and coalition building are generally the key. At times it is useful for political representatives to tour ITS deployments in other areas, similar to the projects being proposed within the Region. First hand experience on the part of the representatives is often crucial to gaining the necessary political support. FHWA has supported these types of tours in the past by paying for travel costs, and the Region should look for these types of opportunities. Additional details on working with the political arena are discussed in Section 9.0.

- **Define Projects to Involve Multiple Jurisdictions** – Building on the principle that funding is political in nature, it is important to maximize perhaps the greatest benefit of ITS projects. That is that ITS projects can be deployed within multiple jurisdictions with relative ease. Roadway resurfacing, construction projects, sidewalk improvements, etc. generally only benefit a small area of the Region at any one time. This can limit political and community support where compromises must often be struck between political representatives in order to reach agreement. Including multiple jurisdictions in ITS deployment efforts provides the dual benefits of enhanced coordination between the jurisdictions and can help to move the project from a quid-pro-quo amongst representatives to a situation of common agreement. In order to best utilize this principle it is important that agency staff and management pass on information on the importance and the benefits of the project to their respective representatives.

- **Persistence is the Key to Obtaining Funds** – Obtaining funds is often a “hit and miss” activity. Sometime project sponsors and deployment champions get into the rut of thinking that only one particular type of funds may be applied to a specific type of ITS project. This is never the case, as most funding sources are open to many types of projects. The key is identifying all of those funding sources that may be available. After a thorough review of numerous funding sources, and a great deal of effort, proponents of the Alameda Corridor project in the Los Angeles area secured a

funding portfolio including 15 different federal, state, regional, local, and private funding sources. While ITS projects in the San Joaquin Valley are not likely to require such a large array of funding sources, the basic principle of persistency and broad thinking hold true. Many funding sources may be utilized for ITS purposes, but may not have traditionally been used by the Region for ITS purposes. This does not mean that ITS projects cannot attempt to use these funds, and the Region may find that in some cases ITS projects may be more important to the community than the more traditional ones.

- **ITS Projects Do Not Compete with Traditional Transportation Projects for Funds** – A common perception by many agencies and politicians is that ITS projects compete with traditional transportation projects for funds. This should not be the case if the deployment of ITS is approached in the appropriate manner. The need to better manage our transportation network as communities grow and travel demands increase is well accepted by the transportation profession and political representatives. ITS should be viewed as simply one of the many components that should be included in the expansion and improved management of the transportation network. Freeways are not constructed without striping, protective barriers, and signage. Major arterials are not built without traffic signals at appropriate locations. If deployed along with traditional transportation projects the incremental costs of ITS are very small. To act on this principle it is essential that ITS be considered in the design and construction/procurement of traditional transportation infrastructure. The deployment of ITS on existing facilities can be viewed as retrofitting and updating the facilities to current standards. The basic premise behind this principle is that,"how you operate a transportation facility is just as important, if not more so, than how you construct it."

- **Mainstreaming ITS is Critical** – ITS should be incorporated into the regional transportation planning and programming process. This will speed its acceptance as simply another tool for dealing with transportation problems, and will promote its visibility to public officials and the community. The presence of ITS projects in the mainstream programming and funding process also assists in obtaining outside funding sources. For example, it may be easier to obtain special federal or State funds for some needed system or integration component if some of the related infrastructure components are already programmed through the traditional funding processes. Acting on this principle requires that ITS be incorporated into the Regional Transportation Plan (RTP). At first, ITS may appear as a separate section in the RTP, however, the goal should be to eventually integrate into the RTP as a simple series of projects or as pieces of more traditional projects. This effort is beginning in the Valley with this project and the development of a Valleywide RTP ITS element.

- **Funding Can Be Pooled/Managed** – ITS projects often supply benefits to many different transportation modes and geographic areas. This allows them to utilize many different funding sources. It is not uncommon for a larger ITS deployment to utilize funds from many different sources with a diverse set of requirements. This often requires extra effort on the part of the sponsoring agencies to effectively manage the funds. Timing, funding amounts, restrictions, local funding matches must all be carefully planned and considered. Most importantly, the search for ITS project funds should not stop until the project is fully funded.

- **Public/Private Partnerships Are Complex Undertakings** – Partnerships between public and private interests in ITS deployments can offer some excellent opportunities and benefits to both groups. However, the development of these partnerships is often difficult and time consuming, and they are only applicable under the right conditions. Private interests sometimes view the public sector as being fraught with politics and red-tape which are insensitive to their profit potential. Public interests sometimes see the private sector as insensitive to community interests and the long-range goals of the Region. Public and private interests can come together if all parties involved expect to both bring something to and take something away from the table. At their most fundamental level, partnerships are about self-interest. It is not fair for the public sector to expect the private sector to forfeit its profit, and conversely it is not fair for the private sector to expect the public sector to assume all the risk. Broad assessments of the public and private sectors willingness to accept risk are generally erroneous. Public/private partnership considerations are addressed later in this Section, as well as in Section 9.0. In order for a public/private partnership to work successful, each party should be able to clearly define their benefits arising from the partnership.

8.3 Recommendations for Strategic Positioning for Funds

The regional deployment of ITS is a long-term effort, and the Region should take the efforts to position ITS for long-term funding sources. No funding opportunities should go unexplored, and the Valley COG's should act as an information resource to the Region on the timelines, requirements, and procedures relating to these funding opportunities. From the long-range perspective, the Region should position ITS projects within the following efforts:

- San Joaquin Valley COG Member Agencies Long Range Transportation Planning (City, County, etc.)
- San Joaquin Valley Regional Transportation Plans (RTP)

- Future Federal Transportation Funding Legislation (Reauthorization of TEA-21)
- State of California's Statewide Transportation Plan (STP)
- California Transportation Commission (CTC) Annual Report to the Legislature
- Regional Transportation Improvement Program (TIP)
- State Transportation Improvement Program (STIP)
- Future County Measure Expenditure Plans (if applicable)

8.3.1 Regional Transportation Plan & Regional Transportation Improvement Program

The RTP should include appropriate sections or information to ensure that ITS projects are addressed both in terms of their potential benefits to the transportation network in the Region, as well as in terms of their costs. Different regions have used different approaches to the inclusion of ITS into their RTP's. Some regions simply include a special ITS section, while others have directly incorporated ITS into more traditional infrastructure projects.

The concept suggested for the San Joaquin Valley is to provide a section of the RTP to discuss regional integration systems that focus on improving communications and operations between agencies. These projects are somewhat unique and may require additional explanation and a somewhat different treatment from traditional projects.

For ITS infrastructure projects including field devices and communications, it is important to include at least some of these projects with the appropriate traditional infrastructure projects. For example, if the RTP includes a project for 2 miles of new freeway, then the appropriate communications and ITS field devices should be included as a part of the freeway project. The RTP should focus on the air quality, economic, safety, and congestion relief benefits of ITS projects. Inclusion of ITS projects into the RTP is the first step to mainstreaming ITS, and is critical to a successful regional ITS deployment effort.

The TIP, Regional Transportation Improvement Program, is largely a project programming effort. Similar to the RTP, it is critical that ITS projects work their way into the TIP, and eventually the STIP, in order to ensure a successful regional ITS deployment program. ITS may work its way into the TIP either as separate projects or as components of larger infrastructure projects.

8.3.2 State Transportation Improvement Program & State Highway Operation and Protection Program

Based on SB45, discretionary funds are available at the State level through Caltrans and the California Transportation Commission (CTC). The Valley represents the most important freight and agricultural corridor in the State. If the entire Valley provides an integrated ITS project for interregional discretionary funds there is the potential that some of these funds could be tapped. If these discretionary funds are pursued it will be important that the Region present a coordinate effort and provide the CTC with a clear understanding of the benefits related to the proposed projects.

Over the past couple of years SHOPP has become of increasing importance in funding ITS efforts. Application and utilization of SHOPP funds requires close coordination and cooperation with Caltrans Districts, as well as Caltrans Headquarters. Caltrans programs SHOPP funds in the STIP and is responsible for administering the program.

8.4 Types of Public/Private Partnerships

The feasibility of private capital or public-private revenue/cost sharing arrangements is a function of the market and whether the public sector has anything to offer in terms of either creating, enhancing or providing access to that market. If the market is not there, or if the private sector can accomplish its goals without public sector involvement then partnering arrangements are unlikely to prove feasible or productive.

Potential public-private partnerships fall into three broad categories:

- **Privatization of Public Sector Functions** - In this kind of partnership, the public sector's resource is its legal authority over certain types of activities. It exercises that authority by granting to the private sector, either by lease, license, franchise or outright sale, the right to engage in certain activities. The private sector uses its own capital to provide the service. This kind of partnering arrangement works only if there is a consumer market (current or potential) which is sufficient to make the activity profitable. In other words, the value of the public agency's authority is directly a function of the market to which the granting of that authority provides access.

- **Joint Ownership** - Any arrangement falls into this category if it involves the sharing of responsibility and benefits of owning and operating a facility or service. How the costs, risks and rewards are shared is entirely dependent on the objectives and capabilities of the partners. It is determined by negotiations and cannot be determined in advance. In this kind of partnering arrangement,

financial resources from the public sector, private capital markets and the consumer may all be part of the effort.

- **Innovative Institutional Arrangements** – In this category, any number of other arrangements short of joint ownership are possible. These include: functional division of responsibilities; public/private consortia under the auspices of a public agency; and a variety of cost-sharing arrangements, including direct and indirect payments, in-kind contributions, revenue sharing, and cession of future property rights.

As noted above, the feasibility and potential for revenue generation of public-private partnerships depends on a myriad of factors, including: policies and priorities of the parties, their respective fiscal resources and risk preferences, the existence and strength of a market, and a host of legal, policy, contractual, project structure and technology issues. In the context of the ITS deployment efforts in the San Joaquin Valley, these factors will seriously limit the potential for public/private partnerships. Partnership opportunities involving the Region are far more likely to arise out of statewide or valleywide efforts, however some potential does exist within the Region for small scale partnerships as discussed in Section 9.0.

8.5 Local, Regional, State, and Federal Funding Opportunities

Based on other Strategic Deployment Plans throughout Southern California, as well as input from the Valley COG's, the following series of tables outline many of the funding sources available for application in ITS projects. Tables are divided into local, regional, State, and federal sources, as follows:

- Local funding sources (Table 8.1)
- Regional funding sources (Table 8.2)
- State funding sources (Table 8.3)
- Federal funding sources (Table 8.4)
- Federal funding sources specific to ITS (Table 8.5)

8.5.1 Local Funding Sources

Local Motor Vehicle Registration Fees – Funds accumulated from vehicle registration fees collected in the Air Basins will be distributed by the Air Quality Management District (AQMD)or Air Pollution Control District (APCD). According to legislation, any local project with a direct improvement on air quality may compete for these revenues. With a direct relationship between air quality improvements and traffic management, some of the ITS programs should qualify for these funds. To date, Travel Demand Management (TDM) programs have received the majority of funds from the AQMD/APCD.

Table 8.1: Local Funding Sources

Funding Source	Approximate Amount Available	Eligible Uses	Who Allocates	Other Comments
1. Measure C Program (Fresno)	$37.5 million annually	All multimodal transportation projects in the Region.	County Transportation Authority	Current sales tax sunsets in 2006-7. It is hoped that voters will choose to renew this important transportation funding resource.
2. Measure A (Madera)	$4.8 million annually	All multimodal transportation projects in the Region.	County Transportation Authority	Current sales tax sunsets in 2005. It is hoped that voters will choose to renew this important transportation funding resource.
3. Measure K (San Joaquin Co.)	$36.75 million annually	All multimodal transportation projects in region	County Transportation Authority	Current sales tax sunsets in 2010. It is hoped that voters will choose to renew this important transportation funding resource.
4. Fare Box Revenues	Typically 20% to 50% of operating budget.	Transit capital and operating costs. Must be reflected in transit operators' Short Range Transportation Plans (SRTPs).	Transit operators	

Table 8.2: Regional Funding Sources

Funding Source	Approximate Amount Available	Eligible Uses	Who Allocates	Other Comments
1. Regional Improvement Program (SB45 "Regional Choice Program") **(75% of SB45)**	$3.467 billion in 1998 STIP Statewide $10.5 million for Region	75% of the funds under SB 45 go to the Regional Improvement Program for a variety of uses including roads, buses, rail, and pedestrian and bicycle facilities.	Regional Transportation Planning Agency	Program replaces county minimum methodology.
2. AB2766	$500,000 annually	Projects which produce quantifiable emission reductions	SJVAPCD allocates to cities and counties within SJVAPCD area on a per capita basis.	

Table 8.3: State Funding Sources

Funding Source	Approximate Amount Available	Eligible Uses	Who Allocates	Other Comments
1. SB 45 STIP Reform (County Transportation Improvement Program, CTIP) : $4.623 billion in 1998 STIP (FY98 - FY04) This legislation consolidated a number of state and federal funding streams into two new programs -- 75% of the funds go to the Regional Improvement Program and 25% of the funds go to the Interregional Improvement State Discretionary program. ***State*** programs that were consolidated and eliminated include the Flexible Congestion Relief Program, Traffic Systems Management (TSM) and TSM Match, Transit Capital Improvement (TCI), Urban and Commuter Rail, Interregional Roads, Intercity Rail, Retrofit Soundwalls, and State and Local Transportation Partnership Program (SLTPP). ***State and Federal*** programs not consolidated into the SB 45 programs are: expenditures for administration of Caltrans; maintenance and operation of the state highway system; rehabilitation of the state highway system; or local assistance programs required by state or federal law or regulations, including, but not limited to, railroad grade crossing maintenance, bicycle lane account, congestion mitigation and air quality, regional surface transportation programs, local highway bridge replacement and rehabilitation, local seismic retrofit, local hazard elimination and safety, local federal demonstration projects, and local emergency relief. [See §163 and 164 of the Streets and Highways Code.] Because all the new SB 45 funds mix federal Transportation Enhancements Activities (TEA) funding as part of their revenue stream, each program has a portion of funds that are restricted to TEA activities. This is discussed under the TEA program in the section on federal funds.				
1. Interregional Improvement State Discretionary Program **(25% of SB45 – see Regional funds)**	(40%) $565 million in 1998 STIP	Any projects which facilitate the movement of goods and people.	Caltrans nominates projects in the Interregional Transportation Improvement Program (ITIP) which is approved by the CTC.	Funds are subject to 40%/60% North/South split.
	(60%) $693 million in 1998 STIP	Interregional road and rail, *outside* urbanized areas. with a minimum of 15% of this fund (the 60%) for rail and grade separation projects.	(See above)	These funds are not subject to the North/South split.
2. Article XIX	Permits up to 25% of state gas tax revenues to be spent on fixed guideway projects.	Previously funded under Transit Capital Improvement and Flexible Congestion Relief, now under SB 45 funds.	CTC	
3. State Transportation Development Act (TDA)				
3.a. Article 3	N/A	Bicycle and pedestrian facilities.	COG pass-thru to local agencies	
3.b. Article 4	N/A	Bus capital and operating costs for municipal operators, transit authorities, joint powers authorities.	COG pass-thru to local agencies	
3.c. Article 8	N/A	Transit and paratransit programs which fill unmet needs.	COG pass-thru to local agencies.	

Table 8.3: State Funding Sources

Funding Source	Approximate Amount Available	Eligible Uses	Who Allocates	Other Comments
4. Public Transit Account (PTA): SB 45 changed name from Transportation Planning and Development to PTA.				
4.a. State PTA Funds (50%)	Funds are currently over committed and CTC anticipates a $47 million shortfall by FY04.	State transit programs, intercity bus/rail service and rideshare programs	CTC	
4.b. State Transit Assistance (STA) (50%)	$1.02 million annually for Region	For public transit capital and operations.	Pro-rata allocation	Transit projects or operations must be consistent with the Short Range Transportation Transit Plan and the Short Range Transportation Improvement Program.
5. State PUC Grade Separation Project Fund	$15 million/year (Statewide)	Funds to modify existing or build new railroad/ roadway crossings.	State PUC prioritizes list of projects to be funded.	Railroads required to provide 10% match for grade separations built at existing railroad/roadway crossings. Localities also must provide a 10% match.
6. State Highway Operation & Protection Program (SHOPP)	$2.4 million annually for Region	Capital funds for state highway rehabilitation, operation, safety, other improvements to maintain system integrity.	Caltrans	Caltrans programs these projects in the STIP and administers the program.
7. Environmental Enhancement and Mitigation (EEM)	$10 million (Statewide)	To mitigate the effects of transportation projects on the environment.	State Resources Agency ranks projects and CTC selects them.	Projects must entail environmental mitigation over and above that required in environmental documents (e.g. EA, EIR).
8. Budget Change Proposal Funds	TBD	Funds for the Freeway Tow Service Patrol (FTSP)	Caltrans, CHP	Caltrans Headquarters allocates to Caltrans District 6, which passes them through to COG's.
9. State Infrastructure Bank (SIB)/ Transportation Finance Bank (TFB)	Up to $100 million total credit (Statewide)	Toll roads, intermodal corridor improvements, rail transit construction, enhancements to existing facilities.	Caltrans,CTC,California Economic Development Finance Authority (CEDFA)	Application and selection processes are under development.
10. State Gas Tax and Motor Vehicle Fee Subventions **(Section 2105, 2106, 2107, 2107.5)**	$267 million/year (Statewide) $20 million annually for Region	Direct subvention for local streets and roads purposes	Pro-rata allocation by RTPA to member agencies	
11. Petroleum Violation Escrow Account (PVEA)	Funds are allocated to states by the Federal government. Projects require specific state legislation.	Energy conservation projects and programs that result in energy savings and/or displaced or non-renewable fuels.	State legislature	

Table 8.4: Federal Funding Sources (TEA-21)

Funding Source	Approximate Amount Available	Eligible Uses	Who Allocates	Other Comments
Federal Highway Program				
1. National Highway System (NHS)	Approx. $441.7 million per year FY98-03 (Statewide)	NHS projects; up to 50% may be shifted to STP.	Programmed by the CTC through the STIP process.	TEA-21 clarifies that funds **may be spent on infrastructure based ITS,** publicly owned bus terminals, and natural habitat mitigation.
1.a. Interstate Maintenance Program	Approx. $344.2 million per year FY98-03 (Statewide)	Maintenance and reconstruction on Interstate routes.	CTC, Caltrans through the STIP process.	Under TEA-21, the IM program is technically a sub-program of NHS. The legislation allows states with unused Interstate Construction authorization to transfer the funds to their IM account.
2. Surface Transportation Program (STP): $535.4 million per year FY98-03 (Statewide); Program is divided into 4 subcategories, 10% Safety programs, 10% Transportation Enhancements (TEA), 50% Regional STP (STP 110% guarantee program and rural areas guarantee program), and 30% State Discretionary funds.				
2.a. Safety Projects (10%)	10% of Statewide STP funds	Highway safety projects.	Caltrans	Funds are included in the STIP but not called out as separate program.
2.b Transportation Enhancement Activities (TEA) (10%)	$1.2 million annually in the Region	Funds improvements which beautify or enhance transportation projects and make them more environmentally or community "friendly."	Regional competitive bid process	Since federal TEA funds are blended into both SB 45 funding programs, a percentage of Regional Improvement Program funds as well as a portion of Interregional Program funds are restricted to TEA projects.
2.c. Regional suballocations (50%)	$5.9 million annually in the Region	Highway, transit, multi-modal, and intermodal projects.	Regional competitive bid process	Eligibility under the regional and statewide discretionary STP has been broadened to include additional environmental provisions, **ITS capital improvement projects**, intercity bus terminals and facilities, etc.
2.d. State Discretionary STP funds (30%)	Approx. $160.6 million per year FY 98-03 (Statewide)	Highway, transit, multi-modal, and intermodal projects.	Included as part of SB 45 CTIP funding.	See above.
3. Congestion Mitigation & Air Quality (CMAQ)	Approx. $277.4 million per year FY 98-03 (Statewide) $6.5 million annually	Projects to improve air quality. **Funds may be spent on ITS strategies that improve traffic flow.**	Regional competitive bid process	TEA-21 broadens CMAQ eligibility from only non-attainment areas to both non-attainment areas and maintenance areas. Also, a State may transfer up to 50% of its increase in CMAQ funds to other federal aid programs for projects in maintenance or non-attainment areas.

Table 8.4: Federal Funding Sources (TEA-21)

Funding Source	Approximate Amount Available	Eligible Uses	Who Allocates	Other Comments
4. Highway Bridge Rehabilitation and Replacement (HBRR) Program	Approx. $260.8 million per year FY98-03 (Statewide)	Funds for 7 project categories: (1) Seismic Retrofit; (2) Replacement Projects; (3) Rehabilitation Projects; (4) Bridge Painting; (5) Low Water Crossings; (6) Barrier Rail Replacement; (7) Special Bridge Program	Local Caltrans Office (Districts 6 and 10)	Districts 6 and 10 creates list of projects and forwards to Caltrans Headquarters for approval; Seismic Retrofit requirements are the top priority for funds.
5. Minimum Guarantee Program	Approx. $348.7 million per year FY98-03 (Statewide)	Funds are distributed among the program listed above. 50% of the funds are administered as though they were STP. The rest are divided among IM, NHS, Bridge, CMAQ and STP based on share for each program under the regular formula allocations.	See relevant program.	TEA-21 added the minimum allocation program to ensure that each State received at least a 90.5% return on each dollar put into the Highway Trust Fund. The funding for the Minimum Allocation program is listed separately from the other programs even though it is incorporated into their funding streams.
6. Federal Lands Highways Program	$4.1 billion FY98-03 (Nationally); No formula amount -- allocations made on a need basis.	Indian reservation roads; parkways and park roads; public and federal lands highways.	FHWA; Caltrans	
7. High Priority Projects	$153.7 million per year FY98-03 (Statewide)	Highway, transit, intermodal, and other projects.	Congress	TEA-21 designated 1,850 projects as high priority projects to receive earmarked demonstration grant funds.
Federal Transit Program				
8. Section 5307 (9) Formula Grant Program	$5.2 million annually for the Region	Bus capital and operations	As per grant	
9. Section 5311 (18) Rural Program	$200,000 annually for the Region	Rural transit purposes.	Caltrans	Capital/operating assistance for areas under 50,000 population
10. Section 5310 [16(b)(2)] Paratransit Vehicles	NA	Transportation for elderly and disabled persons.	Statewide competitive bid process	In California, funds are restricted to capital purchases only.
11. Section 5309 Discretionary				
11.a. New Starts	$6.1 billion in TEA-21 FY98-03 (Nationwide)		Congress (via earmarks); FTA	
11.b. Fixed Guideway Modernization	NA to Region			

Table 8.4: Federal Funding Sources (TEA-21)

Funding Source	Approximate Amount Available	Eligible Uses	Who Allocates	Other Comments
11.c. Bus & Other	$3 billion in TEA-21 FY98-03 (Nationwide)		FTA, or Congress (via earmarks)	TEA-21 created several new subcategories for this grant program, including projects using fuel cell technology, and other clean fuels.
12. Transit Planning & Research Program	Over $600 million in TEA-21 FY98-03 (Nationwide)	Specified transit-related research activities and programs.	FTA; TCRP Board.	45% subvened to MPOs for regional planning (see Regional Sources).
Selected Other TEA-21 Programs				
13. MAGLEV Deployment Program	$60 million in TEA-21 FY 99-02 $950 million in TEA-21 is authorized from FY 98-03, but must be appropriated.	To fund nationally significant projects testing the feasibility and safety of MAGLEV technologies.	US Department of Transportation (USDOT)	STP and CMAQ funds may also be used for developing MAGLEV technology.
14. Welfare to Work Program	$400 million in TEA-21 for FY 99-03 out of the Highway Trust Fund; $350 million can be appropriated.	To develop transportation services to move welfare recipients to jobs; and to develop transportation services for residents of urban areas to commute to suburban areas where there are employment opportunities.	USDOT	
15. National Corridor Planning and Border Infrastructure Programs	$700 million in TEA-21 for FY 99-03 $30 million available for law enforcement needs in border States	For coordinated planning, design and construction of corridors for international and interregional trade; specific corridors are identified in ISTEA. And for improving the infrastructure along the US/Mexico, US/Canada border.	USDOT/Congress	
16. Recreational Trails Program	Approx. $3.1 million in TEA-21 for FY 98-03 (Statewide)	To provide and maintain recreational trails. 30% for motorized use; 30% for non-motorized and 40% for diverse trail uses.	Caltrans	
17.National Scenic Byways	$148 million in TEA-21 for FY 99-03	Developing National Scenic Byways Programs	USDOT	
18. Transportation and Community and System Preservation Pilot	$120 million in TEA 21 for FY 99-03	Demonstration grants to plan and implement strategies which improve the efficiency of the transportation system, reduce the environmental impacts of transportation, etc.	USDOT	

Table 8.5: Specific ITS Funding Sources in TEA-21

Funding Source	Approximate Amount Available	Eligible Uses	Who Allocates	Other Comments
1. Research and Technology: This part of the TEA-21 legislation is broken down generally into three categories: Surface Transportation Research, Technology Deployment and Training and Education. The first two programs are listed below. Training and Education is to be provided through the National Highway Institute, and through funds that States may set aside to fund training.				
1.a.Surface Transportation Research	$592 million for FY 98-03 (Nationwide) 50/50 match for collaborative research and development projects.	Research, development and technology transfer activities for motor carrier transportation and all phases of transportation planning and development activities.	FHWA	Funds are set aside under this program for: Advanced Research (long term, high risk), Surface Transportation-Environment Cooperative Research, Advanced Vehicle Technologies, Long-Term Pavement Performance program, the Seismic Research Program, and the International Highway Program also continue to be funded.
1.b. Technology Deployment	$250 million for FY 98-03 (Nationwide) Note: Preference shall be given to projects that leverage significant public and private resources.	Projects that stimulate advances in transportation technology and promote the rapid deployment of such technology based on 5 goals to be determined by the Secretary.	FHWA	There is a separate program specifically for Innovative Bridge Research and Construction that applies innovative material technology to the construction of bridges.
1.c. Training and Education	$90 million for FY 98-03 (Nationwide) - National Highway Institute receives $39 million over 6 years. - Local Technical Assistance Program (LTAP) receives $51 million over 6 years.	Training and education of local, state and federal officials as well as private contractors about a range of transportation issues. Also, to provide technical assistance to transportation agencies about how to effectively address transportation problems.	USDOT	
2. Intelligent Transportation Systems: $1.2 billion is provided for FYs 98-03 to fund the Intelligent Transportation Systems (ITS) programs. Of this amount $603 million is for research, training and the development of National Standards. The legislation requires the USDOT to issue "critical" National ITS Standards by June 1, 1999 with all standards completed by January 1, 2001. Applications for funds for ITS projects under any funding category will not be approved unless the project is in conformance with the national standards.				
2.a. ITS Integration Program	$482 million in FY 98-03 (Nationwide)	Projects that accelerate the integration and inter-operability of intelligent transportation systems in metropolitan and rural areas.	FHWA	In any fiscal year, no more than $15 million may be used for projects in a single metropolitan area, and not more than $2 million in a single rural area. Not more than $35 million may be used for projects in a State.

Table 8.5: Specific ITS Funding Sources in TEA-21

Funding Source	Approximate Amount Available	Eligible Uses	Who Allocates	Other Comments
2.b. Commercial Vehicle ITS Deployment	$184 million in FY 98-03 (Nationwide) Federal funds made available under this source must be matched 50/50. Total federal funds for a project in this program must not exceed 80% of total costs.	Deployment of ITS programs that improve the safety and productivity of commercial vehicles, and reduce costs associated with commercial vehicle operations and federal and state regulatory requirements.	FHWA	A number of priorities are listed for projects that can receive funding; however, one of the key priorities is that the project address inter-state and international commercial vehicle operations issues.
2.a. ITS Integration Program	$482 million in FY 98-03 (Nationwide)	Projects that accelerate the integration and inter-operability of intelligent transportation systems in metropolitan and rural areas.	FHWA	In any fiscal year, no more than $15 million may be used for projects in a single metropolitan area, and not more than $2 million in a single rural area. Not more than $35 million may be used for projects in a State.

Development Fees (Transportation Impact Fees) – Agencies can supplement funding sources through various forms of development contributions. This may include the provision of specific signal system improvements as mitigation to proposed development and/or the inclusion of signal system improvements in a formally adopted traffic impact fee program.

Transportation Control Measures (TCM) Program – The development of a TCM program is part of a statewide effort to comply with provisions of the 1988 California Clean Air Act. A TCM program, combined with planned actions by the State Air Resources Board, is designed to achieve the following goals by the year 2000:

- Reduction in automobile fuel consumption by 8%
- Reduction in peak period congestion by 30%
- Lowering of vehicle emissions by 35%

8.5.2 Regional Funding Sources

Regional funding sources are extremely limited, but special funding from air quality district or California Public Utilities Commission (PUC) for ITS projects with area wide benefits is available. Most likely, the regions planning agencies will join forces through MOU's to obtain funding for a Multijurisdictional Project or program.

8.5.3 STATE FUNDING SOURCES

Flexible Congestion Relief (FCR) – In order for a project to receive funds from this source, the COG must typically have nominated the project. The project must prove that it contributes some type of measurable operational improvements and helps to avoid or reduce congestion on existing routes. The defined project must be consistent with the State Transportation Improvement Program (STIP).

Proposition 111 Gas Tax – These funds, automatically administered through the COG, are available to local agencies in the form of turnback funds.

8.5.4 Federal ITS Funding Sources

There are no large, dedicated ITS funding programs to support wide-scale local implementation of ITS. For the most part, deployment of local ITS infrastructure, such as traffic signal controllers and changeable message signs, must compete with "traditional" or non-ITS projects for funding under "traditional" funding programs, such as the Surface Transportation Program. Fortunately, the funding levels of these traditional programs have been increased under the current federal transportation legislation, TEA-21. Unfortunately, since most areas have a "waiting list" of unfunded transportation projects, there will be stiff competition for the extra funds.

There are some dedicated federal ITS funds, however, they are not sufficient to fund major local infrastructure deployments, both due to the modest size of the programs—funding levels are far less than necessary to meet demands nationwide—and because use of the funds is restricted to certain activities and areas.

The sections below summarize both the ITS-dedicated and the non-dedicated but ITS eligible funding programs under TEA-21.

8.5.4.1 Dedicated ITS Funding Programs

The Intelligent Transportation Systems Act of 1998 (the provisions of TEA-21 that define the ITS program) is divided into two primary sections. The first is ITS Deployment and the second is ITS Research and Development. This structure reflects the fundamental shift away from a research and development (R&D) program, to one more balanced between R&D and infrastructure deployment. Table 8.6 lists the dedicated federal ITS funding programs.

Just over $100 million per year is available during TEA-21's 6-year life. In addition, TEA-21 has created an ITS Deployment category which provides an additional $113 million per year for implementation of ITS projects. However, "earmarking," or the practice of funding to specific projects at the suggestion of members of Congress, has had a significant impact on the availability of these funds. (Practically all of the FY 1998 and FY 1999 Deployment allocation is being used for "earmarked" projects.) The minimum, non-local matching share under these programs is 20 percent. Furthermore, since there is no state-by-state allocation of ITS funds, competition for these limited funds will require local congressional support (i.e., "earmarking") or a larger state matching percentage—up to 50/50 match as envisioned by the FHWA.

Table 8.6: Dedicated Federal ITS Funding

ITS Program Funding ($ in millions)							
Year	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**Total**
R&D	95	95	98	100	105	110	603
Deployment	101	105	113	118	120	122	679
Total	196	200	211	218	225	232	1,282

ITS Research and Development

The R&D portion of the ITS program encompasses all other aspects of the program not included under Deployment. This includes funding of early deployment plans, the Intelligent Vehicle Initiative, as well as research on metropolitan travel management, rural ITS services, advanced public transportation systems, and commercial vehicle applications. This portion also includes program support activities, including continued maintenance and expansion of the National ITS

Architecture, development and testing of ITS standards, and providing technical assistance and training.

ITS Deployment

The purpose of the ITS Deployment section of TEA-21 is to fund small incentive grants to states and local governments to deploy integrated intelligent transportation systems through two ways: the ITS Integration Program and Commercial Vehicle ITS Infrastructure Deployment.

ITS Integration Program

The purpose of the ITS Integration Program is to accelerate the integration and interoperability of intelligent transportation systems in metropolitan and rural areas through small funding incentives. TEA-21 directs between $74 and $85 million per year over its 6-year life. It also stipulates that at least 10 percent of these funds will be directed toward rural areas. In metropolitan areas, the money may be used only for integrating existing — or legacy — systems, or integrating new systems funded from other sources e.g., traffic signal systems, preemption systems, etc. Deployment of ITS infrastructure components is not eligible for urban projects. In rural areas, the money may be used for integrating legacy systems, as well as for deploying new ITS infrastructure components.

TEA-21 lists several requirements for project funding under the Integration Program. Projects must:

- Contribute to national deployment goals and objectives;
- Demonstrate strong commitment among stakeholders;
- Maximize private sector involvement;
- Demonstrate conformity to the National ITS Architecture and use approved ITS standards and protocols;
- Be included in statewide or metropolitan transportation plans;
- Ensure continued long-term operations and maintenance; and
- Demonstrate that personnel have necessary technical skills.

Because these guidelines are relatively new and fairly broad, a wide range of projects could qualify for funding. Examples of such projects would be expanding an existing traffic signal system to include transit vehicle priority preemption, or providing freeway surveillance data to local agencies for use in new or existing traveler information systems.

For an individual project, the federal cost share from the ITS Integration program is not to exceed 50 percent, and the federal share from all sources (such as regular federal aid) is not to exceed 80 percent.

Commercial Vehicle ITS Infrastructure Deployment

TEA-21 seeks to advance the technological capability and promote the deployment of ITS applications to commercial vehicle operations. The program's goals are to improve the safety and productivity of commercial vehicles and drivers, and to reduce costs associated with operating and regulating commercial vehicles in the United States. These goals will be met by directing project funds toward the Commercial Vehicle Information Systems and Networks, or CVISN, infrastructure. The CVISN infrastructure will enable states to provide:

- Automated roadside inspections that target unsafe carriers;
- Automated vehicle screening and weighing at international border crossings and weigh stations; and
- Electronic credentialing and automated tax reporting and filing.

TEA-21 sets the goal for the CVISN infrastructure to be deployed in a majority of States by September 30, 2003. Similar to the requirements of the Integration Program, for individual projects, the Federal cost share from ITS program funds is not to exceed fifty percent, and the Federal share from all sources is not to exceed eighty percent.

8.5.4.2 Non-Dedicated ITS Funding Programs

With TEA-21, as was the case with ISTEA, the major sources of funding for ITS-related projects are the Federal-aid highway programs and the Federal Transit Administration programs. Funding for ITS projects is obtained through the same local programming as "traditional" projects. Once the project request is received, it is reviewed for applicability under the various funding programs by state and local officials and prioritized along with all other requested projects.

There are six specific areas of TEA-21 that may be utilized to access over $122 billion for project implementation. In every case except for the FTA 5307 program, toll revenue credits may be used as the local match share for these funds. (Toll revenue credits represent the cost to the operator of an interstate toll road for system maintenance. No toll revenue is actually transferred to FHWA. Rather, a portion of the annual maintenance and authorized capital cost of the facility is eligible to be used as matching funds. The use of Toll Revenue Credits must have the approval of the State D.O.T.).

ITS Operations and Maintenance Funds

Operations and maintenance (O&M) funding is a particular concern for many jurisdictions, so it's important to specifically clarify the use of federal funds for these purposes. In the case of National Highway System and Surface Transportation Program funds, funds may be used indefinitely (through the life of TEA-21) for ITS operations and maintenance assuming that the ITS project itself satisfies the basic eligibility provisions associated with the particular funding source. For example, assuming an ITS project satisfies the funding eligibility requirements for National Highway System (NHS) funds, the funds can be used for either construction or O&M.

In the case of the Congestion Mitigation and Air Quality Improvement (CMAQ) program, funds for many types of projects, including new transit services, can be used for O&M for only three (3) years, with no provisions for time extensions. For traffic flow improvements—which TEA-21 defines as including a wide range of ITS projects including regional multi-modal traveler information systems, traffic signal control systems, freeway management systems, incident management and systems. CMAQ funds can only be used for three years, with special provisions for continued use of the funds. In order to continue using the funds for O&M, a special consultation with the EPA is required. If it can be shown that "the continued operation of the project will assist in the attainment or maintenance of an air quality standard", the funds can continue to be used beyond the three-year limit (FHWA TEA-21 web site; www.fta.dot.gov/fta/library/planning/enviro/cmaq.htm; July 28, 1999). Given the air quality benefits of ITS traffic flow improvements, the potential for continued use of CMAQ funds seems promising.

Summary of Non-Dedicated Federal ITS Funding Sources

Each of the six TEA-21 funding programs that may be used for ITS are summarized below. In all cases, a 20 percent local match is required.

1.) Surface Transportation Program (STP)

STP Funding is available to MPO's and County Engineers for improvements to eligible Federally Classified Highway System Routes and Transit systems. Local traffic management and traffic control projects are eligible under this program. TEA-21 amended prior legislation (ISTEA) by specifically allowing STP funds to be used for infrastructure based intelligent transportation system capital improvements. Total funding for STP is $33.3 billion over the 6-year life of TEA-21. However, 10% of all STP funds must be spent on safety projects and another 10% on Transportation Enhancements, reducing the amount of available STP Funds to $26.6 billion.

2.) National Highway System (NHS)

The NHS program is similar to STP in that the funds may be spent only on designated NHS roadways. States can (if they desire) transfer NHS funds to their STP pool with DOT approval. TEA-21 amended prior legislation (ISTEA) by specifically allowing STP funds to be used for infrastructure based intelligent transportation system capital improvements. The program is funded at $28.6 billion over the life of TEA-21.

3.) Congestion Mitigation and Air Quality Improvement Program (CMAQ)

Due to the favorable impacts of ITS projects on mobile emissions and fuel consumption, CMAQ has become a popular source of funding for traffic signal and traffic management projects. CMAQ funds must be used in EPA-designated "non attainment" or "maintenance" areas for projects which can demonstrate air quality benefits, which includes a wide range of ITS activities. The program provides $8.1 billion over the life of TEA-21.

4.) Interstate Maintenance Program (IM)

TEA-21 made minor changes to the regulations governing the use of Interstate Maintenance funds. These changes, however, had no effect on the implementation if ITS-related projects on the Interstate Highway System. Improvements such as ramp metering, freeway surveillance, variable message signs, etc., are fundable under the IM program whether or not they are part of a larger 4R (Resurfacing, Restoring, Rehabilitation, and Reconstruction) project. Total funding under the IM program is $23.8 billion.

5.) Federal Transit Administration (FTA) 5309 – Capital Program Grants and Loans

This program is one of two transit programs with money eligible for ITS under TEA-21. Of the $41 billion for transit in TEA-21, $28.2 billion is eligible for ITS projects under one of these two programs. Traditionally the 5309 funds have been used to fund new starts, fixed guideway modernization, and bus acquisition and these programs can fund innovative techniques and practices for management of public transit. Availability of these funds for ITS purposes should be considered limited due to commitments to "earmarked" projects. TEA-21 allocates $12.6 billion for this program over 6 years.

6.) FTA 5307 - Urban Formula Grant Program

Like the 5309 Capital Program, this program also permits FTA funds to be used for both capital and maintenance costs of Advanced Public Transportation System (APTS) projects. Although 6-year funding amounts to $15.6 billion, ITS-related projects must compete with other Formula Grant projects.

8.5.4.3 Summary

Table 8.7 summarizes the applicability of the Federal ITS programs described in this section to various types of ITS projects that may be recommended for deployment in the Valley.

8.5.5 Public-Private Partnerships

Historically, ITS has been treated as "special", as fundamentally different than other traditional transportation investments. In the early days of the Federal ITS program, there were some good reasons for doing so: many transportation professionals were not familiar with ITS applications, ITS applications themselves were new, the specific technologies underlying the ITS applications were emerging and changing rapidly, and the ITS marketplace was undefined and evolving, with a wide range of companies entering and exiting the market quickly.

One of the things that was widely touted as "special" about ITS was the potential for private sector funding participation. The logic was that ITS was a new market, one that would utilize new technologies and deliver new services, and that there would be firms interested in working in partnership with the public sector to "test the waters" in ITS. Based on these assumptions, the potential for public-private partnerships as a primary means for funding ITS deployment was widely cited by early ITS proponents.

Unfortunately, public-private ITS partnerships have not generally proven to be as significant of a source for major ITS deployment funding as was hoped. The overall contribution by the private sector has not been as large as was expected, and the bulk of ITS funding responsibility has remained with the public sector. Overall, there have been fewer "win-win" partnerships than was expected, generally because the private sector has found less profit potential than envisioned by early public sector ITS proponents. Several large defense contracting technology firms that entered the ITS market early on, such as Rockwell and Hughes, have either significantly reduced or eliminated their involvement. Also, the USDOT ITS Field Operational Test program—the primary venue for private sector technology test deployments—has essentially been eliminated.

Table 8.7: Applicability of Federal Funds to ITS Related Projects

Project Type/Phase	Federal Funding Source								
	Dedicated ITS Sources				Non-Dedicated (Traditional) Sources				
	Research and Development	Deployment Integration [1]		Commercial Vehicle	STP	NHS	CMAQ	IM	FTA
		Urban	Rural						
Freeway/Incident Management Feasibility/Planning	●	O	●	●	O	O	O	O	X
Research/Demo	●	O	●	●	O	O	O	O	X
Design/Construction	X	O	●	●	O	●	●	●	X
O&M	X	X	X	O	O	●	●	●	X
Arterial Streets/Traffic Signals Feasibility/Planning	●	O	O	O	O	O	O	X	O
Research/Demo	●	O	O	O	O	O	O	X	O
Design/Construction	X	O	O	O	●	●	●	X	O
O&M	X	X	X	O	●	●	●	X	X
Transit Feasibility/Planning	●	O	O	X	O	O	O	X	●
Research/Demo	●	O	O	X	O	O	O	X	●
Design/Construction	X	O	O	X	O	O	O	X	●
O&M	X	X	X	X	O	O	O	X	●[2]
Regional Traveler Information System Feasibility/Planning	●	O	●	X	O	O	O	O	O
Research/Demo	●	O	●	X	O	O	O	O	O
Design/Construction	X	O	●	X	O	O	O	●	O
O&M	X	X	X	X	O	O	O	●	O[2]

[1] In urban areas, funds can only be used for *Integration* with existing systems. In rural areas, funds can be used for any ITS infrastructure. Generally, the eligibility for *Integration* funds will vary considerably form project to project in urban areas, depending on the extent to which the project interfaces with existing systems.
[2] FTA funds cannot be used for operations, but can be used for maintenance.

Legend:

● = Funding source has **high** applicability to this type of project/phase of project.
O = Funding source has **low** applicability to this type of project/phase of project, but funding is possible.
X = Funding source is generally not applicable to this type of project/phase of project

However, although public-private ITS partnerships have not lived up to the lofty expectations that characterized the first several years of the Federal ITS program, **there have been many successful partnerships, and public-private partnerships can help support ITS deployment in the region**. The remainder of this section identifies some specific areas where public-private partnerships have been successful and where partnerships should be sought as the region deploys its ITS system.

Ultimately, there is no set check-list of public-private partnership opportunities in ITS deployment. Although the following list identifies some areas where successes have occurred and/or where potential appears high, partnerships should be sought anywhere the private and public interests can both be served.

8.5.5.1 Potential ITS Public-Private Partnership Opportunities

Although public-private partnerships have not yet proven themselves as a viable approach to meeting the bulk of the funding needs of ITS projects, there have been successful partnerships, and partnerships can help defray the required public ITS investment. Some successful partnership approaches are summarized below.

Requests for Partnership Proposals

Several state departments of transportation, including the Minnesota Department of Transportation, have been successful in attracting private sector investment in ITS deployment through the use of Requests for Partnership Proposals (RFPP's), open solicitations for private sector participation in an overall, well-defined ITS program. The most successful RFPP's have been for large, diverse deployments, and have left respondents free to identify their desired form of participation. Broadly defined, open RFPP's have generally been more successful in attracting private investment than narrowly defined ones. The key to a broad RFPP is to clearly describe the overall objectives and basic components of the ITS deployment.

Traveler Information Dissemination

Traveler information dissemination is one of the areas where public-private partnerships were thought to have the greatest potential. To date, there have been several attempts at such partnerships, with mixed results. Ultimately, a proven business model has yet to emerge. Generally, the public sector provides the private sector with the raw data collected through the public sector ITS system, and the private sector packages and disseminates the information to businesses and the public for a fee. Several private traveler information service providers, including Smart Route Systems and Metro Networks, have launched traveler information systems in major urban areas. Although a proven paying market for traveler information has not yet emerged, traveler information dissemination remains as one of the more promising areas of

ITS public-private cooperation/partnership and opportunities should be pursued to the extent possible.

Cellular Telephone Hotline for Incident Reporting

Partnerships in this area generally consist of the private cellular telephone companies agreeing to pay for cellular phone calls made to a publicly operated traffic reporting hotline. The companies receive a public relations benefit and, according to companies participating in such programs, feel that these types of initiatives promote the use of cellular phones in general.

Freeway Service Patrols

There are many successful public-private freeway service patrol partnerships in operation across the United States, and along with right-of-way sharing partnerships these represent some of the most opportunities to leverage private sector investment. Typically freeway service patrol costs are split approximately 50-50 between the public and private sectors, with the private sector responsible for the actual operation of the patrols. The private sector has been able to fund their participation, and to make a profit, by renting advertising space on the patrol vehicles. A successful service patrol partnership is in operation in the Cincinnati, Ohio area.

Non-Federally Funded Technology Demonstrations

Although the demise of the USDOT Field Operational Test program eliminated the most successful venue for attracting private sector investment in new technology deployment, it is still possible for public agencies to partner independently with vendors interested in supplying limited quantities of ITS equipment for free, or at a significantly reduced cost, in return for the opportunity to field test the product. Such ventures, since they may involve untested technologies, can be higher risk and can include more delays and frustrations, they can be a good way to acquire equipment very inexpensively. Metro RTA in the Akron area has been very successful in such independent (i.e., non-Federal) partnerships, and is currently involved in a test of automatic vehicle location and other ITS technology in conjunction with a German manufacturer.

8.6 Transportation Agency Funding Opportunities

The successful implementation of the ITS Strategic Plan will largely depend upon the availability of funds. Beyond the initial funding for program implementation, a critical factor to the success of ITS will be the continued availability of funding for operations and maintenance. The implementation of ITS elements for the detection, surveillance, and management of transportation will necessarily increase the

operations and maintenance demands of those agencies responsible for transportation. This can be a starting point for the pursuit of funds.

There are several possible strategies for pursuing ITS funding in the Region. Because of the diverse multi-modal, multi-jurisdictional nature of ITS, it is usually found that funding must be pursued along multiple tracks simultaneously. An individual project may require multiple sources of funding. Elements of this multi-dimensional strategy could include the following:

1. Use of Surface Transportation Program (STP), National Highway System (NHS), Statewide Transportation Improvement Plan (STIP), State Highway Operational Protection Program (SHOPP), Regional Transportation Plans (RTP's), Office of Traffic Safety (OTS), and County Measure (i.e., local sales tax) funds as opportunities arise for ITS to be implemented alone or included as an integrated element of other projects. In some cases, ITS elements can be included as part of traffic management for larger construction projects, with the opportunity to maintain operation of the equipment following construction or to use it on other projects (e.g. in the case of portable message signs (CMS)).

2. Funds budgeted by Caltrans for operations (District 6 and 10 are eligible for a portion of these funds each year).

3. Development of a local incentive match program for ITS using STP, CMAQ, and Measure funds. Criteria could be established by RTPA's for local agency submission of ITS Projects that, ideally, have both congestion and air quality benefits. Similar match programs may be established to coincide with other funding sources such as those for safety-related improvements.

4. Working cooperatively with Caltrans to secure other state funds. Again, the RTPA's should serve as coordinators of these applications to have the best chance of bringing the most funds into the eight- county area.

5. Earmarked demonstration project funding, requiring unsolicited proposals directly to FHWA and FTA. These would be coordinated through legislators or through applications processes established through U.S. DOT.

6. Operational test funding through FHWA and FTA via unsolicited proposals or responses to their initiatives.

7. Cooperative funding with the private sector. The most significant opportunities are in the provision of traveler information. Examples could include private installation or leasing of information kiosks, privately initiated information services through pager technology or FM-subcarrier, or private financing of CCTV cameras at key

locations of interest to the media. Private financing of motorist aid service patrols is also possible.

The actual pursuit of the various funding sources will be the responsibility of each lead agency, in conjunction with the ITS Deployment Committee established for the San Joaquin Valley.

9.0 Program Management Element

9.1 Purpose of Program Management in San Joaquin Valley

The most important component of successful Regional ITS deployment is the active and continuous cooperation between transportation stakeholders in the San Joaquin Valley.

This Section of the San Joaquin Valley ITS Strategic Deployment Plan provides suggested deployment guidelines, as well as ITS program procedures and policies to support the development of ITS in the San Joaquin Valley. There are three key actions which should be undertaken by the Region to promote successful ITS deployment:

- Appropriate components of the San Joaquin Valley ITS Strategic Deployment Plan should be incorporated into the regional transportation planning process and the eight county's Regional Transportation Plan (RTP). This is consistent with the USDOT concept of mainstreaming ITS into transportation deployments. The goal is to approach ITS similar to any other transportation deployment effort.

- All significant transportation management and information system deployment efforts should be carried out in a cooperative manner within the Region with projects being proposed, promoted, and deployed with due consideration for the integration objectives of the Region and it's Counties.

- Consideration should be given to the potential rural applications of major system deployments in the more urban areas of the Region to maximize any economies of scale possible throughout the Region.

This Section is meant to provide suggestions, not prescriptive requirements. The most important component of successful Regional ITS deployment is the active and continuous cooperation between transportation stakeholders in the San Joaquin Valley.

9.2 Regional Advantages and Disadvantages

The San Joaquin Valley has several important advantages and disadvantages in terms of deploying ITS. These factors should be considered by agencies and individuals when they are promoting ITS deployment in the Region. Promotion and acceptance of ITS deployment in the Valley is likely to follow a somewhat different dynamic than the more urbanized Bay Area and Southern California regions. The smaller size of the transportation community in the Region allows for more direct and interpersonal communication regarding ITS deployment. This means that the more complex institutional arrangements adopted by some urbanized areas should not be necessary in the San Joaquin Valley if the lines of communication remain active, open, and cooperative. The various ITS deployment advantages and disadvantages for the Region are outlined in Table 9.1.

Table 9.1: San Joaquin Valley ITS Deployment Advantages and Disadvantages

Advantages	Disadvantages
➢ Transportation agencies in the Region have established a good basis for cooperation through past transportation efforts. ➢ Geographic nature of the Region when compared with many areas simplifies communication and cooperation. ➢ Caltrans and several local urban agencies have already begun deployment of some communications, traffic management, transit management and signal system infrastructure. ➢ Agencies have displayed a cooperative spirit in the development of the Strategic Deployment Plan, as well as other regionally significant issues and recognize the need to work together. ➢ Projected growth in the Region should assist in promoting ITS applications.	➢ Region is still relatively unfamiliar with many ITS concepts and additional promotion of ITS benefits may be necessary. ➢ Many agencies lack the staffing and resources to provide their own support for ITS deployment. ➢ General public in the Region may be unfamiliar with the concept of ITS. ➢ Some agencies may still view ITS as competition for traditional transportation projects as opposed to a complement to traditional projects. ➢ Relative to many of the larger urbanized areas of the State, the Region has a smaller funding pot available for transportation and more specifically, ITS deployment.

9.3 Continued Sponsorship of the ITS Program

ITS mainstreaming is a strategy for planning and implementing ITS, not as a separate Research and Development program, but as a regularly considered, important alternative in planning, designing, and managing our transportation systems.

Successful regional deployment of ITS in the Valley requires continued sponsorship of the ITS concept and its associated projects until such time that the Region fully mainstreams ITS into the transportation planning and programming process. Sponsorship of the San Joaquin Valley ITS program, as outlined in this Plan, stems from two areas: (1) transportation agencies and organizations throughout the Region; and (2) individual program and project champions that promote specific components of the ITS program.

➢ **Agency Sponsorship** - ITS deployment should be regional in character. Even small local deployments can leverage funding for regional projects when the larger project or system is deployed within the context of the Valley Strategic Deployment Plan. The eight Council of Governments (COG's), Caltrans District 6 and 10, California Highway Patrol (CHP), and the other larger transportation and emergency service agencies within the Region should work cooperatively with local jurisdictions in building partnerships and deploying projects that fit within the structure of the Strategic Deployment Plan. In addition, the larger urban Cities and Counties should play key and cooperative roles in deploying ITS throughout the Region. Specific sponsorship roles are discussed for some of the larger transportation players in the Region below.

- <u>COG's and RPTA's</u> – In general, the county planning agencies should be the keeper of the San Joaquin Valley ITS Strategic Deployment Plan and ensure that appropriate elements of the Plan are incorporated into the regional transportation planning process. These agencies

should attempt to establish standards and supporting tools for cooperative deployments in the ITS area. They should be a key player in the provision of ITS project/deployment champions and take the lead in the regional promotion of ITS and in introducing political interests to the concept and benefits of ITS. Through the Steering Committee made up of the COG directors, they should continue to work to organize and support agencies that are attempting to promote, fund, program, and deploy ITS projects. As it is a regional agency, these entities may often be able to operate as an effective umbrella agency for multiple local jurisdictions working cooperatively in ITS procurement efforts.

- Caltrans – In general, Caltrans District 6 and 10 should support and encourage agency staff to proactively champion ITS deployment efforts. Working with local COG representation, Caltrans should promote and support cooperative deployment efforts and/or partnership opportunities among transportation stakeholders. The Districts should also promote ITS deployment efforts at the Caltrans, Headquarters, and federal agency levels. Finally, Caltrans should support the development of consistent ITS standards across the Region and should assist in ensuring that the regional standards are consistent with State and national standards.

The Office of System Planning is Caltrans' long-range transportation planning process used to identify and prioritize future transportation improvements in cooperation with its planning partners. The following documents are prepared by Caltrans System Planning Staff:

- Transportation Concept Report (TCR – The TCR is a system planning document and tool which includes an analysis of a transportation corridor. It establishes a twenty-year transportation planning concept that is consistent with the District's goals as set forth in the District System Management Plan. The TCR establishes the future concept of Level of Service (LOS) for segments along the route and broadly identifies the nature and extent of the improvements needed to attain that Level of Service. Operating conditions for each corridor are projected for ten and twenty-year horizons. Beyond the twenty-year planning period, the TCR identifies the Ultimate Transportation Corridor (UTC) to ensure that adequate right-of-way is perserved for ultimate facility projects. While the ten and twenty-year plans consider funding issues, the UTC does not.

This report is prepared by Caltran's staff in cooperation with the regional and local agencies that have jurisdiction within this corridor. The objective of the TCR is to have local, regional, and state consensus on route or corridor concepts, improvement priorities, and planning strategies. This document provides concept information only and does not determine policy.

The TCR is updated as needed, as conditions change, or as new information is obtained.

- Transportation System Development Program (TSDP) – The TSDP is one of three Caltrans system planning documents. It replaces the prior Route Development Plan which was a listing of Caltrans recommended capacity increasing improvements on state highways. The other two system planning documents are the Transportation Corridor Report (Route Concept Report) and Transportation System Management Plan. Transportation Corridor Reports are "depth documents tat analyze a route from its beginning to end in the district and formulate a "concept" level of service and facility type for the route. The Transportation System Management Plan is Caltrans' plan for maximizing the efficient operation of the state highway system, describes its relationship to other modal systems in the district, and recommends options for improving the overall intermodal transfer and multimodal transport of people and goods on a larger regional and interregional basis.

  The TSDP fits between the Transportation Concept Report and the Transportation System Management Plan. It analyzes from a district wide perspective route deficiencies, concept level of service, and concept facilities identified in the district transportation concept reports and proposes a program of alternatives and priorities for addressing them. Alternatives consider a broad range of transportation, land use, and quality of life factors.

  The purpose of the TSDP is to identify a comprehensive, reasonable and effective range of transportation improvements intermodal categories (infrastructure/capital outlay), strategies and actions, and demand and system management options that when comprehensively implemented or implemented alone, improve interregional and regional mobility and intermodal transfer of people and goods on state highways and major travel corridors.

- City and County Agencies – City agencies such as Fresno, Stockton, Modesto and Bakersfield have played a prominent leadership role in the deployment of ITS within the local areas and between the smaller Cities and Counties. This leadership role should continue and be expanded if possible. These City efforts in the area of communications are important to Regional ITS deployment, and they should assist in establishing regionwide communications standards. As the largest urban areas in the Region, it is important that the City of Stockton, Modesto, Merced, Fresno, Visalia, Tulare, Hanford and Bakersfield participate in regional ITS activities. They may also serve as an effective pool of potential project champions.

- Other Transportation and Emergency Service Agencies – There are numerous other agencies in the Region which should play a key role in sponsoring ITS deployment. These agencies should provide project champions and participate in cooperative deployment efforts where appropriate. Specifically, the larger transit properties such as SMART, MAX, FAX and GET should lead the way in ITS deployment and assist the smaller transit agencies in their efforts by providing the opportunities for technical support and joint procurements. Many of the smaller cities in the Region do not have the resources necessary for continuous involvement in ITS deployment. The COG's and the larger cities should consider opportunities to assist deployment of systems in smaller cities as an adjunct to their larger deployments.

➢ **Deployment Champions** – Deployment champions are individuals who have a political, professional, and/or personal interest in the deployment of certain ITS projects. Champions are critical to maintaining momentum and streamlining the deployment of ITS in the Region. They provide a central "knowledge base" and continuous understanding of the particular deployments in which they are involved. They deal with project deployment issues both inside and outside of structured institutional environments. Taken as a whole, the deployment champions in the San Joaquin Valley Region will comprise the core of ITS sponsorship and deployment support. The characteristics and roles of deployment champions are discussed in greater detail below.

9.4 Plan and Deployment Support

Supporting and managing the deployment efforts for individual ITS systems or projects is primarily the responsibility of the deployment champion. The desired qualities, general responsibilities, and arenas of

institutional involvement for deployment champions are discussed below.

9.4.1 Qualities and Roles of Deployment Champions

Each ITS deployment effort or project should have a designated champion who will see the project through from beginning to end. Ideally, champions should have the following qualities:

- Time to dedicate to the effort,
- Support of their superiors,
- Desire to see the system/project deployed,
- Good communication and moderation skills,
- Willingness to compromise on system/project details combined with the will to maintain the integrity of the system/project,
- Basic understanding of the regional ITS vision and on-going architecture efforts, and
- Solid understanding of the system/project concept and how it will fit into existing operations.

Promotional and mediation capabilities are more important qualities for a deployment champion than technical skill, as long as technical resources will be made available to support the champion. It is desirable for a champion to be supported by a subcommittee or even unofficial group of stakeholders in the project being deployed. However, while tasks may be distributed among members of a group to assist the champion, it is critical that an individual be the recognized coordinator of a deployment effort. The champion is the early project manager for an ITS deployment with the distinction that the project may not be fully conceptualized, funded, or designed. The champion must be a "jack of all trades." Champions should be prepared to focus their efforts in the following areas.

- **System/Project Concept/Design** – The champion should ensure that the system concept and design are in keeping with the needs for which the project was originally proposed and considered. The champion should establish a basic understanding of how the project fits into the regional ITS vision. Finally, the champion must be able to describe the basic project components or design considerations, although he/she need not be the most knowledgeable in these matters.

- **Funding Applications** - The champion should identify which timely funding sources may be available for deployment of the ITS system/project and aggressively pursue these sources. COG's may be an excellent support resource for champions from smaller agencies or stakeholder groups.

- **Inter-Agency Communication** – The champion is responsible for maintaining consistent communication with agencies involved in the deployment of a system/project. ITS deployments will likely require the champion to gain local and regional support.

- **Political Support** - The deployment champion should identify the political support required to obtain funding and overcome institutional obstacles. The champion may need to aggressively argue their viewpoint to both internal and external political concerns in order to gain this support. Additional deployment champions from the political arena are often very effective in promoting deployment and overcoming obstacles.

- **Agency Support** – Some champions will be required to promote the project internally with their own agencies and organizations in addition to their external promotion efforts. Champions will have to seek substantial support from their organizations. This may include the identification of additional supporting champions from within the organization, as well as the recognition of the champions' time commitment to ITS deployment efforts by their organizations.

- **Public Promotion** – In addition to gaining and maintaining support from within the champions organization at political levels, the champion will need to consider the application of public promotion activities. Most projects could benefit from some general promotion to the public that will inform them as to the purposes and benefits of the project. Potential use of web pages, flyers, and news articles/reports should be considered. If possible, the champion may seek the support of additional champions with good connections within communities that the project will benefit. Chambers of Commerce, economic development groups, and professional organizations are good sources of support.

- **Deployment Concept** – The deployment concept for the San Joaquin Valley Region is described in Section 7.0 of this Plan. The deployment champion should consider how and where his/her project fits within this concept. Often a deployment champion may find other people promoting similar efforts within the Region. Combining two or more geographically or functionally similar projects can often assist both projects in achieving deployment. The champion should also be familiar with other related projects in the Region. The champion should consider, "Does the proposed system provide or receive information or resources from these projects?"

As a whole, the actions of deployment champions drive successful regional ITS deployment. Potential sponsoring agencies have been identified for each of the projects outlined in Section 6.0 of this Plan,

however many of these projects lack a specific champion to push forward with deployment efforts. COG'S and sponsoring agencies should attempt to select project deployment champions for priority near-term projects.

9.4.2 Arenas of Deployment Champion Involvement

When promoting deployment of ITS projects in the San Joaquin Valley, deployment champions should understand four institutional arenas in which they may be involved. The level of involvement may vary from arena to arena and project to project, but generally some involvement in at least three of the four arenas will be required for successful deployment.

- **Political Arena** – comprised of local, regional, and national politicians and community leaders.

- **Agency Executive Arena** – comprised of transportation related agency executives at upper management levels with the authority to make decisions regarding staffing and funding concerns including the COG Director's and Caltrans District Director's.

- **Private Market Arena** – comprised of private industry and organizations with a recognizable stake in the deployment of effective and marketable ITS services.

- **Agency Staff Arena** – comprised of agency middle management, technical, and support staff.

It is the job of the deployment champion to effectively utilize available resources in each of these arenas. It is likely that deployment champions will come from the agency staff arena, and that they will need to gain the support and championship of key individuals in the political and agency executive arenas. When considering these arenas it may be useful for the deployment champion to consider the abilities, skills, and barriers to utilizing resources from each arena. Figure 9.1 displays some important considerations for each arena.

- **Political Arena** – The champion should point out the public benefits of deploying the system/project, especially any benefits that may be easily promoted to the general public. The champions should seek to describe the project in simple terms that take into account the limited time and variable technical knowledge likely to be present in the political arena. It is ideal if the champion takes a few hours to develop a simple and brief presentation (five slides/five minutes) and project sheet that describe the key concepts of the deployment effort. It is often useful to have politicians participate in tours or visit similar systems deployed at other locations across the nation to generate political support for a deployment effort.

Figure 9.1: Four Arenas of Deployment

- **Agency Executive Arena** – The deployment champion should promote the regional benefits of the deployment. The champion should seek to discuss the deployment of the system/project in terms familiar with each executive. As with the political arena, initial presentations should be simple and brief, with further details and technical information being provided as requested. As with the political arena, the champion should try to get agency executives to visit sites with similarly deployed ITS systems. Tours of similar ITS deployments in neighboring regions or states are an effective means to display the ITS has real operational and resource benefits.

- **Private Market Arena** – The champion should determine the best role for the private market in the ITS deployment under consideration. The current population and market potential of the San Joaquin Valley Region is likely to limit any large-scale private market involvement in the near-term.

Deployment champions may want to consider the potential for leveraging private market involvement in three areas:

- Statewide deployment efforts – If a project is developed in a manner consistent with similar statewide systems the ability to attract private involvement is enhanced. For example, if a statewide deployment of traveler information systems is propagated across the state, and the Cities develop its systems in a manner compatible with statewide efforts, then much of the private sector investment in the statewide system may also benefit Cities.

- Specialized vendor specific deployment efforts – If a project will demonstrate a new technology or equipment from a particular vendor, then the Region may be able to involve the private sector vendor as a partner. This may reduce the costs and risks of the deployment. Vendors sometimes desire to deploy some of their newer equipment in the field to support their marketing efforts.

- Small scale private sector investment – Some of the most successful public/private partnerships occur on a small scale. Deployment champions should consider opportunities for working with local private interests to promote/support ITS deployments. For example, a privately owned or sponsored special event that attracts significant Traffic may benefit from enhanced traffic management and information. They may assist in supporting deployments where the benefits are clear. Another good example is the location of field infrastructure. Some private interests are flexible and will cooperate with the placement of equipment within their property boundaries.

CCTV cameras and information kiosks are common examples of ITS infrastructure often placed within private right-of-way.

- **Agency Staff Arena** – The support of agency staff is critical to a champion being able to perform effectively. The champion should seek the support of stakeholding agencies' staff by pointing out the benefits to agency operations. The champion should work closely with agency staff to maintain open lines of communication.

9.5 Suggested Regional Institutional Structure, Procedures, and Policies

Cohesive, integrated, and well planned regional ITS deployment does not occur on its own. The key is continuing communication and cooperation amongst transportation stakeholders, combined with clearly defined objectives and regional system standards. For the purposes of planning and some specific project deployments, the agencies of the San Joaquin Valley have displayed the willingness to cooperate and work together towards common goals. Regional deployment of ITS requires the Region take the next step and provide some form of institutional structure and regional policies for deployment efforts. The goal of this structure and policies is not to be prescriptive, but instead, to support deployment champions and sponsoring agencies in achieving their goals. Many of the projects defined in this Plan are generally beyond the capabilities of any single agency or person to deploy, and a cooperative effort will not only be desirable, but required. As discussed below in greater detail, this Plan contains a suggested institutional structure and policies to support ITS deployment in the Region.

9.5.1 Suggested Institutional Structure

Figure 9.2 displays the suggested institutional structure for ITS deployment in the San Joaquin Valley. In recognition of the limited time available to deployment champions and the limited resources of sponsoring agencies, this structure is relatively simple when compared with the structure adopted by many other regions. While the implementation of this structure may seem somewhat burdensome at first, it should save time, effort, and money in the long-run considering the Region's desire to better integrate and cooperatively operate its transportation systems.

Figure 9.2 summarizes the name, general roles and responsibilities, and agency involvement for each component of the institutional structure. Each component is discussed in greater detail below.

Figure 9.2: Suggested Institutional Structure

- **Valleywide ITS Steering Committee (a.k.a. San Joaquin Valley Council of Governments (COG) Directors)**

Status: Already established

Role: The COG Board of Director's should serve as the regional stakeholder for ITS deployment. The support of the Board is important to promoting the regional deployment and integration of systems. The Board should consider adopting appropriate ITS related policies as outlined in either this Plan or the Regional Transportation Plan. The Board is also an important partner in programming ITS projects into the Transportation Improvement Program (TIP) process. Acting at the direction of the Board and the Executive Director, COG'S staff has a crucial role to play in supporting ITS deployment as described earlier in this Section. It is important that the Board understand that ITS is not "star wars" at ground level. ITS is simply the application of improved systems and communications in our day to day transportation operations.

Participants: COG'S Director's

Objectives:

- Provide political support at the regional level for the deployment and integration of transportation management systems.
- Resolve outstanding institutional issues that present themselves as significant barriers to ITS deployment within the Region.
- Provide a regional entity on which to base sharing of ITS infrastructure, systems, and operational responsibility.
- Pursue any new legislation or regional guidelines necessary to allow the sharing of resources and responsibilities as deemed appropriate by the Region.
- Provide policy level input and a venue for public reaction and input to ITS deployments.

Frequency/Lifespan: Meet quarterly as applicable.

- **San Joaquin Valley ITS Deployment Committee**

Status: This Group is already established as the San Joaquin Valley ITS Technical Advisory Committee, however there should be a shift from the development of the Strategic Deployment Plan to deployment activities.

Role: Should serve as the regional forum for the development and deployment of ITS systems within the Region. Also, the Group facilitates the exchange of ideas and issues relating to ITS deployment. The Steering and Review Group should serve multiple roles in supporting integration and deployment efforts, including but not limited to: making suggestions to the COG'S Board, reviewing and adopting project concepts, supporting funding and grant development efforts, and providing a venue for the identification and resolution of institutional issues. Supporting this group are three workgroups focusing on particular areas of ITS deployment: Traffic Systems Workgroup, Transit Systems Workgroup, and Traveler Information Systems Workgroup. Each of these workgroups should occasionally report their activities back to the ITS Deployment Committee. The Group can serve as a systems configuration management group for the Region or delegate this role as appropriate. Finally, as no particular working group has been defined for Valleywide Incident Management, this Group should oversee this deployment area.

Participants: Same as existing ITS TAC, but specific representatives may change depending on the particular activities underway at any one time. It is important that several key players in the Region continue to participate:

- COG'S
- Cities and Eight Counties
- Caltrans
- Transit agencies and/or representatives from the Transit Systems Workgroup
- Emergency service agencies and/or representatives from the urban area Incident Management Teams.

Objectives:

- Coordinate ITS promotion, programming, and deployment efforts.
- Review and act on ITS funding opportunities.
- Support ITS deployment on a regional, valleywide, and statewide basis.
- Promote interagency cooperation and communication.
- Provide project funding and prioritization suggestions to responsible funding agencies.

Frequency/Lifespan: The frequency of meetings should be based on activities underway. At this point and time, the TAC has a great deal of work to do in terms of moving forward with ITS deployment. Regular meetings may occur on a bi-monthly or quarterly basis, however near-term activities may dictate a more rigorous schedule.

- **Traffic Systems Workgroup**

Status: Previous cooperative efforts between the Cities and Eight Counties have laid the groundwork for this Workgroup. However, this group has not met in the recent past on ITS deployment issues.

Role: The Traffic Systems Workgroup should focus on deployment efforts in the Freeway/Traffic Management Program Area. This includes the promotion and cooperative deployment of traffic management systems and infrastructure throughout the Region. The Workgroup may choose to act as a somewhat informal configuration management group by building consensus amongst agencies on the particular standards and policies relating to systems deployment. The Workgroup should elect a Chairperson that will be responsible for coordinating meetings and occasionally reporting to the ITS Deployment Steering and Review Group. The Workgroup should prioritize project deployment efforts and focus on one or two key projects at any one time.

Participants: Cities, Caltrans, Eight Counties, and other local agencies as appropriate.

Objectives:

- Promote the deployment of regional traffic system projects to the ITS Deployment Committee, COG Boards, City Councils, and other appropriate entities.

- Establish operational guidelines and regional traffic system standards as appropriate to support regional traffic system deployment efforts.

- Promote interagency cooperation and communication.

- Improve local and regional traffic systems through cooperative programming and deployment efforts.

- Receive input from and provide suggestions to deployment champions and project managers responsible for deploying traffic management systems.

- Provide a knowledge pool for traffic systems information for the Region including funding opportunities, specifications, new technologies, accepted standards, and system capabilities.

Frequency/Lifespan: Varies depending on current activities, although monthly meetings may be appropriate.

- **Transit Systems Workgroup**

Status: No current group exists.

Role: Similar to the Traffic Systems Workgroup, the Transit Systems Workgroup should promote the programming and deployment of the projects outlined in the Transit Systems program area of this Plan. The Transit Systems Workgroup should work together to identify opportunities for improving interagency cooperation and improved coordinated transit operations. Throughout the development of the Strategic Deployment Plan, transit agencies emphasized the need to keep deployment efforts simple and maximize the use of existing infrastructure and systems. The most prominent ITS deployments in the Region involve agencies such as SMART, MAX, FAX and GET's AVL and Transit Management Systems as well as smaller services that are beginning to consider automated dispatching and AVL systems. The Transit Systems Workgroup should discuss and review opportunities for the expansion of this system to support the entire Region, while at the same time retaining the desired level of autonomy for each transit agency. Participants in the development of the SDP noted the lack of a map accurate enough for automatic vehicle location (AVL) applications outside of the urban areas. The Workgroup should review AVL deployments in the Valley, as well as GIS efforts that are proposed by San Joaquin Valley, to determine the best path for improving mapping accuracy in rural areas. The Workgroup should elect a Chairperson that will be responsible for coordinating meetings and occasionally reporting to the ITS Deployment Committee. The Workgroup should also review and promote opportunities to provide improved real-time transit information to patrons throughout the Region.

Participants: All Transit and Paratransit agencies implementing ITS including such services as SMART, MAX, FAX, KART, GET, Local Transit services and rural County Paratransit services.

Objectives:

- Promote the deployment of transit system projects to the ITS Steering and Review Group, COG'S Board, City Councils, and other appropriate entities.

- Work to establish guidelines and a plan for enhanced cooperation and coordination between transit agencies within the Region.

- Promote interagency cooperation and communication.

- Improve transit systems through cooperative programming and deployment efforts.

- Receive input from and provide suggestions to deployment champions and project managers responsible for deploying transit systems.

- Provide a knowledge pool for transit systems information for the Region including funding opportunities, specifications, new technologies, accepted standards, and system capabilities.

Frequency/Lifespan: Most of the transit system projects have been identified for mid-term (5-10) deployment in this Plan. If this deployment timeframe is acceptable to the Transit Systems Workgroup then near-term meetings may not be necessary. However, it may be desirable to hold occasional meetings to review funding opportunities and promote cooperation and communication. When deployment efforts commence, meeting schedules will need to be intensified accordingly.

9.5.2 Suggested Procedures And Policies

There are a few suggested procedures and policies that should be considered by the San Joaquin Valley Region. Procedures include processes or tools that support ITS deployment efforts. Policies are statements of policy to be adopted by ITS stakeholders that will promote cooperation and integration in ITS deployment efforts.

Suggested Procedures/Tools

There are several actions that may be undertaken by the region that may not lead to specific ITS deployments, but will promote deployment efforts and the coordination of those efforts. Each of these is discussed below.

- Develop a Regional ITS Deployment Database - COG'S should consider development of a Regional ITS Deployment Database. The purpose of this database would be to serve as a common information resource for all ITS deployments within the Region. Information to be included in the database could include project descriptions, system architecture, design information, hardware/software being deployed, etc. If such as database was deployed, Workgroups and/or agencies could view the information to determine what hardware/software were being deployed on similar projects throughout the Region. The database should be simple, perhaps a spreadsheet or simple Access database.

- ITS Deployment Information Packet – COG'S, with the cooperation of regional transportation stakeholders, should develop an ITS deployment information packet that includes simple presentation materials on the goals and components of ITS deployments. The packet should provide a clear and simple message, and it should be suitable for distribution to political representatives.

- Develop ITS Deployment Impact Analysis Tools - As ITS deployments occur in the Region simple impact analysis tools should be developed for use by deployment champions in determining costs, emissions reductions, traffic impacts, etc. For ITS to become part of the common transportation "tool box" of solutions, simple impacts analysis tools are needed.

- Precede Deployments with Appropriate Studies – Each ITS deployment should be proceeded by a study that establishes background conditions prior to deployment. A good example of this process is signal coordination, where before and after studies are performed to determine the impacts of the coordination effort. In addition, ITS deployments throughout the nation have generally suffered from a lack of deployment and operations documentation. Each deployment should provide documentation sufficient to existing and anticipated future needs.

- Review and Update of the Strategic Deployment Plan Every Two Years – COG'S should consider updating Sections 6.0, 7.0, and 9.0 of the SDP approximately once every two years or at least when RTP's are updated. If these portions of the Plan are incorporated into the regional transportation planning process, it may not be necessary to maintain a totally separate ITS SDP. Responsibility for updating the Plan should rest with COG'S.

Suggested Policies

- The following suggested policies should be considered for adoption by agencies in the San Joaquin Valley to promote and support effective ITS deployment:

- Agencies in the San Joaquin Valley should be encouraged to cooperate and work together to program, deploy, and operate common ITS resources and systems.

- Incorporation or allowance for communications infrastructure should be made during the development of any regionally significant transportation infrastructure.

- Adoption of the regional, statewide, and national architecture should be encouraged to support the exchange of transportation related information and integration of systems between agencies.

- Agencies deploying communications, transportation management and/or information, and emergency services systems should be encouraged to utilize regional standards.

- Institutional arrangements should be sought where the joint deployment of an ITS project promotes economies of scale, avoids duplication of effort, and/or promotes Regional integration of systems.

- When the distribution of ITS projects is considered, preference should be given to projects that represent a cooperative effort between two or more agencies, all other factors being equal.

- Agencies should cooperate at a local and regional level to establish common and/or seamless transportation operations across jurisdictional boundaries.

- Agencies that integrate and/or coordinate transportation management systems should always retain the ability to "take control" of their respective components of integrated system(s).

- Agencies should be encouraged to integrate and establish ITS elements as part of all appropriate major transportation projects during the project development process.

- The accuracy and extent of traveler information provided to the traveling public in the Region should be enhanced through the deployment of ITS infrastructure, communications, and systems. Where appropriate, ITS deployments in the Region should consider future integration with statewide, neighboring regions, and valleywide systems.

9.6 Moving Forward With Deployment

Figure 9.3 provides an overview of the ITS deployment process from the perspective of a deployment champion. Many of the details of this process are described in Sections 7.0 and 8.0 of this Plan, however a brief summary is provided as follows:

Figure 9.3: Moving Forward with Deployment of ITS Projects

Project Initiation

Project Deployment Concept – The project deployment concept serves to introduce deployment champions to the overall regional ITS deployment picture as discussed in Section 7.0. Champions should be aware of how their project fits into this picture.

Sponsoring Agencies/Deployment Champions – The key players in any deployment are the sponsoring agencies and deployment champions. Persistence on the part of these players is crucial to move an ITS project from concept to reality. Deployment champions should try to gain the support of other potential champions.

San Joaquin Valley ITS Institutional Structure – The institutional structure provides a forum within which regional ITS deployment efforts can be introduced, reviewed, and supported. The champion should work within this structure to promote his/her project. This structure can provide a sanity check for projects, and also assist in securing funding.

Project Definition

ITS Strategic Deployment Plan – The SDP provides important information on project concepts, preliminary costs estimates, potential standards, funding opportunities, and the overall regional ITS deployment process. It does not however, provide specific details for project deployment. The champion should review the SDP, determine where the proposed project fits within the Plan, and develop a more specific project definition to move forward.

Specific Project Definition – In order to prepare more detailed cost estimates and define specific deployment efforts and timelines, the champion should develop a brief but specific project definition. This definition may be as brief as one or two pages. The definition may use supporting information from the SDP, but it does not necessarily need to duplicate the information in the Plan. The definition should provide a clear picture of the deployment proposed by the champion, and it should address any issues, changes, or details not outlined in the SDP.

Secure Funding – Perhaps the most difficult and involved part of the deployment process, the champion should work to secure funds for the project. Potential funding sources are outlined in Section 8.0 of the SDP, and the San Joaquin Valley Region ITS institutional structure may prove helpful in realizing funding opportunities.

Regional Transportation Plan (RTP) – An important component of ITS project programming and deployment, the RTP should be reviewed to determine where the proposed project fits within the overall transportation deployment picture. Policies and objectives

within the RTP, which would be supported by deployment of the proposed project, should be noted as they may play a key role in project promotion.

Design

- National, Statewide, and Regional Standards – These standards all play an important role in ITS deployment. Consideration of the standards which may impact the proposed project should be noted early and tracked as the development of these standards proceeds. The champion should work with the appropriate Workgroups and/or agencies to determine which standards are prevalent in the Region. If a standard is identified as critical to deployment, it should be clearly noted in any project documentation from this point forward.

- Preliminary Design/Studies – Almost every ITS project can benefit from preliminary design efforts and/or studies. These documents are often required for certain funding sources, and they often provide the basis for the procurement process. The deployment champion may want to speak with appropriate Workgroup and/or agencies to determine if preliminary study and/or design documents exist for similar projects.

- Procurement Process – Procurement options are discussed in Section 7.0 of this Plan. It is important that the procurement process be appropriate to the project. Timing considerations are an important component of the procurement effort, as many funding sources have timing limitations. Sometimes a regional agency can act as a contract administrator for a smaller agency and speed the procurement process that involves multiple agencies. Lowest bid procurements are often not well-suited to ITS deployment efforts as vendor/deployer skill levels and experience varies greatly.

- Detailed Design – Detailed design for ITS software is most frequently done by vendors or system integrators. Agency staff or consultants often do infrastructure design. Detailed design is important for documentation purposes and for identifying specific details, costs, and potential problems.

Deployment

- Prototype (Optional) – Systems or technologies that are new to the transportation field or deployment within the San Joaquin Valley should be prototyped prior to committing to larger scale deployments. It is important that an acceptance test plan be developed for the prototype, and that thorough testing confirm the performance and reliability of the system. Acceptance testing is discussed in Section 7.0 of this Plan. The people/staff

that will be responsible for operating the system should be involved as early as possible so that they may provide input and fully understand the project, as well as its benefits.

- Deploy Project – The step that was the whole point in the first place, deployment of the system to the planned locations and/or agencies is the largest single step in the process. Even though testing may have occurred during the prototype phase, it is important that testing following each significant individual phase of project deployment. It is also important that the project champion continue to promote the project well after its initial deployment to ensure continued support and to highlight project benefits.

- Training – Often overlooked, training is critical with management system deployments. Training should consider both operational and maintenance requirements. Training should be planned for prior to project deployment to ensure proper funds are available. Management system deployments should provide for useful and concise documentation that includes operations instructions and troubleshooting help.

- On-Going Operations and Maintenance – The deployment of the system is only the first step. On-going operations are where the true benefits of the project will be realized, and continued maintenance will be necessary to realize those benefits. The predominate component of operations costs are usually labor, communication, and /or licensing agreement related. Maintenance costs are largely comprised of labor and equipment costs. If the system or project has proven successful then expansion and eventual replacement should be planned for by the sponsoring agencies.

Glossary of Terms
List of Acronyms

A

AASHTO	American Association of State Highway and Transportation Officials. One of five standards development organizations with which US DOT is working to establish standards for integrated, interoperable ITS deployment.
ABS	Antilock Brake System
ADA	Americans with Disabilities Act
AFD	Architecture Flow Diagram
AID	Architecture Interconnect Diagram
AHS	Automated Highway System
AMPS	Advanced Mobile Phone System
ANSI	American National Standards Institute
APTS	Advanced Public Transportation System
Architecture	An overarching framework that allows individual Intelligent Transportation System (ITS) services and technologies to work together, share information, and yield synergistic benefits.
ASTM	American Society of Testing and Materials. One of five standards development organizations with which US DOT is working to establish standards for integrated, interoperable ITS deployment.
ATC	Automatic Train Control
ATMS	Advanced Traffic Management Systems. An array of institutional, human, hardware and software components designed to monitor, control and manage traffic on streets and highways.
ATIS	Advanced Traveler Information Systems . Vehicle features which assist the driver with commute planning by giving accurate, real-time information on routes, road conditions, etc.
AVCS	Advanced Vehicle Control Systems. Vehicle and/or roadway-based electromechanical and communications devices that enhance the control of vehicles by facilitating and augmenting driver performance. Of particular importance are collision avoidance or warning systems to prevent accidents.
AVI	Automated Vehicle Identification. A system that combines an on-board transponder with roadside receivers to automate identification of vehicles for purposes such as electronic toll collection and stolen vehicle recovery.
AVL	Automatic Vehicle Location. Computerized system that tracks the current location of vehicles to assist dispatching, emergency response, data collection, route navigation, etc.
AVO	Automated Vehicle Operation

B

Beacons	Short-range roadside transceivers for communicating between vehicles and the traffic management Infrastructure. Common transmission technologies include microwave and infrared
BNF	Backus-Nauer Form
Bus Lane	A lane reserved for bus use only. Sometimes also known as a "diamond lane." See also "HOV".

C

CAD	Computer-Aided Dispatch. Uses advanced communications to coordinate and relay information efficiently to vehicle fleets, such as transit buses, patrol cars, emergency-response vehicles, and private carriers.
CASE	Computer Aided Systems Engineering
CCTV	Closed Circuit TV
CD	Compact Disk
CDROM	CD Read Only Memory
CDMA	Code Division Multiply Access
CDPD	Cellular Digital Packet Data
CMAQ	Congestion Management and Air Quality program. Funding category in the Intermodal Surface Transportation Efficiency Act that targets efforts to reduce metropolitan air pollution. ITS technologies that contribute to improving air quality are eligible for CMAQ funds.
CMS	Changeable Message Signs. Electronic sign on a highway that can change the message it displays. Used to warn and redirect traffic.
Conformity	Process to assess the compliance of any Federally funded or approved transportation plan, program, or project with air quality implementation plans. The conformity process is defined by the Clean Air Act. Conformity also applies in reference to the National ITS Architecture.
COTR	Contracting Officer Technical Representative
CSP	Communication Service Provider
CV	Commercial Vehicle
CVAS	Commercial Vehicle Administration Subsystem
CVCS	Commercial Vehicle Check Subsystem
CVISN	Commercial Vehicle Information System and Networks. A network that connects existing federal, state, and private-sector information systems to improve commercial vehicle movement.
CVO	Commercial Vehicle Operations. Assist the safe and efficient movement of trucks and buses. These systems use electronic screening and vehicle identification systems, advances in administration.
CVS	Commercial Vehicle Subsystem

D

DAB	Digital Audio Broadcast
DC	Double Click (or District of Columbia)
DD	Data Dictionary
DDE	Data Dictionary Element
Demand Response	Segment of public transit designed to efficiently move persons not able to access regular, fixed transit routes. This form of transit is utilized especially for persons with disabilities and senior citizens.
DFD	Data Flow Diagram
DGPD	Differential Global Positioning System
DMS	Dynamic Message Sign
DMV	Department of Motor Vehicles
DOD	Department of Defense
DOT	Department of Transportation. When used alone, indicates US Department of Transportation. In conjunction with a place name, indicates state, city, or county transportation agency.
DSRC	Dedicated Short Range Communications
DTA	Dynamic Traffic Assignment

E

E9-1-1	Emergency 9-1-1
ECPA	Electronic Communications Privacy Act
EDI	Electronic Data Interchange
EDP	Early Deployment Plan. Same as a Strategic Deployment Plan.
Electronic Fare Payment.	Systems that allow electronic debit or credit processing of transit fares
EPA	Environmental Protection Agency
EM	Emergency Management Subsystem
EMC	Emergency Management Center
EMMS	Emissions Management Subsystem
EMS	Emergency Management Services. Services designed to optimize the response time to incidents and enhance emergency service coordination.
ESMR	Enhanced SMR
ETC	Electronic Toll Collection. Scanners at toll plazas read transponders on vehicles entering the facility and allow traffic to flow without stopping to pay toll fees

ETA	Expected Time of Arrival
ETS	Emergency Telephone Services
ETTM	Electronic Toll and Traffic Management

F

FAA	Federal Aviation Administration. The Federal agency which regulates air travel and associated areas in the United States.
FARS	Fatal Accident Reporting System
FCC	Federal Communications Commission. The Federal agency which regulates telecommunications in the United States.
FHWA	Federal Highway Administration. Agency of the US Department of Transportation that funds highway planning and deployment programs.
Fiber.	A medium used to transmit information via light impulses rather than through the movement of electrons. A single strand of optical fiber, the approximate size of a human hair, can carry thousands of digital voice conversations or data transmissions at the same time
Financial Capacity	Refers to the ISTEA requirement that an adequate financial plan for funding and sustaining transportation improvements be part of the plan and TIP.
FIPS	Federal Information Processing Standard
FOT	Field Operation Test
FMC	Freeway Management Center
FMS	Final Management Subsystem
FPR	Final Program Review
FRA	Federal Railroad Administration. Agency of the US Department of Transportation that funds rail planning and deployment programs.
FTA	Federal Transit Administration. Agency of the US Department of Transportation that funds transit planning and deployment programs.

G

GIS	Geographic Information System. Computerized data management system designed to capture, store, retrieve, analyze, and report on geographic and demographic information.
GPS	Global Positioning Systems. A system that determines the real-time position of vehicles using communications with a satellite. Also, refers more specifically to a government owned system of 24 Earth-orbiting satellites which transmit data to ground-based receivers and provides extremely accurate latitude/longitude ground positions.

H

HAR	Highway Advisory Radio
HAZMAT	Hazardous Material(s)
HELP / Crescent.	A multi-state research effort to design and test an integrated truck-monitoring systems using AVL, AVC, and WIM technologies.
HOV	High Occupancy Vehicle. Any vehicle containing more than one or two persons, such bus, carpool, or vanpool.
HRI	Highway Rail Intersection/Interface
HSR	High Speed Rail
HUD	Head-Up Display

I

IEEE	Institute of Electrical and Electronics Engineers. One of five standards development organizations with which US DOT is working to establish standards for integrated, interoperable ITS deployment.
Intermodal	The ability to connect, and make connections between modes of transportation.
Intermodalism	Seamless integration of multiple travel modes.
Internet	A collection of computer networks, all connected using a common set of protocols and rules on sharing and directing messages.
Interoperability	The ability to the integrate the operation of diverse networks and systems. The vision of the intelligent transportation infrastructure is a seamless interoperable network from coast to coast that allows drivers and information to flow through the system without barriers.
Interstate Highway System	The system of highways that connects the principal metropolitan areas, cities, and industrial centers of the United States. The Interstate System also connects the U.S. to internationally significant routes in Mexico and Canada.
IP	Internet Protocol
IPR	Interim Program Review
ISO	International Standards Organization
ISP	Information Service Provider
ISTEA	Intermodal Surface Transportation Efficiency Act of 1991. Federal law providing primary federal funding for highway and other surface transportation programs in the United States through 1998. ISTEA contains the Intelligent Vehicle-Highway Systems Act, and has been superceded by the Transportation Equity Act for the 21st Century (TEA-21).
ITE	Institute of Transportation Engineers. One of five standards development organizations with which US DOT is working to establish standards for integrated, interoperable ITS deployment.
ITI	Intelligent Transportation Infrastructure. The computer, communications, and control systems required to support a variety of intelligent transportation system products and services in urban

	and rural areas.
ITS	Intelligent Transportation Systems. The application of advanced technologies to improve the efficiency and safety of transportation systems.
ITS America	Intelligent Transportation Society of America. A nonprofit, public/private scientific and educational corporation that works to advance a national program for safer, more economical, more energy efficient and environmentally sound highway travel in the United States. Federal advisory committee used by the US Department of Transportation.
ITS Infrastructure	Computer, communications, and control systems required to support a variety of ITS products and services in urban and rural areas.
IVHS	Intelligent Vehicle Highway Systems
IVIS	In Vehicle Information System

J

JPO	Joint Program Office for ITS. Office of the US Department of Transportation established to oversee and guide the multi modal National ITS program.

L

LAN	Local Area Network
LCD	Liquid Crystal Display
LED	Light Emitting Diode
LEO	Low-Earth Orbit Satellite System
Long Term	In transportation planning, refers to a time span of, generally, twenty years.
Loop Detectors	Sensors embedded below the surface of roads and highways that monitor the flow of vehicles and help authorities manage traffic and incidents.
LPD	Liability and Property Damage
LRMS	Location Reference Messaging Standard

M

Mainstreaming	The act of bringing ITS technology into everyday use by travelers and transportation professionals. Also refers to incorporating ITS into traditional transportation planning and programming processes.
MAN	Metropolitan Area Network
MDI	Model Deployment Initiative. A program designed to develop model sites demonstrating integrated intelligent transportation infrastructure and successful jurisdictional and organizational working relationships. The program is also designed to demonstrate the benefits of integrated transportation management systems that feature strong regional, multimodal traveler information services.
MMDI	Metropolitan DI

MMI	Man-Machine Interface (or Interaction)
Mode	A form of transportation such as an automobile, bus or bicycle.
MOE	Measure of Effectiveness
MPH	Miles per Hour
MPO	Metropolitan Planning Organization. Regional policy body that is responsible in cooperation with the state and other transportation providers for carrying out the metropolitan transportation planning requirements of federal highway and transit guidelines.
MTC	Metro Traffic Control
Multi-Modal	The availability of transportation options using different modes within a system or corridor.

N

NA	National Architecture
National ITS Architecture	Establishment of nationally compatible systems linking all modes of transportation. Discourages local or regional areas from developing incompatible ITS implementations.
NAR	National Architecture Review
NAV	Navigation
NEMA	National Electrical Manufacturers Association
NHPN	National Highway Planning Network
NHS	National Highway Traffic Safety Administration. Agency of the US Department of Transportation that whose charge is safety
NII	National Information Infrastructure (aka Information Superhighway)
NPRM	Notice of Proposed Rule Making
NTCIP	National Transportation Communications for ITS Protocol. Required for traffic management operations. Allowing for wireline communications between traffic management centers and field equipment.

O

OEM	Original Equipment Manufacturer
Open System	A vendor-independent computer system that is designed to interconnect with a variety of commonly available technology products.
OSI	Open Systems Interconnection
OTP	Operational Test Plan

P

Paratransit	A variety of smaller, often flexibly-scheduled and routed transportation services using low-capacity vehicles, such as vans, to operate within normal urban transit corridors or rural areas. These services usually serve the needs of persons that standard mass transit services would serve with difficulty, or not at all. Often, the patrons include the elderly and persons with disabilities.
PC	Personal Computer
PCB	Professional Capacity Building program
PCS	Personal Communications System
PD	Police Department
PDA	Personal Digital Assistant
PIAS	Personal Information Access Subsystem
PMS	Parking Management Subsystem
PS	Planning Subsystem
PSA	Precursor System Architecture
PSPEC	Process Specification
PSTN	Public Switched Telephone Network
PTS	Positive Train Separation
Public Participation	The active and meaningful involvement of the public in the development of transportation plans and programs.

R

Ramp Metering	Regulation of vehicle entry to a freeway via sensor-controlled freeway-ramp signals.
R&D	Research and Development
RDS	Radio Data Systems
RDS-TMC	Radio Data Systems incorporating a Traffic Message Channel
RFID	Radio-Frequency Identification. An electronic identification method that uses radio-frequency signals to read on-vehicle tags for automated vehicle identification.
RFP	Request for Proposal
RS	Roadway Subsystem
RSPA	Research and Special Programs Administration of the US Department of Transportation.
RTA	Regional Transit Authority
RTS	Remote Traveler Support Subsystem

S

SAE	Society of Automotive Engineers. One of five standards development organizations with which US DOT is working to establish standards for integrated, interoperable ITS deployment.
SC	Single Click
SDO	Standards Development Organization. US DOT is working with five organizations to develop standards in areas relevant to intelligent transportation: state-level participation and roadside infrastructure, (AASHTO), dedicated short-range communication systems (ASTM), electronics and communication message sets and protocols (IEEE), traffic management and transportation planning systems (ITE), and in-vehicle and traveler information (SAE).
SDP	Strategic Deployment Plan
Smart Card	Electronic information systems that uses plastic cards (similar to credit or debit cards) to store and process information. Used in fare-payment and parking applications.
SMR	Specialized Mobile Radio
SONET	Synchronous Optical Network
SOV	Single Occupancy Vehicle
SOW	Statement of Work
Statewide Transportation Plan	The official, statewide intermodal transportation plan that is developed through the statewide transportation planning process.
SQL	Standard Query Language
SSR	Standard Speed Rail
STIP	Statewide Transportation Improvement Plan. A staged, multi-year statewide Intermodal program of transportation projects, which is consistent with the statewide transportation, plan and planning processes and metropolitan plans, TIPs, and processes.
STMF	Simple Transportation Management Framework

T

TAS	Toll Administration Subsystem
TCIP	Transit Communications Interface Profiles
TCM	Transportation Control Measures. Actions to adjust traffic patterns or reduce vehicle use to reduce air pollutant emissions. These may include HOV lanes, provision of bicycle facilities, ridesharing, telecommuting, etc.
TCS	Toll Collection Subsystem
TDM	Transportation Demand Management - Programs designed to reduce demand for transportation through various means such as the use of high occupancy vehicles, alternative work hours, transit and telecommuting.
TDMA	Time Division Multiple Access

TEA-21	Transportation Equity Act for the 21st Century. The latest Federal law providing primary federal funding for highway and other surface transportation programs in the United States through 2004. TEA-21 contains guidelines and funding for ITS deployment.
Telecommuting	The substitution, either partially or completely, of transportation to a conventional office through the use of computer and telecommunications technologies (e.g., telephones, personal computers, modems, facsimile machines, electronic mail).
TIP	Transportation Improvement Plan. An MPO program for transportation projects, developed jointly with the state for a 3 to 7 year period.
TM	Traffic Management
TMA	Transportation Management Area. All urbanized areas over 200,000 in population and other areas that request designation.
TMC	Traffic Management Center
TMDD	Traffic Management Data Dictionary
TMS	Traffic Management Subsystem
TOC	Traffic Operations Center
Transit	Generally refers to passenger service provided to the general public along established routes with fixed or variable schedules at published fares. Related terms include: public transit, mass transit, public transportation, urban transit and paratransit.
Transponder	Electronic device designed to store information. Electronic readers access the information stored on these devices for such functions as toll collection and trucking activities.
TRB	Transportation Research Board. Part of the National Academy of Science, National Research Council. Serves to stimulate, correlate, and make known the findings of transportation research.
TRMC	Transit Management Center
TRMS	Transit Management Subsystem
TRT	Technical Review Team
TRVS	Transit Vehicle Subsystem
TSM	Transportation System Management . The element of a TIP that proposes non-capital intensive steps toward the improvement of a transportation system, such as refinement of system and traffic management, the use of bus priority or reserved lanes, and parking strategies. It includes actions to reduce vehicle use, facilitate traffic flow, and improve internal transit management.

U

Urbanized Area	Area which contains 50,000 or more population plus incorporated surrounding areas.
USDOT	US Department of Transportation – Principal direct Federal funding agency for transportation facilities and programs.

User Services — Services available to users of an ITS equipped roadway, as set forth by ITS America. There are 30 services, arranged in seven categories as follows:

- Travel and Transportation Management
- Travel Demand Management
- Public Transportation Operations
- Electronic Payment
- Commercial Vehicle Operations
- Emergency Management
- Advanced Vehicle Control and Safety Systems

USR — User Service Requirement

V

VMS — Variable-Message Sign. Electronic highway sign that can change the message it displays. Used with traffic-management systems. Also referred to as changeable or electronic message signs.

VMT — Vehicle Miles of Travel. A standard area wide measure of travel activity. The most conventional VMT calculation is to multiply average length of trip by the total number of trips.

VRC — Vehicle/Roadside Communications

VS — Vehicle Subsystem

W

WAN — Wide Area Network

WIM — Weigh-in Motion

WWW — World Wide Web

Z

Zone — The smallest geographically designated area for analysis of transportation activity. A zone can be from one to 10 square miles in area. Average zone size depends on the total size of study area.

APPENDIX A

COUNTY BY COUNTY PROJECT DESCRIPTIONS

1.0 INTRODUCTION

The following pages of this Appendix contain the specific ITS project definitions for the counties within the San Joaquin Valley. The key countywide project descriptions are outlined below:

- 1.1 Kings County
  - Hanford Central Traffic Signal Control System
  - KART AVL Demo
  - Hanford Traffic Signal Coordination
  - Portable Changeable Message Signs
  - Railroad Grade Crossing Treatments
- 1.2 Tulare County
  - Fast Pass Electronic Fare Collection System
  - City of Visalia Transit AVL/silent alarm system
  - Visalia/Tulare traffic signal system Central Control
  - Visalia/Tulare Arterial Signal Coordination
- 1.3 Merced County
  - Advanced Railroad Grade Crossing projects
  - Central Traffic Signals Control for Merced and Atwater
  - Next Bus Arrival Sign System for Transit
  - Yosemite.com System Deployment
- 1.4 Stanislaus County
  - MAX AVL System
  - Modesto/Ceres Signal Coordination
  - MAX Fare Equipment Deployment
  - Modesto/Ceres ATMS Expansion
- 1.5 San Joaquin County

- San Joaquin Transit Electronic Fare Payment (coordinate with MTC's regional system)
- Vanpool Vehicle Traffic Probes Project
- Stockton area signal coordination
- Fare Equipment Deployment at SMART
- Stockton ATMS Expansion, Phase 2
- Curve Warning System on County Roads

➢ 1.6 Kern County
- Smart Call Box System Deployment
- Smart Studs Demo Project
- Incident Management Procedures
- Communication Network, Phase II
- Kern County Regional Communication Links
- RWIS with CCTV System
- Bakersfield TOC Expansion
- GET FARE Equipment Deployment

➢ 1.7 Fresno County
- Fresno/Clovis Regional ATMS Completion Project, Phase 3
- Fresno/Clovis area Signal Coordination
- FAX Fare Equipment Deployment and Transit Management System Expansion

➢ 1.8 Madera County
- Curve Warning System on County Roads
- AVL/Silent Alarm System
- Next Bus System for County Transit
- TOS Expansion in County along State Highways
- Transit Information System

Projects are identified by a unique identification number within each of these subsections. Readers may wish to reference this Appendix Table of Contents to locate particular projects of interest.

1.1 Kings County

The total estimated capital deployment costs for all potential ITS projects over 20 years is $4,650,000.

1.1.1 TRAFFIC/FREEWAY MANAGEMENT SYSTEMS (ATMS)

1.1.1.1 Urban Area Traffic Signal Coordination Project

General Description:

This project would implement local traffic signal coordination plans at specific urbanized locations along regionally significant arterials in the County not currently developed. The objective of this project would primarily be to reduce delays at traffic signals by improving coordination between adjacent signals, with improved safety a possible secondary benefit depending on the specific improvements made. The specific improvements to be made would vary by location, which could include intra- and inter-jurisdictional efforts. The types of improvements that are possible include upgrading traffic signal controllers and detection, adding or upgrading signal interconnects, and communications systems enabling centralized (i.e., remote) timing plan updating and maintenance and malfunction monitoring. Although providing emergency vehicle preemption, transit vehicle priority or automated enforcement would not be the focus or justification for these improvements, the equipment installed as part of this project may support these features. Local agency traffic operations staff would lead this project.

The provision of traffic signal coordination for small communities is most often initiated with use of either time-based coordination (TBC) or a closed-loop system (CLS). Depending on the type of controller equipment now in place, and depending on the level of staffing support that the City (or County) is able to make in the maintenance of signal coordination plans, the initial cost and recurring effort to achieve signal coordination in Hanford would vary from a very low cost, to a moderate cost. A number of communication alternatives are possible to tie the intersection controllers to a supervisory computer at City Hall (in the CLS alternative). With a CLS, the capability is created to remotely monitor intersection operation and the capability to remotely change both basic and coordination timing. A first step in the signal coordination capability would be the design and implementation of TBC timing plans. A feasibility study on possible and appropriate upgrade plans for creation and installation of a traffic signal system could be completed at the same time. Any small community that has more than 10 traffic signals would probably benefit from having signal coordination implemented along its heaviest-traveled street(s) so that vehicles can progress through a series of signalized intersections without stopping. The initial effort to achieve this basic level of coordination is relatively low, especially if it is contracted out. The resulting basic timing plans (perhaps just 2 or 3 plans which run between 7AM and 6 PM) can be left in place with very little subsequent retiming effort required or needed. Traffic signal coordination typically has one of the very highest benefit-to-cost ratios of any public works activity.

Project Objectives:

- Provide improved signal coordination that one upgrades for revised traffic conditions.

Sponsorship: Lead agencies to be selected by Valley COG Directors

Deployment Phasing: This project is a single-phase deployment.

	Phase Components
Phase 1	➢ Develop time based traffic timing plans ➢ Develop alternative solutions for signal communication such as fiber optic cable and wireless spectrum signal interconnect ➢ Upgrade signal controllers as necessary

Deployment Locations: Valleywide

Deployment Timeframes: This project is a near to mid term deployment.

	Phase Timelines
Phase 1	Near to Mid Term:

Benefits:

- Improved mobility
- Reduction in congestion and delays
- Reduced emissions

Budget Estimate:

	Phase Budget Estimates	
	Capital Costs	**Operations and Maintenance Per Year**
Phase 1	$2,000K	$200K
Totals	$2,000K	$200K

Evaluation Criteria:

- LOS and overall delay
- Travel Time
- Emissions

O&M Considerations: An increase in Operation and Maintenance budget should be considered to provide the proper level of system maintenance.

1.1.1.2 Advanced Railroad Highway Interface Technology Deployment

General Description:

This project would deploy a demonstration of railroad-highway grade crossing technology at needed grade crossings with safety (high accident) and/or high volume and delay concerns. The objective of the demonstration would be to field validate a specific strategy or strategies for improving safety, reducing delay and/or providing travelers with improved real-time information on grade crossing status. The

demonstration could feature any combination of detection (both for trains and approaching vehicles), warning/traveler information, and control devices. Many different strategies are possible. Possible strategies include sensors coupled with message signs, in-vehicle devices and/or highway advisory radio that would provide approaching travelers with information on the expected duration of a crossing blockage. Another possible application would tie sensors to emergency vehicle dispatching systems to provide dispatchers and drivers with real time crossing status information.

This project could provide a blueprint for applying technology to enhance grade crossing safety throughout the entire San Joaquin Valley area. One major cause of crashes at railroad grade crossings is the persistent presence of the heavy Tule fog in the Valley, and the inability for drivers to see grade crossings which are occupied with a train, usually in motion, until they are too close to stop. If some kind of train presence detection could be devised, and tied to an advance-warning beacon, approaching drivers would be forewarned about the dangerous situation. Such an active presence could be detected by an advanced detector, and need not involve the cooperation / joint solution with the railroad. Because of liability, railroads are not eager to create new and unproven detection or safety mechanisms; they have a well-defined program for active warning devices at the crossing which are very involved "systems" tied in with the railroad's own advance detection systems. The possibility of deploying an advanced technology solution, especially at locations where no active warning devices now exist, would be the basis for this project.

Highway traffic at highway-rail intersections (HRIs) could be managed, where operational requirements demand advanced features (e.g., where rail operational speeds are greater than 80 miles per hour). This would include all capabilities from the Standard Railroad Grade Crossing and augments these with additional safety features to mitigate the risks associated with higher rail speeds. The active warning systems would include positive barrier systems, which preclude entrance into the intersection when the barriers are activated. Like the Standard Package, the HRI equipment is activated on notification by wayside interface equipment, which detects, or communicates with, the approaching train.

The wayside interface equipment would provide additional information about the arriving train so that the train's direction of travel, estimated time of arrival, and the estimated duration of closure may be derived. This enhanced information may be conveyed to the driver prior to, or in context with, warning system activation. This would also include additional detection capabilities, enabling it to detect an entrapped or otherwise immobilized vehicle within the HRI and provide an immediate notification to highway and railroad officials.

Project Objectives:

- Design and deploy either a single or a series of systems, which enhance safety at high activity railroad crossings.
- Develop traveler information systems, which display accurate, timely, and useful information on expected train crossings and anticipated delays.
- Consider inexpensive options to enhance RR crossing safety.

Sponsorship: City of Hanford and Kings County

Deployment Phasing: This project is a single-phase deployment.

	Phase Components
Phase 1	➢ Analyze locations of Smart crossing sites within project area ➢ Deploy Smart Crossing Sites

Deployment Locations: Countywide

Deployment Timeframes: This project is a near to mid term deployment.

	Phase Timelines
Phase 1	Near to Mid Term

Benefits:

General Benefits:

- Enhanced safety at grade crossings through improved warning of approaching trains.
- Decreased travel delays to travelers through enhanced information.

Emissions Reductions:

- Emissions reductions may result from these types of projects through the diversion of some traffic to alternative routes not delayed by train traffic. Based on the site being deployed, the volume of traffic, and availability of alternative routes to reach the same destination it should be possible to estimate the emissions reductions resulting from anticipated traffic diversions.
- Deployment of this type of equipment along high volume routes with viable alternative paths of travel should improve the emissions reduction potential of these projects.

Budget Estimate:

	Phase Budget Estimates	
	Capital Costs	**Operations and Maintenance Per Year**
Phase 1	$1,000K	$100K
Totals	$1,000K	$100K

Evaluation Criteria:

- MOE
  - Traffic delays at RR-xings
  - Number of incidents at crossings
  - Number of illegal crossings
  - Emissions reduction
  - Diverted traffic volumes
  - Survey of public perceptions

O&M Considerations: Concurrence of the California Public Utilities Commission (CPUC) and property owners will be required to place devices within the railroad right-of-way.

Architecture Considerations: Refer to Figure 5-5 in Section 5.0 of this Plan. Readers may also want to review market packages ATMS 14 and 15 of the National Architecture.

1.1.1.3 Central Control of Traffic Signals

General Description:

Basic signal coordination provides signal control for a series of signals on an independent basis, without bringing surveillance or monitoring information to a central location. Central control provides communications to a central point where monitoring and control functions can occur. The capabilities of the central system can vary widely, from simple monitoring of signal controller functions to full graphic display of intersection traffic movement. One of the strengths of central computer control is the ability to design and implement multiple signal timing plans that deal with particular times, or days of traffic that vary from the norm (special events, etc.). Enhanced maintenance monitoring functions can also be provided (immediate identification of failed loops, burned out lamps, etc.). System features will vary by city.

Project Objectives:

- Design and deploy appropriate communications infrastructure along key arterial in the urbbanized area
- Design and deploy a regionally integrated signal system to improve interagency coordination and cooperation.
- Establish regional signal system standards.

Sponsorship: City of Hanford

Deployment Phasing: This project is a single-phase deployment.

	Phase Components
Phase 1	➢ Local fiber communications. ➢ Deployment of centralized signal software ➢ Deployment of signal workstations to smaller cities. ➢ Upgrade of outdated controllers. ➢ Network equipment & services for communications between signal systems & with remote cities.

Deployment Locations: City of Hanford

Deployment Timeframes: This project is a near to mid term deployment.

	Phase Timelines
Phase 1	Near to Mid Term

Benefits:

General Benefits:

- Communications infrastructure along key arterials will allow for improved signal coordination along those corridors.
- Traffic signals coordination can improve the flow of traffic, even during unexpected traffic conditions.
  - In Los Angeles, traffic signals can adjust for current traffic conditions, even when incidents divert traffic from the freeways. As a result, 41% fewer vehicles are stopped at red lights.
- By using improved communications and control techniques, traffic management can reduce delay in both uncongested and congested situations.
  - The Automated Traffic Surveillance and Control (ATSAC) program in Los Angeles reported an 18% reduction in travel time, a 16% increase in speed, and a 44% decrease in delay.
  - Toronto, Canada evaluated a computerized signal control system on two corridors and the central business district network, totaling about 75 signals. The two-month evaluation period compared the computerized system to a "best effort" fixed timing plan, and showed that the computerized control system resulted in an 8% decrease in travel time, as well as a 17% decrease in delay.
  - The City of Abilene, Texas installed a closed-loop computerized signal system, and reported that the travel times decreased by 14%, the delays decreased by 37%, and the travel speeds increased by 22%.
- Regional system standards will ease the process of coordination among systems in the different agencies, such as cities, counties, and Caltrans by providing a common base for all of the agencies to work from.

Emission Reductions:

- Emissions reductions from signal coordination and centralized signal control have been well established through testing and evaluation. A notable example of background information on the emissions and fuel reduction of signal coordination is California's FETSIM program.
- Emissions reductions from signal coordination and control result from increased travel speeds, fewer stops, and decreased acceleration cycles.
- In order for signal interconnection projects to provide emissions reductions, it is essential that an effective operational plan be put in place to implement improved signal timing.

Budget Estimate:

	Phase Budget Estimates	
	Capital Costs	**Operations and Maintenance Per Year**
Phase 1	$150K	$20K
Totals	$150K	$20K

Fiber-optic deployment costs based on a unit cost of $25/LF. Design costs were assumed to be 15% of capital costs, and contingencies were 15% of capital costs for traditional project components and 30% for software development. The fiber-optic interconnect portions of this project represent approximately 60% of the total estimated budget.

Evaluation Criteria:

- MOE
  - Intersection delay
  - Arterial travel times
  - Average time to diagnose and resolve a signal problem at a remote location
  - Emissions reduction
  - Data traffic between cities and other signal control agencies
  - Number of interjurisdictional coordinated signals
- MOP
  - Time to access information on another agency's signal
- MOS
  - Mean-time between failures
  - O&M costs

O&M Considerations: The Traffic Systems Workgroup should develop a set of informal guidelines to assist agencies in interjurisdictional signal coordination. In addition, the Workgroup should draft some example bi-lateral letters of agreement between agencies to share signal information, timing plans, and (in some cases) control.

Architecture Considerations:

Throughout the nation there are significant efforts underway to enhance signal interconnectivity and operations between jurisdictions. Three efforts are of primary importance to the project outlined in this Plan.

- Development of CT-Net – CT-Net is the Caltrans developed version of a centralized signal control system. The main software is free to Caltrans Districts, and it is generally being adopted by Districts throughout most of the State, including District 6. There is some discussion that the CT-Net software will be available for free to local jurisdictions that request it, however the controller firmware (C8 v4) is not. It is not clear at this time whether or not CT-Net will be fully compatible with the Bi-Trans QuicNet 4 software currently being deployed by the area. Interested jurisdictions should contact their District office for further information.
- Development of QuicNet 4+ - QuicNet 4.0 is the central signal control software currently available from Bi-Trans. A more advanced version of QuicNet is about to enter development in the San Diego Region. This development may offer opportunities for the region and should be carefully followed.
- NTCIP – Class E - Many signal software packages are beginning to support the new NTCIP– Class E standard for center to center communications. The continued adoption of this standard by vendors may simplify signal integration efforts in the Region. Compliance with this standard should be an important consideration for any future signal control system.

Reference should be made to market package ATMS 3 in the National Architecture.

1.1.2 INCIDENT MANAGEMENT/EMERGENCY SERVICES

Currently, there are no Incident Management/Emergency Service projects proposed for the County.

1.1.3 TRANSIT SYSTEMS

1.1.3.1 KART AVL Demonstration

General Description:

This project would equip KART transit vehicles with Automatic Vehicle Location (AVL) equipment to track vehicles. The AVL system is most typically deployed using GPS (satellite-based) position acquisition equipment, which would pinpoint the exact (to within 20 meters) location of the tracked vehicle. Such tracking would be ongoing all the time, and not limited to the transit service area. If a bus were removed from the area, it could still be located using the AVL equipment. . The vehicle coordinate information is transmitted to a central receiving site (dispatch center) using a data radio communications medium, allowing transit dispatchers to track the busses. In many cases, the tracking information could be integrated into the same workstation that the dispatchers use in supervising and managing the transit vehicles. KART is the public transportation system in Kings County, serving the 4 cities in the County (Avenal, Corcoran, Lemoore and Hanford) as well as throughout the County along major routes. The service is contracted by a joint powers agency (KCAPTA), and provides both fixed route and paratransit service. An Automatic Vehicle Location (AVL) system for KART would improve the system's efficiency. When buses are tracked remotely using an AVL system, dispatchers could monitor relative positions of vehicles, and take contemporaneous actions to better space vehicles on fixed routes. Dispatchers would also be able to monitor and track paratransit vehicles, and ascertain whether scheduled pickups could be made, and whether additional pickups could be fit into the current day's schedule. With this system in place, KCAPTA should also be able to monitor movements of the transit fleet, so as to provide a supervisory control over their contractor's service.

Project Objectives:

- Design and implement an efficient AVL system

Sponsorship: KART, KCAG

Deployment Phasing: This project is a single-phase deployment.

	Phase Components
Phase 1	➢ Deploy transit vehicles (including fixed route & paratransit) with standard AVL/GPS equipment. ➢ Procure new or additional workstations

Deployment Locations: Countywide

Deployment Timeframes: This project is a near term deployment.

	Phase Timelines
Phase 1	Near Term

Benefits:

- Improved transit service
- Improved transit safety
- Enhanced information for transit managers.

Budget Estimate:

	Phase Budget Estimates	
	Capital Costs	**Operations and Maintenance Per Year**
Phase 1	$700K	$70K
Totals	$700K	$70K

1.1.3.2 Demand Responsive Transit System Integration Study

General Description:

This project would fund a study of demand-responsive transit system integration strategies, culminating in a specific set of recommendations to implement strategies within specified transit agencies. The primary objective of integrating multiple demand-responsive transit services is to improve operating efficiency by reducing service redundancies and sharing vehicles, staff and scheduling/dispatch technology among agencies. These improvements result in an overall better quality of service to riders, and riders may benefit directly through enhanced schedule and/or destination options enabled through the integration of services across agencies. Typically, especially in county-based or rural oriented demand responsive transit environments, a number of different agencies operate within a given geographic area, providing service to many of the same destinations but often serving a slightly different client base. One of the primary objectives of demand-responsive transit service integration strategies is to reduce these redundancies and associated inefficiencies. Demand-responsive service integration includes a wide range of potential specific activities, ranging from simple coordination to full integration. Examples of specific strategies include consolidation of scheduling and/or dispatch functions (where multiple agencies can share the cost of improvements and share access), agreements to share access to vehicles under specified circumstances, and consolidation of ride reservation systems.

Project Objectives:

- Improve paratransit efficiency by providing coordinated operations and improved system purchasing power.

Sponsorship: KART, KCAG

Deployment Phasing: This project is a single-phase deployment.

	Phase Components
Phase 1	➢ Prepare a study of the feasibility of integrated services.

Deployment Locations: Countywide

Deployment Timeframes: This project is a mid term deployment.

	Phase Timelines
Phase 1	Mid Term

Benefits:

- Improved paratransit service Countywide

Budget Estimate:

	Phase Budget Estimates	
	Capital Costs	**Operations and Maintenance Per Year**
Phase 1	$600K	$60K
Totals	$600K	$60K

1.1.4 TRAVELER INFORMATION SYSTEMS

Currently, there are no local traveler information systems projects are proposed for the County.

1.1.5 REGIONAL ITS CONFIGURATION MANAGEMENT/COORDINATION/PLANNING

1.1.5.1 DEN/Communication Interties

General Description:

The project would develop logical data exchange network partnerships; initially focus on the urbanized areas of the County. Presumably the County and Caltrans would also be involved in the partnerships. In addition, the logical interties between Caltrans District 6, the County and major cities of the County. In general, local agencies that partner and interconnect more than one agency with Caltrans have been more successful in obtaining state and federal funding than those proposals that intertie only one agency to Caltrans.

Data exchange networks are typically set up in areas where several jurisdictions are interested in collectively sharing information from their respective traffic management systems. The most common information shared is from traffic signal systems. While information exchange on the network can be used to more efficiently monitor multiple signal systems, the network usually doesn't allow for field device control or system interoperability. However, those capabilities can be included depending on user needs.

Data exchange networks depend on some type of communication infrastructure (dedicated agency owned or leased line) and software to exchange information. Communication intertie projects can establish some of the necessary communication links for a data exchange network. Data exchange networks differ from interties in that data exchange networks typically focus on the network connectivity and "logical" protocols of sharing data among several agencies. Interties typically focus on

the "physical" communication link between agencies. Both, interties and data exchange networks can form the basis and initial implementation of the "center to center" portion of a Regional Architecture.

Communications intertie projects typically take place between a Caltrans Transportation Management Center (TMC) and a local agency TMC/Traffic Operations Center (TOC). To be most effective, the Caltrans TMC and the local agency would be required to have centralized command and control of traffic management systems and field devices within their respective jurisdictions. In other areas of California, intertie projects allow Caltrans and the local agency to more efficiently share transportation management information, including but not limited to: traffic flow and congestion information, weather information, incident information, video images and in some cases, signal timing plans and modes. In some cases, shared control of a limited number and type of field devices has been arranged between agencies. While full control of one another's assets (field devices, signal systems, etc.) is technically possible it may not be a desired arrangement institutionally. The most important element of an intertie project is a communication link between the intertie agencies. This can either be a dedicated agency owned asset (fiber or copper wire) or some type of telco lease line technology (T1, ISDN or DSL). Another major element of an intertie project is the software, protocols, and interfaces that would allow for the exchange of information between different systems. Interties differ from data exchange networks (see Data Exchange Network fact sheet) in that interties focus on the "physical" communication link between agencies. Data exchange networks typically focus on the network connectivity and "logical" protocols of sharing data among several agencies. Both, interties and data exchange networks can form the basis and initial implementation of the "center to center" portion of a Regional Architecture.

Project Objectives:

- Improve coordination and data sharing among agencies within the County.

Sponsorship: Valleywide through Regional TMC's, City of Hanford, City of Lemoore, ·Kings County· and Caltrans District 6

Deployment Phasing: This project is a single-phase deployment.

	Phase Components
Phase 1	➢ System engineering design of the DEN ➢ Develop and deploy DEN within the County

Deployment Locations: Countywide

Deployment Timeframes: This project is a long term deployment.

	Phase Timelines
Phase 1	Long Term

Benefits:

- Improve incident management and traffic management in the urbanized area.

Budget Estimate:

	Phase Budget Estimates	
	Capital Costs	**Operations and Maintenance Per Year**
Phase 1	$200K	$20K
Totals	$200K	$20K

Table A.1: Summary of Kings County ITS Projects

ID	Program Area/Project	Involved Agency	Brief Description	Project Initiation*			Capital Cost Estimates 2001 (Thousands of $)**		
				N	M	L	Total		
							Phase 1	Phase 2	Phase 3
KINGS COUNTY									
1.0 Traffic/Freeway Management Systems (ATMS)									
1.1KI	**URBAN AREA TRAFFIC SIGNAL COORDINATION PROJECT**	**City of Hanford**	This project would implement local traffic signal coordination plans at specific urbanized locations along regionally significant arterials in the County not currently developed. The objective of this project would primarily be to reduce delays at traffic signals by improving coordination between adjacent signals, with improved safety a possible secondary benefit depending on the specific improvements made. The specific improvements to be made would vary by location, which could include intra- and inter-jurisdictional efforts. The types of improvements that are possible include upgrading traffic signal controllers and detection, adding or upgrading signal interconnects, and communications systems enabling centralized (i.e., remote) timing plan updating and maintenance and malfunction monitoring. Although providing emergency vehicle preemption, transit vehicle priority or automated enforcement would not be the focus or justification for these improvements, the equipment installed as part of this project may support these features. This project would be led by local agency traffic operations staff. The provision of traffic signal coordination for small communities is most often initiated with use of either time-based coordination (TBC) or a closed-loop system (CLS). Depending on the type of controller equipment now in place, and depending on the level of staffing support that the City (or County) is able to make in the maintenance of signal coordination plans, the initial cost and recurring effort to achieve signal coordination in Hanford would vary from a very low cost, to a moderate cost. A number of communication alternatives are possible to tie the intersection controllers to a supervisory computer at City Hall (in the CLS alternative). With a CLS, the capability is created to remotely monitor intersection operation and the capability to remotely change both basic and coordination timing. A first step in the signal coordination capability would be the design and implementation of TBC timing plans. A feasibility study on possible and appropriate upgrade plans for creation and installation of a traffic signal system could be completed at the same time. Any small community that has more than 10 traffic signals would probably benefit from having signal coordination implemented along its heaviest-traveled street(s) so that vehicles can progress through a series of signalized intersections without stopping. The initial effort to achieve this basic level of coordination is relatively low, especially if it is contracted out. The resulting basic timing plans (perhaps just 2 or 3 plans which run between 7AM and 6 PM) can be left in place with very little subsequent retiming effort required or needed. Traffic signal coordination typically has one of the very highest benefit-to-cost ratios of any public works activity.	X	X		**$2,000**		
1.2KI	**ADVANCED RAILROAD HIGHWAY INTERFACE TECHNOLOGY DEPLOYMENT**	**City of Hanford** **Kings County**	This project would deploy a demonstration of railroad-highway grade crossing technology at needed grade crossings with safety (high accident) and/or high volume and delay concerns. The objective of the demonstration would be to field validate a specific strategy or strategies for improving safety, reducing delay and/or providing travelers with improved real-time information on grade crossing status. The demonstration could feature any combination of detection (both for trains and approaching vehicles), warning/traveler information, and control devices. Many different strategies are possible. Possible strategies include sensors coupled with message signs, in-vehicle devices and/or highway advisory radio that would provide approaching travelers with information on the expected duration of a crossing blockage. Another possible application would tie sensors to emergency vehicle dispatching systems to provide dispatchers and drivers with real time crossing status information. This project could provide a blueprint for applying technology to enhance grade crossing safety throughout the entire San Joaquin Valley area. One major cause of crashes at railroad grade crossings is the persistent presence of the heavy Tule fog in the Valley, and the inability for drivers to see grade crossings which are occupied with a train, usually in motion, until they are too close to stop. If some kind of train presence detection could be devised, and tied to an advance-warning beacon, approaching drivers would be forewarned about the dangerous situation. Such an active presence could be detected by an advanced detector, and need not involve the cooperation / joint solution with the railroad. Because of liability, railroads are not eager to create new and unproven detection or safety mechanisms; they have a well-defined program for active warning devices at the crossing which are very involved "systems" tied in with the railroad's own advance detection systems. The possibility of deploying an advanced technology solution, especially at locations where no active warning devices now exist, would be the basis for this project. Highway traffic at highway-rail intersections (HRIs) could be managed, where operational requirements demand advanced features (e.g., where rail operational speeds are greater than 80 miles per hour). This would include all capabilities from the Standard Railroad Grade Crossing and augments these with additional safety features to mitigate the risks associated with higher rail speeds. The active warning systems would include positive barrier systems, which preclude entrance into the intersection when the barriers are activated. Like the Standard Package, the HRI equipment is activated on notification by wayside interface equipment, which detects, or communicates with, the approaching train. The wayside interface equipment would provide additional information about the arriving train so that the train's direction of travel, estimated time of arrival, and the estimated duration of closure may be derived. This enhanced information may be conveyed to the driver prior to, or in context with, warning system activation. This would also include additional detection capabilities, enabling it to detect an entrapped or otherwise immobilized vehicle within the HRI and provide an immediate notification to highway and railroad officials.	X	X		**$1,000**		
1.3KI	**CENTRAL CONTROL OF TRAFFIC SIGNALS**	**City of Hanford**	Basic signal coordination provides signal control for a series of signals on an independent basis, without bringing surveillance or monitoring information to a central location. Central control provides communications to a central point where monitoring and control functions can occur. The capabilities of the central system can vary widely, from simple monitoring of signal controller functions to full graphic display of intersection traffic movement. One of the strengths of central computer control is the ability to design and implement multiple signal timing plans that deal with particular times, or days of traffic that vary from the norm (special events, etc.). Enhanced maintenance monitoring functions can also be provided (immediate identification of failed loops, burned out lamps, etc.). System features will vary by city.	X	X		**$200**		
2.0 Incident Management/Emergency Services									
3.0 Transit Systems									
3.1KI	**KART AVL DEMONSTRATION**	KART, KCAG	This project would equip KART transit vehicles with Automatic Vehicle Location (AVL) equipment to track vehicles. The AVL system is most typically deployed using GPS (satellite-based) position acquisition equipment, which would pinpoint the exact (to within 20 meters) location of the tracked vehicle. Such tracking would be ongoing all the time, and not limited to the transit service area. If a bus were removed from the area, it could still be located using the AVL equipment. . The vehicle coordinate information is transmitted to a central receiving site (dispatch center) using a data radio communications medium, allowing transit dispatchers to track the busses. In many cases, the tracking information could be integrated into the same workstation that the dispatchers use in supervising and managing the transit vehicles. KART is the public transportation system in Kings County, serving the 4 cities in the County (Avenal, Corcoran, Lemoore and Hanford) as well as throughout the County along major routes. The service is contracted by a joint powers agency (KCAPTA), and provides both fixed route and paratransit service. An Automatic Vehicle Location (AVL) system for KART would improve the system's efficiency. When buses are tracked remotely using an AVL system, dispatchers could monitor relative positions of vehicles, and take contemporaneous actions to better space vehicles on fixed routes. Dispatchers would also be able to monitor and track paratransit vehicles, and ascertain whether scheduled pickups could be made, and whether additional pickups could be fit into the current day's schedule. With this system in place, KCAPTA should also be able to monitor movements of the transit fleet, so as to provide a supervisory control over their contractor's service.	X			**$700**		

ID	Program Area/Project	Involved Agency	Brief Description	Project Initiation*			Capital Cost Estimates 2001 (Thousands of $)**		
				N	M	L	Total		
							Phase 1	Phase 2	Phase 3
3.2KI	**DEMAND-RESPONSIVE TRANSIT SYSTEM INTEGRATION STUDY**	KART, KCAG	This project would fund a study of demand-responsive transit system integration strategies, culminating in a specific set of recommendations to implement strategies within specified transit agencies. The primary objective of integrating multiple demand-responsive transit services is to improve operating efficiency by reducing service redundancies and sharing vehicles, staff and scheduling/dispatch technology among agencies. These improvements result in an overall better quality of service to riders, and riders may benefit directly through enhanced schedule and/or destination options enabled through the integration of services across agencies. Typically, especially in county-based or rural oriented demand respsonsive transit environments, a number of different agencies operate within a given geographic area, providing service to many of the same destinations but often serving a slightly different client base. One of the primary objectives of demand-responsive transit service integration strategies is to reduce these redundancies and associated inefficiencies. Demand-responsive service integration includes a wide range of potential specific activities, ranging from simple coordination to full integration. Examples of specific strategies include consolidation of scheduling and/or dispatch functions (where multiple agencies can share the cost of improvements and share access), agreements to share access to vehicles under specified circumstances, and consolidation of ride reservation systems.		X		**$600**		
4.0 Traveler Information Systems									
5.0 Regional ITS Configuration Management/Coordination/Planning									
5.1KI	**DEN/COMMUNICATIONS INTERTIES**	Valleywide through Regional TMC's • City of Hanford • City of Lemoore • Kings County • Caltrans District 6	The project would develop logical data exchange network partnerships, initially focus on the urbanized areas of the County. Presumably the County and Caltrans would also be involved in the partnerships. In addition, the logical interties between Caltrans District 6, the County and major cities of the County. In general, local agencies that partner and interconnect more than one agency with Caltrans have been more successful in obtaining state and federal funding than those proposals that intertie only one agency to Caltrans. Data exchange networks are typically set up in areas where several jurisdictions are interested in collectively sharing information from their respective traffic management systems. The most common information shared is from traffic signal systems. While information exchange on the network can be used to more efficiently monitor multiple signal systems, the network usually doesn't allow for field device control or system interoperability. However, those capabilities can be included depending on user needs. Data exchange networks depend on some type of communication infrastructure (dedicated agency owned or leased line) and software to exchange information. Communication intertie projects can establish some of the necessary communication links for a data exchange network. Data exchange networks differ from interties in that data exchange networks typically focus on the network connectivity and "logical" protocols of sharing data among several agencies. Interties typically focus on the "physical" communication link between agencies. Both, interties and data exchange networks can form the basis and initial implementation of the "center to center" portion of a Regional Architecture. Communications intertie projects typically take place between a Caltrans Transportation Management Center (TMC) and a local agency TMC/Traffic Operations Center (TOC). To be most effective, the Caltrans TMC and the local agency would be required to have centralized command and control of traffic management systems and field devices within their respective jurisdictions. In other areas of California, intertie projects allow Caltrans and the local agency to more efficiently share transportation management information, including but not limited to: traffic flow and congestion information, weather information, incident information, video images and in some cases, signal timing plans and modes. In some cases, shared control of a limited number and type of field devices has been arranged between agencies. While full control of one another's assets (field devices, signal systems, etc.) is technically possible it may not be a desired arrangement institutionally. The most important element of an intertie project is a communication link between the intertie agencies. This can either be a dedicated agency owned asset (fiber or copper wire) or some type of telco lease line technology (T1, ISDN or DSL). Another major element of an intertie project is the software, protocols, and interfaces that would allow for the exchange of information between different systems. Interties differ from data exchange networks (see Data Exchange Network fact sheet) in that interties focus on the "physical" communication link between agencies. Data exchange networks typically focus on the network conectivity and "logical" protocols of sharing data among several agencies. Both, interties and data exchange networks can form the basis and initial implementation of the "center to center" portion of a Regional Architecture.			X	**$200**		
			Total Estimated Capital Deployment Costs for All Potential ITS Projects Over 20 Years						**$4,650**

Notes:

* Project initiation timeframes - N = Years 1-5, M = Years 6-10, L = Years 11+

**All capital costs are approximate and rounded for purposes of this table.

Table A.2: Timeline of Kings County ITS Projects

PROGRAM AREAS/PROJECTS	NEAR TERM					MID-TERM					LONG TERM										TOTAL COSTS
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
1.0 Traffic/Freeway Management Systems (ATMS)																					
1.1(6) URBAN AREA TRAFFIC SIGNAL COORDINATION PROJECT																					$2,000
1.2(6) ADVANCED RAILROAD HIGHWAY INTERFACE TECHNOLOGY DEPLOYMENT																					$1,000
1.3(6) CENTRAL CONTROL OF TRAFFIC SIGNALS																					$150
2.0 Incident Management/Emergency Services																					
3.0 Transit Systems																					
3.1(6) FARE AVL DEMONSTRATION																					$700
3.2(6) DEMAND-RESPONSIVE TRANSIT SYSTEM INTEGRATION STUDY																					$600
4.0 Traveler Information System																					
5.0 Regional ITS Configuration Management/ Coordination/ Planning																					
5.1(6) DEVICE/COMMUNICATIONS INTERFACE																					$200
TOTAL ESTIMATED EXPENDITURES																					
																					$4,650

Revised September 25, 2001

Phase 1 Deployment
Phase 2 Deployment
Phase 3 Deployment

Notes:

1. *All values are displayed in 2001 dollars*
2. *Timeline does not reflect operations and maintenance timeframes*
3. *All budget estimates are preliminary and should be utilized for planning purposes only*

Figure A.1: Sequence of Proposed ITS Implementation Activities for Kings County

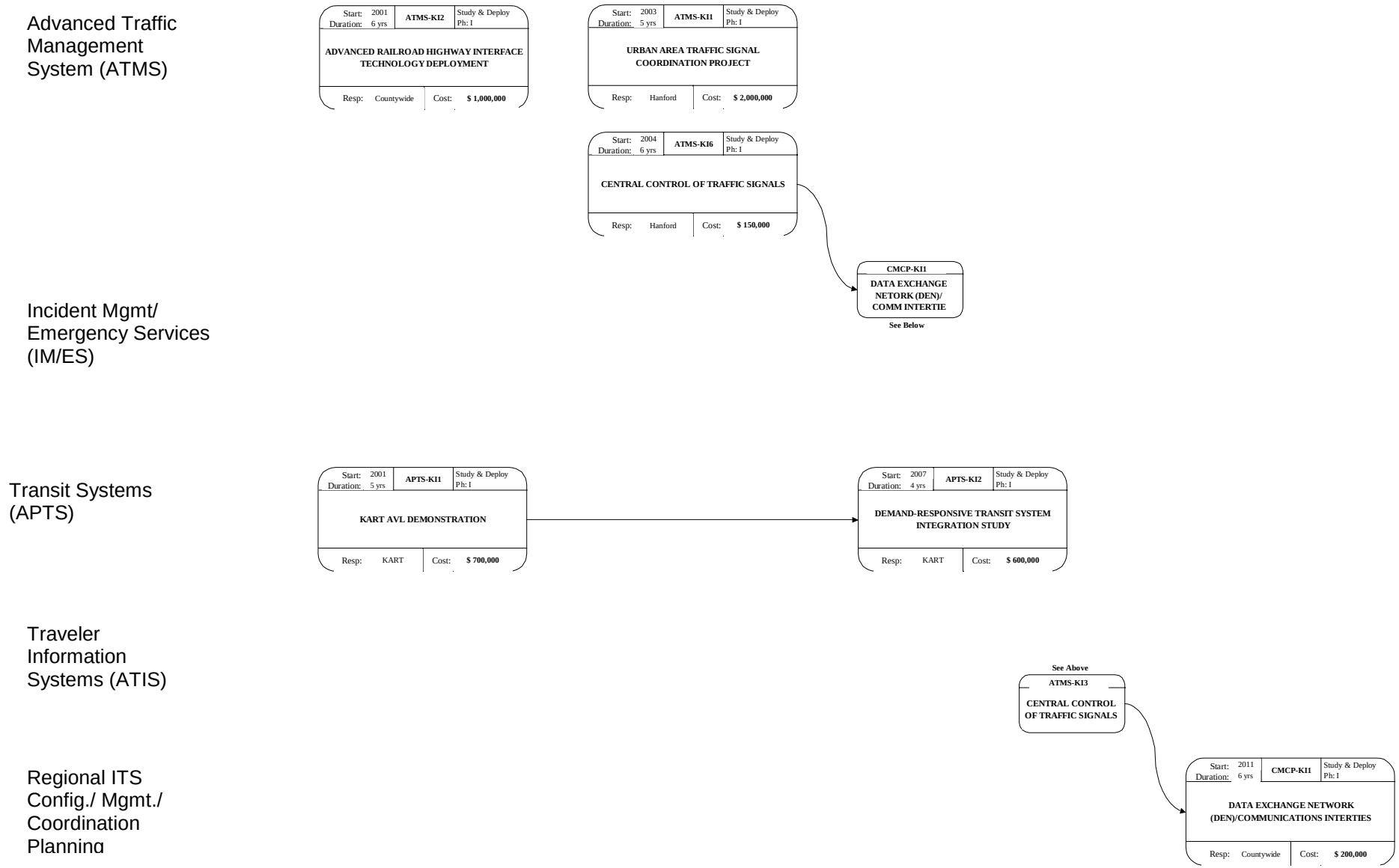
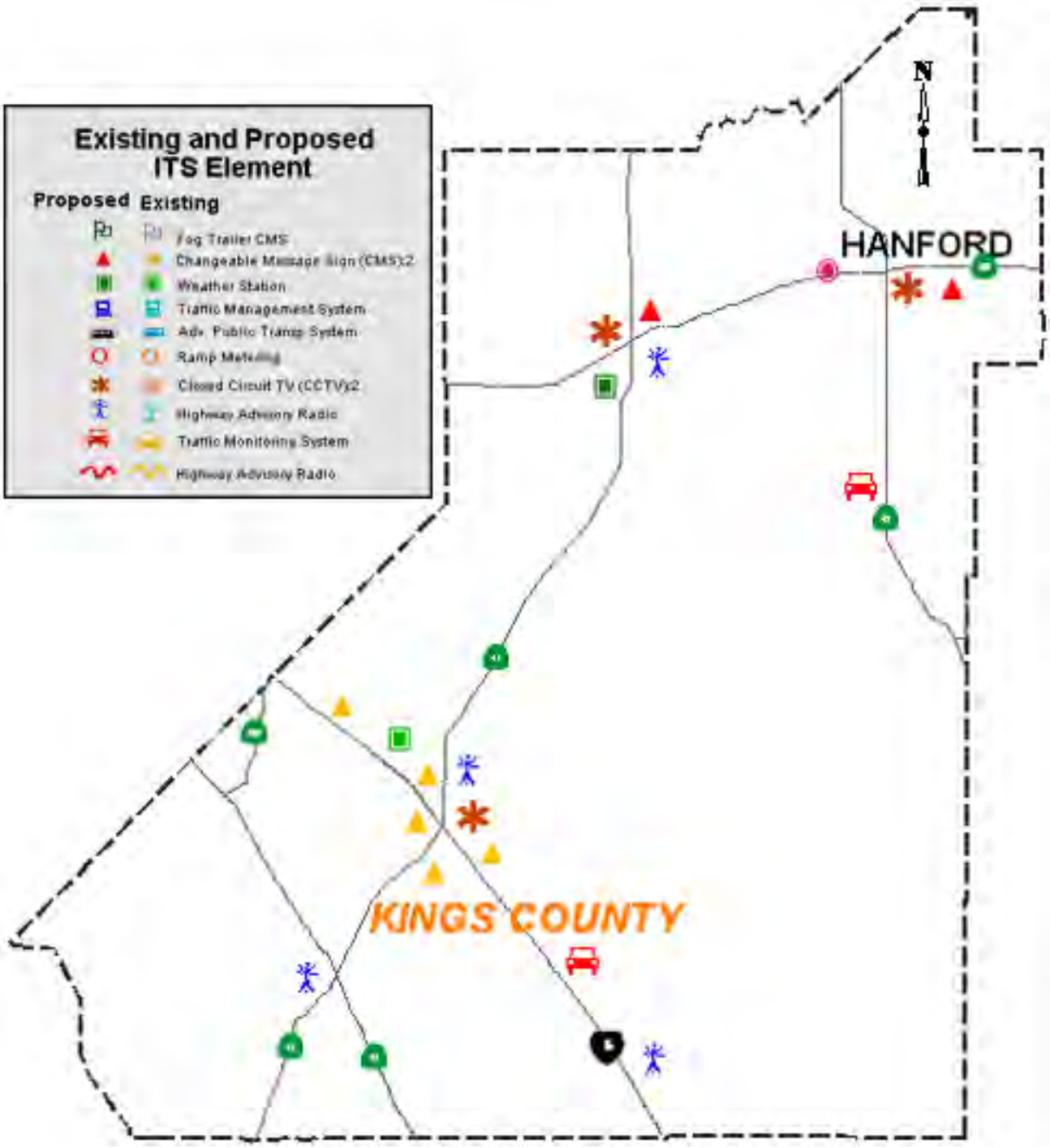


Figure A.2: Existing and Proposed ITS Elements for Kings County



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1.2 Tulare County

The total estimated capital deployment costs for all potential ITS projects over 20 years is $20,956,000.

1.2.1 TRAFFIC/FREEWAY MANAGEMENT SYSTEMS (ATMS)

1.2.1.1 Central Control of Traffic Signals in Urban Area

General Description:

Basic signal coordination provides signal control for a series of signals on an independent basis, without bringing surveillance or monitoring information to a central location. Central control provides communications to a central point where monitoring and control functions can occur. The capabilities of the central system can vary widely, from simple monitoring of signal controller functions to full graphic display of intersection traffic movement. One of the strengths of central computer control is the ability to design and implement multiple signal timing plans that deal with particular times, or days of traffic that vary from the norm (special events, etc.). Enhanced maintenance monitoring functions can also be provided (immediate identification of failed loops, burned out lamps, etc.). System features will vary by city.

This project would be divided into two separate parts: development of Automated Traffic Control System (ATMS) for the City of Tulare with a workstation at the Tulare County planning offices and expansion of the current ATMS for the City of Visalia with a connection to the Tulare County Planning offices. The ATMS projects would coincide with the FUA coordination project described in the next section.

The City of Tulare ATMS would be compatible to the City of Visalia BiTran QuicNet 4 system, with capabilities of sharing selected real time traffic data. A workstation would be installed at the Tulare County Planning offices to provide communication links to County signals, as well as collect vehicle detector counts for future traffic modeling. **Figure 4.1** and **Figure 4.2** of the Visalia-Tulare-Goshen FUA ITS System Architecture and Operations Report illustrate the conceptual layout of the City of Tulare ATMS deployment and the City of Visalia ATMS expansion.

Project Objectives:

- Design and deploy appropriate communications infrastructure along key arterial in the urbanized area
- Design and deploy a regionally integrated signal system to improve interagency coordination and cooperation.
- Establish regional signal system standards.

Sponsorship: City and County of Tulare.

Deployment Phasing: This project is a single-phase deployment.

	Phase Components
Phase 1	➢ Local fiber communications. ➢ Deployment of centralized signal software ➢ Deployment of signal workstations to smaller cities. ➢ Upgrade of outdated controllers. ➢ Network equipment & services for communications between signal systems & with remote cities.

Deployment Locations: Countywide

Deployment Timeframes: This project is a near term deployment.

	Phase Timelines
Phase 1	Near Term

Benefits:

General Benefits:

- Communications infrastructure along key arterials will allow for improved signal coordination along those corridors.
- Traffic signals coordination can improve the flow of traffic, even during unexpected traffic conditions.
  - In Los Angeles, traffic signals can adjust for current traffic conditions, even when incidents divert traffic from the freeways. As a result, 41% fewer vehicles are stopped at red lights.
- By using improved communications and control techniques, traffic management can reduce delay in both uncongested and congested situations.
  - The Automated Traffic Surveillance and Control (ATSAC) program in Los Angeles reported an 18% reduction in travel time, a 16% increase in speed, and a 44% decrease in delay.
  - Toronto, Canada evaluated a computerized signal control system on two corridors and the central business district network, totaling about 75 signals. The two-month evaluation period compared the computerized system to a "best effort" fixed timing plan, and showed that the computerized control system resulted in an 8% decrease in travel time, as well as a 17% decrease in delay.
  - The City of Abilene, Texas installed a closed-loop computerized signal system, and reported that the travel times decreased by 14%, the delays decreased by 37%, and the travel speeds increased by 22%.
- Regional system standards will ease the process of coordination among systems in the different agencies, such as cities, counties, and Caltrans by providing a common base for all of the agencies to work from.

Emission Reductions:

- Emissions reductions from signal coordination and centralized signal control have been well established through testing and evaluation. A notable example of background information on the emissions and fuel reduction of signal coordination is California's FETSIM program.

- Emissions reductions from signal coordination and control result from increased travel speeds, fewer stops, and decreased acceleration cycles.
- In order for signal interconnection projects to provide emissions reductions, it is essential that an effective operational plan be put in place to implement improved signal timing.

Budget Estimate:

	Phase Budget Estimates	
	Capital Costs	**Operations and Maintenance Per Year**
Phase 1	$300K	$30K
Totals	$300K	$30K

Fiber-optic deployment costs based on a unit cost of $25/LF. Design costs were assumed to be 15% of capital costs, and contingencies were 15% of capital costs for traditional project components and 30% for software development. The fiber-optic interconnect portions of this project represent approximately 60% of the total estimated budget.

Evaluation Criteria:

- MOE
  - Intersection delay
  - Arterial travel times
  - Average time to diagnose and resolve a signal problem at a remote location
  - Emissions reduction
  - Data traffic between cities and other signal control agencies
  - Number of interjurisdictional coordinated signals
- MOP
  - Time to access information on another agency's signal
- MOS
  - Mean-time between failures
  - O&M costs

O&M Considerations: The Traffic Systems Workgroup should develop a set of informal guidelines to assist agencies in interjurisdictional signal coordination. In addition, the Workgroup should draft some example bi-lateral letters of agreement between agencies to share signal information, timing plans, and (in some cases) control.

Architecture Considerations:

Throughout the nation there are significant efforts underway to enhance signal interconnectivity and operations between jurisdictions. Three efforts are of primary importance to the project outlined in this Plan.

- Development of CT-Net – CT-Net is the Caltrans developed version of a centralized signal control system. The main software is free to Caltrans Districts, and it is generally being adopted by Districts throughout most of the State, including District 6. There is some discussion that the CT-Net software will

be available for free to local jurisdictions that request it, however the controller firmware (C8 v4) is not. It is not clear at this time whether or not CT-Net will be fully compatible with the Bi-Trans QuicNet 4 software currently being deployed by the area. Interested jurisdictions should contact their District office for further information.

- Development of QuicNet 4+ - QuicNet 4.0 is the central signal control software currently available from Bi-Trans. A more advanced version of QuicNet is about to enter development in the San Diego Region. This development may offer opportunities for the region and should be carefully followed.
- NTCIP – Class E - Many signal software packages are beginning to support the new NTCIP– Class E standard for center-to-center communications. The continued adoption of this standard by vendors may simplify signal integration efforts in the Region. Compliance with this standard should be an important consideration for any future signal control system.

Reference should be made to market package ATMS 3 in the National Architecture.

1.2.1.2 Centralized Traffic Signal Control Upgrade

General Description:

This project would upgrade the current QuicNet BiTran 2 AMTS system to the Current QuicNet 4 system. The project would upgrade include hardware and software Basic signal coordination provides signal control for a series of signals on an independent basis, without bringing surveillance or monitoring information to a central location. Central control provides communications to a central point where monitoring and control functions can occur. The capabilities of the central system can vary widely, from simple monitoring of signal controller functions to full graphic display of intersection traffic movement. One of the strengths of central computer control is the ability to design and implement multiple signal timing plans that deal with particular times, or days of traffic that vary from the norm (special events, etc.). Enhanced maintenance monitoring functions can also be provided (immediate identification of failed loops, burned out lamps, etc.). System features will vary by city.

Project Objectives:

- Upgrade existing BiTrans QuicNet 2 software to QuicNet4.
- Design and deploy any necessary regionally integrated signal system components to improve interagency coordination and cooperation.

Sponsorship: City of Visalia

Deployment Phasing: This project is a single-phase deployment.

	Phase Components
Phase 1	➢ Upgrade of centralized signal software ➢ Upgrade of signal workstations. ➢ Upgrade of outdated controllers. ➢ Network equipment & services for communications between signal systems & with remote cities.

Deployment Locations: City of Visalia

Deployment Timeframes: This project is a near term deployment.

	Phase Timelines
Phase 1	Near Term

Benefits

General Benefits:

- Improved traffic signal coordination can improve the flow of traffic, even during unexpected traffic conditions.
- By using improved communications and control techniques, traffic management can reduce delay in both uncongested and congested situations.

Emission Reductions:

- Emissions reductions from signal coordination and centralized signal control have been well established through testing and evaluation. A notable example of background information on the emissions and fuel reduction of signal coordination is California's FETSIM program.
- Emissions reductions from signal coordination and control result from increased travel speeds, fewer stops, and decreased acceleration cycles.
- In order for signal interconnection projects to provide emissions reductions, it is essential that an effective operational plan be put in place to implement improved signal timing.

Budget Estimate:

	Phase Budget Estimates	
	Capital Costs	**Operations and Maintenance Per Year**
Phase 1	$70K	$10K
Totals	$70K	$10K

Evaluation Criteria:

- MOE
  - Intersection delay
  - Arterial travel times
  - Average time to diagnose and resolve a signal problem at a remote location
  - Emissions reduction
  - Data traffic between cities and other signal control agencies
  - Number of interjurisdictional coordinated signals
- MOP
  - Time to access information on another agency's signal
- MOS
  - Mean-time between failures
  - O&M costs

O&M Considerations: The upgrade of software should not result in an increase in O&M.

Architecture Considerations: Reference should be made to market package ATMS 3 in the National Architecture.

1.2.1.3 Visalia ATMS Expansion

General Description:

This project would provide for a variety of travel management enhancements that could include the installation of a sophisticated traffic control center that controls traffic signals, the installation of traffic surveillance using closed circuit TV, providing up to the minute information on traffic to travelers. The project would include the upgrade of existing Traffic Control Center into an advanced Traffic Management Center (TMC).

The project would integrate the system components with other regional systems, including Caltrans. The project would include the study developing the ATMS plan, installation of the ATMS components including the integration of installation of fiber optic cable for improved communication and closed circuit TV, and the installation of a new traffic signal system in the TMC.

Project Objectives:

- Improve mobility
- Decrease traffic congestion

Sponsorship: City of Visalia

Deployment Phasing: This project is a single-phase deployment.

	Phase Components
Phase 1	➢ Centralized Signal Control Upgrade ➢ Communications Links

Deployment Locations: City of Visalia

Deployment Timeframes: This project is a mid term deployment.

	Phase Timelines
Phase 1	Mid Term

Benefits:

- Improved mobility and reduction in congestion and delays

Budget Estimate:

	Phase Budget Estimates	
	Capital Costs	Operations and Maintenance Per Year
Phase 1	$800K	$80K
Totals	$800K	$80K

Evaluation Criteria:

- Travel Time
- Emissions

O&M Considerations: An increase in Operation and Maintenance budget should be considered to provide the proper level of system maintenance.

1.2.1.4 Visalia-Tulare-Goshen Urban Area Traffic Signal Interconnect and Coordination Project

General Description:

This project would implement local traffic signal coordination plans at specific urbanized locations along regionally significant arterials in the County not currently developed. The objective of this project would primarily be to reduce delays at traffic signals by improving coordination between adjacent signals, with improved safety a possible secondary benefit depending on the specific improvements made. The specific improvements to be made would vary by location, which could include intra- and inter-jurisdictional efforts. The types of improvements that are possible include upgrading traffic signal controllers and detection, adding or upgrading signal interconnects, and communications systems enabling centralized (i.e., remote) timing plan updating and maintenance and malfunction monitoring. Although providing emergency vehicle preemption, transit vehicle priority or automated enforcement would not be the focus or justification for these improvements, the equipment installed as part of this project may support these features. Local agency traffic operations staff would lead this project.

The provision of traffic signal coordination for small communities is most often initiated with use of either time-based coordination (TBC) or a closed-loop system (CLS). Depending on the type of controller equipment now in place, and depending on the level of staffing support that the City (or County) is able to make in the maintenance of signal coordination plans, the initial cost and recurring effort to achieve signal coordination in Hanford would vary from a very low cost, to a moderate cost. A number of communication alternatives are possible to tie the intersection controllers to a supervisory computer at City Hall (in the CLS alternative). With a CLS, the capability is created to remotely monitor intersection operation and the capability to remotely change both basic and coordination timing. A first step in the signal coordination capability would be the design and implementation of TBC timing plans. A feasibility study on possible and appropriate upgrade plans for creation and installation of a traffic signal system could be completed at the same time. Any small community that has more than 10 traffic signals would probably benefit from having signal coordination implemented along its heaviest-traveled street(s) so that vehicles can progress through a series of signalized intersections without stopping. The initial effort to achieve this basic level of coordination is relatively low, especially if it is contracted out. The resulting basic timing plans (perhaps just 2 or 3 plans which run between 7AM and

6 PM) can be left in place with very little subsequent retiming effort required or needed. Traffic signal coordination typically has one of the very highest benefit-to-cost ratios of any public works activity.

Project Objectives:

- Provide improved signal coordination that one upgrades for revised traffic conditions.

Sponsorship: City of Visalia, City of Tulare, and County of Tulare

Deployment Phasing: This project is a single-phase deployment.

	Phase Components
Phase 1	➢ Develop traffic timing plans ➢ Install additional signal interconnect (Copper, Fiber optic cable, wireless spread spectrum etc…) ➢ Upgrade signal controllers as necessary

Deployment Locations: Along major arterials within the Visalia-Tulare-Goshen FUA

Deployment Timeframes: This project is a near to mid term deployment.

	Phase Timelines
Phase 1	Near to Mid Term

Benefits:

- Improved mobility and reduced emissions

Budget Estimate:

	Phase Budget Estimates	
	Capital Costs	**Operations and Maintenance Per Year**
Phase 1	$3,500K	$350K
Totals	$3,500K	$350K

Evaluation Criteria:

- LOS and overall delay
- Travel Time
- Emissions

O&M Considerations: Increased coordination between agencies operating and maintaining signals along major corridors (i.e. Mooney Boulevard) should be considered

1.2.1.5 Integrated Smart Corridors

General Description:

This project would implement a package of ITS applications in a highway corridor consisting of at least one main route and one parallel route. The focus of the project would be to improve the level of coordination of traffic management activities on the main route and parallel route(s); in effect to conduct corridor-level rather than facility-specific ITS traffic management. The range of ITS applications that could be included in a smart corridor application include essentially the full range of freeway management, arterial street management (e.g., traffic signalization) and traveler information strategies, including surveillance and detection; incident management, including coordinated and dynamic traffic detouring strategies utilizing both the main and parallel route(s); changeable message signs; dynamic trailblazer signs; highway advisory radio; and integrated traffic signal operations, including coordination between ramp meters and adjacent traffic signals. The smart corridor project would feature implementation of a combination of ITS applications, with the emphasis being on linking operations across multiple facilities serving a defined travel corridor. Given the multi-facility nature of this project, the multi-jurisdictional coordination aspects of the project will be critical, including developing consensus on the specific objectives of the project and on the individual coordination procedures and techniques. The first step in the development of this project would be to identify a candidate project corridor, based on accidents and congestion, travel patterns, availability of alternate routes and interest among the potential project participants.

Project Objectives:

- Design and deploy appropriate ITS infrastructure along the proposed smart corridors.
- Develop common standards for ATMS functions.
- Consider the integration of freeway and major arterial operations (managing the overall transportation network).
- Design and develop integrated corridor system tools that can be deployed throughout the Region.

Sponsorship: Caltrans District 6 Visalia Tulare Goshen FUA

Deployment Phasing: This project is a single-phase deployment.

	Phase Components
Phase 1	➢ Fiber communications ➢ Smart corridor including appropriate (CMS, CCTV, HAR, and freeway/arterial integration)

Deployment of smart corridors is a complex undertaking task for any region. The San Joaquin Valley has the advantage of a less complex institutional arena than the Los Angeles region, but it also has far fewer funds available. While the smart corridors project is outlined in a separate definition, it is important to note that many of the project efforts build towards or support the smart corridor concept. It is important that the Region consider its future goal for smart corridors when deploying smaller-scale ITS efforts in order to move towards that goal

Deployment Locations: Visalia Tulare Goshen FUA

Deployment Timeframes: This project is a long term deployment.

	Phase Timelines
Phase 1	Long Term

Benefits:

General Benefits:

- The Smart Corridor Project for the City of Los Angeles involving I-10 and adjacent arterials is an example of an "integrated" ITS system. A preliminary evaluation of this system was performed to evaluate its impacts. It was estimated that total travel time along the Smart Corridor would be reduced by 11 to 15%. Intersection delay is expected to be reduced by nearly 20%. Vehicle emission will generally decrease as follows: CO (15%), HC (8%). Freeway speeds during peak hours will increase by nearly 70 to 80 %. Stop-and-go freeway conditions will decrease substantially. Average surface street speeds during peak periods will increase by nearly 11%. These same benefits are anticipated for the Fresno County project. A conservative 8% reduction in travel time is assumed for benefit-cost analysis.
- The Information for Motorist (INFORM) program in Long Island, New York, is an integrated program using changeable message signs, ramp meters, in-road traffic detectors, and signal coordination on parallel streets. INFORM has increased rush hour speeds on Long Island from 34 mph to 46 mph. Drivers will divert to an alternate route 5% to 10% of the time when passive messages are displayed on electronic signs, and will divert even more frequently when the message recommends an alternate route.
- Integrated systems have the ability to lower costs by sharing infrastructure, staff, and equipment cost among a number of services and agencies. An analysis performed for the US DOT ITS Joint Program Office indicated that incorporation of the full metropolitan ITS infrastructure into a regional transportation improvement plan could reduce the cost of infrastructure expansion by approximately one-half. The analysis was based on published data regarding VMT growth, infrastructure component benefits, and FHWA cost estimates.
- In Detroit, Michigan, an expansion of the freeway management system is expected to reduce delays from incidents by about 40%. This could lead to an annual reduction of 41.3 million gallons of fuel used, a reduction of 122,000 tons of carbon monoxide, 1,400 tons hydrocarbons, and 1,200 tons of nitrogen oxides.

Emissions Reductions:

- See above.
- Smart Corridor projects reduce emissions by decreasing delay and traffic flow breakdown along congested facilities. The extent of emissions reduction is largely a function of the extent of congestion, volume of traffic, type of traffic management devices/operations, and the number of incidents along the facility in question. Generally, it should be possible to estimate emissions reduction by determining the likely reduction in either the number of incidents or the duration of these incidents and applying this to the affected vehicles.
- As with signal coordination, Smart Corridors are implementations of devices and the operation of those devices. It is essential that a sound operational plan be in place to take full advantage of Smart Corridor operations.

Budget Estimate:

	Phase Budget Estimates	
	Capital Costs	**Operations and Maintenance Per Year**
Phase 1	$2,500K	$180K
Totals	$2,500K	$180K

Fiber-optic deployment costs based on a unit cost of $25/LF. Design costs were assumed to be 15% of capital costs, and contingencies were 15% of capital costs for traditional project components and 30% for software development.

Evaluation Criteria:

- MOE
  - Traffic delays (arterial/freeway)
  - Number of primary and secondary incidents
  - Emissions reduction
  - Diverted traffic volumes
  - Survey of public perceptions

O&M Considerations: Smart Corridors are very dependent on interagency cooperation and coordination. Generally, specific response plans must be developed for each portion of the corridor to prescribe how agencies will react in certain situations. Continued coordination and the setting and following of common standards throughout ITS deployment will greatly assist the development of the Smart Corridor concept.

Architecture Considerations: Prerequisite efforts include software integration/systems elements of county projects. It may also prove helpful to review market packages ATMS 1, 3, 4, 6, and 7, as well as ATMS 8.

1.2.1.6 EVP Deployments

General Description:

The project would implement Emergency Vehicle Preemption (EVP) along key arterials throughout the County for use by City and County fire departments. The implementation EVP at a traffic signal modifies normal signal operation to provide a nearly immediate green signal for an approaching emergency vehicle. This type of system is most often deployed on fire trucks because of the nature of the fire truck vehicle performance. The acceleration rate of fire trucks is rather slow due to their relatively low power-to-weight ratio. If fire trucks must slow down (and sometimes stop) when they encounter signalized intersections along their emergency run, the overall delay in responding to their emergency destination can easily exceed 1 to 2 minutes. For fire events, this delay can mean a significant difference in the level of destruction, the level of effort in suppressing the fire, the level of personal danger for firefighters at the scene, and the number and extent of injuries for victims. Depending on the level of congestion and the distance traveled, fire trucks can encounter many traffic

signals, and heavy congestion. Driving in oncoming traffic lanes is a "last resort" maneuver, which fire departments rightly avoid. If the fire truck encounters a red signal, it can assert the right of way and go through, but only after gaining assurance that it can safely cross through the intersection. EVP isn't needed in every community. Only when traffic congestion is very significant, or only when long emergency vehicle runs are likely to encounter a large number of signalized intersections, would the provision of EVP be cost effective. Some cities in the Central Valley already have EVP in place, the 3M Opticom™ system being predominant. Priority request equipment would be installed in each fire truck and matching reception equipment would be installed at each signalized intersection where EVP is to be granted.

Some larger agencies that have used EVP for many years have broadened the application to also equip ambulance vehicles and, in some cases, police vehicles with this on-board preemption request equipment. While these vehicles have much better acceleration characteristics, and the added delay at signals while on their emergency runs is much lower, granting EVP to these vehicles may provide another benefit. The crossing of very wide and very busy signalized intersections is very difficult in today's traffic. Each year, many such emergency vehicles are "totaled" after being T-boned when crossing a busy intersection. EVP helps reduce and prevent this occurrence. However, this project assumes only fire department vehicles would be equipped with EVP devices.

The project would include the installation of EVP devices at 34 signalized intersections in Downtown Visalia area. The EVP deployments would be installed in downtown corridors including Mooney Boulevard, Walnut Avenue, Tulare Avenue and Whitendale Avenue.

Project Objectives:

- Improved emergency response time

Sponsorship: City of Visalia

Deployment Phasing: This project is a two-phase deployment. The first phase would include the installation of 34 EVP in downtown Visalia. The second phase would expand on the initial deployment throughout the FUA.

	Phase Components
Phase 1	➢ EVP detectors at key intersections ➢ EVP emitters on emergency response vehicles
Phase 2	➢ EVP detectors at key intersections ➢ EVP emitters on emergency response vehicles

Deployment Locations: City of Visalia – 34 intersections around the downtown area.

Deployment Timeframes: The first phase of this project is a near term deployment. The second phase will be a near to mid term deployment.

	Phase Timelines
Phase 1	Near Term
Phase 1	Near to Mid Term

Benefits:

- Improved emergency response time
- Reduction in vehicles accidents during an emergency response

Budget Estimate:

	Phase Budget Estimates	
	Capital Costs	Operations and Maintenance Per Year
Phase 1	$286K	$30K
Phase 2	$1,000K	$100K
Totals	$1,286K	$130K

Evaluation Criteria:

- Emergency response time
- Emergency vehicle related accident history

O&M Considerations: Operation and Maintenance of EVP detectors by traffic signal maintenance staff. Additional funds should be considered if traffic signal maintenance is outsourced.

1.2.1.7 Caltrans Traffic Operations Systems (TOS) Gap Closure Project (Regional)

General Description:

Caltrans considers most field elements that aid in traffic surveillance and management activities to be part of the TOS. The most common field elements deployed as a comprehensive TOS in urbanized areas include, but are not limited to: traffic detection (inductive loops, video, acoustic), closed circuit television (CCTV) cameras, changeable message signs (CMS), highway advisory radio (HAR), communications systems and centralized command and control systems/centers with expert systems to aid in incident detection and response as well as automated ramp metering operations. Additional elements that are typically added to rural settings include, but are not limited to: road weather information systems (RWIS) and other systems that aid in improved emergency response times and dissemination of travel advisory information. In the context of the San Joaquin Valley ITS Strategic Deployment Plan, "Early Winners" exercise, the first step in expansion of the Caltrans TOS would be examination of the existing TOS/TSM Master Plans for Districts 6 and 10. From those Master Plans an Action Plan would be developed for the common sense integration of TOS elements into a seamless central operating system, presumably in the Caltrans TMC(s). One product of the Action Plan would be the development of a Program of Projects, with potential funding sources, to implement the Action Plan and Master Plan.

Project Objectives:

- Develop an action plan based on existing Caltrans District 6 Master Plan to allow for common sense integration of TOS elements into a seamless central operating system, presumably in the Caltrans TMC(s)

- Develop Program of Projects, with potential funding sources, to implement the Action Plan and Master Plan.
- Design and deploy appropriate communications infrastructure along State facilities to eliminate existing gaps and to provide a communications backbone for the Region.
- Design and deploy appropriate field elements that aid in traffic surveillance and management activities.

Sponsorship: Caltrans District 6

Deployment Phasing: This project is a single-phase deployment.

	Phase Components
Phase 1	➢ Develop Implementation Plan ➢ Design and construct TDS elements

Deployment Locations: Countywide

Deployment Timeframes: This project is a mid term deployment.

	Phase Timelines
Phase 1	Mid Term

Benefits:

General Benefits:

- Closing the gaps in the communication systems will improve the flow transportation conditions information from roadway sensors, potentially reduce costs, and allow improved cooperation between various agencies within the Region.
- Improving the communications systems will improve roadway monitoring, as well as lower incident detection frequencies assuming appropriate sensors are in place .

Emission Reductions:

- Communications projects have traditionally been considered as supportive of emissions reductions as long as they provide the capability to install traffic management or signal coordination equipment. Project proponents should work with the regional COG on a case by case basis. To support emissions reduction goals, it may be appropriate to require that communications projects clearly define what traffic management equipment will be connected and what benefits this equipment provides.

Budget Estimate:

	Phase Budget Estimates	
	Capital Costs	**Operations and Maintenance Per Year**
Phase 1	$4,000K	$200K
Totals	$4,000K	$200K

Fiber-optic deployment costs were based on a unit cost of $25/LF. Design costs were assumed to be 15% of capital costs, and contingencies were 15% of capital costs for traditional project components and 30% for software development.

Evaluation Criteria:

- MOE
  - Miles of congested freeway
  - Freeway travel times
  - Amount of transportation conditions information delivered to the public over the proposed fiber network
  - Reduction in freeway accidents near metered interchanges
  - Incident detection/response time (ATMS)
  - Time needed for traffic operations staff to monitor/control field devices (ATMS)
- MOP
  - Connection/data transfer times/rates from field devices to the TMC
  - Communications packet loss
  - Time to access data from the database (ATMS)
  - Screen refresh rates (ATMS)
- MOS
  - Mean-time between system failures
  - O&M costs

O&M Considerations:

There are no particular O&M considerations for this project. However, if the communications backbone is to be shared by agencies other than Caltrans then some form of cost-sharing agreement may be necessary.

Architecture Considerations:

The infrastructure items in this project are not a concern, however the ATMS deployment and the flexibility of the communications backbone are. Caltrans should discuss its standards with Regional stakeholders to assist in ensuring that some common standards are utilized. Note that communications have many different standards or protocol "layers" that may impact the ability of systems to communicate over any given network. Many of these layers are not necessarily discussed in the National Architecture, but are commonly used in the computer networking world. For example, the Internet utilizes the TCP-IP standard, which is only one of many of the standards that make the Internet work. Common fiber network standards include SONET and ATM. Additional discussion of this information can be found in the Technology Options Document (available under separate cover).

Within the National Architecture, it may prove helpful for readers to review market packages ATMS 1, 4, and 6.

1.2.1.8 Advanced Railroad Highway Interface Technology Deployments

General Description:

This project would deploy railroad-highway grade crossing technology at needed grade crossings with safety (high accident) and/or high volume and delay concerns. The objective of the project would use field-validated strategies for improving safety, reducing delay and/or providing travelers with improved real-time information on grade crossing status. The project could feature any combination of detection (both for trains and approaching vehicles), warning/traveler information, and control devices. Many different strategies are possible. Possible strategies include sensors coupled with message signs, in-vehicle devices and/or highway advisory radio that would provide approaching travelers with information on the expected duration of a crossing blockage. Another possible application would tie sensors to emergency vehicle dispatching systems to provide dispatchers and drivers with real time crossing status information.

Highway traffic at highway-rail intersections (HRIs) could be managed, where operational requirements demand advanced features (e.g., where rail operational speeds are greater than 80 miles per hour). This would include all capabilities from the Standard Railroad Grade Crossing and augments these with additional safety features to mitigate the risks associated with higher rail speeds. The active warning systems would include positive barrier systems, which preclude entrance into the intersection when the barriers are activated. Like the Standard Package, the HRI equipment is activated on notification by wayside interface equipment, which detects, or communicates with, the approaching train.

The wayside interface equipment would provide additional information about the arriving train so that the train's direction of travel, estimated time of arrival, and the estimated duration of closure may be derived. This enhanced information may be conveyed to the driver prior to, or in context with, warning system activation. This would also include additional detection capabilities, enabling it to detect an entrapped or otherwise immobilized vehicle within the HRI and provide an immediate notification to highway and railroad officials.

Project Objectives:

- Design and deploy either a single or a series of systems, which enhance safety at high activity railroad crossings.
- Develop traveler information systems, which display accurate, timely, and useful information on expected train crossings and anticipated delays.
- Consider inexpensive options to enhance RR crossing safety

Sponsorship: Tulare County Association of Governments (TCAG)

Deployment Phasing: This project is a single-phase deployment.

	Phase Components
Phase 1	➢ Analyze locations of Smart crossing sites within project area ➢ Deploy Smart Crossing Sites

Deployment Locations: Countywide

Deployment Timeframes: This project is a mid term deployment.

	Phase Timelines
Phase 1	Mid Term

Benefits:

General Benefits:

- Enhanced safety at grade crossings through improved warning of approaching trains.
- Decreased travel delays to travelers through enhanced information.

Emissions Reductions:

- Emissions reductions may result from these types of projects through the diversion of some traffic to alternative routes not delayed by train traffic. Based on the site being deployed, the volume of traffic, and availability of alternative routes to reach the same destination it should be possible to estimate the emissions reductions resulting from anticipated traffic diversions.
- Deployment of this type of equipment along high volume routes with viable alternative paths of travel should improve the emissions reduction potential of these projects.

Budget Estimate:

	Phase Budget Estimates	
	Capital Costs	**Operations and Maintenance Per Year**
Phase 1	$400K	$40K
Totals	$400K	$40K

Evaluation Criteria:

- MOE
  - Traffic delays at RR-xings
  - Number of incidents at crossings
  - Number of illegal crossings
  - Emissions reduction
  - Diverted traffic volumes
  - Survey of public perceptions

O&M Considerations: Concurrence of the California Public Utilities Commission (CPUC) and property owners will be required to place devices within the railroad right-of-way.

Architecture Considerations: Readers may want to review market packages ATMS 14 and 15 of the National Architecture.

1.2.1.9 City of Porterville Emergency Pre-Emption Signal Project

General Description:

Emergency Vehicle Preemption (EVP) is the ITS implementation at a traffic signal which modifies normal signal operation to provide a nearly immediate green signal for an approaching emergency vehicle. This type of ITS project is most often deployed on fire trucks because of the nature of the fire truck vehicle performance. The acceleration rate of fire trucks is rather slow due to their relatively low power-to-weight ratio. If fire trucks must slow down (and sometimes stop) when they encounter signalized intersections along their emergency run, the overall delay in responding to their emergency destination can easily exceed 1 to 2 minutes. For fire events, this delay can mean a significant difference in the level of destruction, the level of effort in suppressing the fire, the level of personal danger for firefighters at the scene, and the number and extent of injuries for victims. Depending on the level of congestion and the distance traveled, fire trucks can encounter many traffic signals, and heavy congestion. Driving in oncoming traffic lanes is a "last resort" maneuver, which fire departments rightly avoid. If the fire truck encounters a red signal, it can assert the right of way and go through, but only after gaining assurance that it can safely cross through the intersection. Some larger agencies that have used EVP for many years have broadened the application to also equip ambulance vehicles and, in some cases, police vehicles with this on-board preemption request equipment. While these vehicles have much better acceleration characteristics, and the added delay at signals while on their emergency runs is much lower, granting EVP to these vehicles may provide another benefit. The crossing of very wide and very busy signalized intersections is very difficult in today's traffic. Each year, many such emergency vehicles are "totaled" after being T-boned when crossing a busy intersection. EVP helps reduce and prevent this occurrence.

Project Objectives:

- Improved emergency response time

Sponsorship: City of Porterville

Deployment Phasing: This project is a single-phase deployment.

	Phase Components
Phase 1	➢ EVP detectors at key intersections ➢ EVP emitters on emergency response vehicles

Deployment Locations: City of Porterville

Deployment Timeframes: This project is a near term deployment.

	Phase Timelines
Phase 1	Near Term

Benefits:

- Improved emergency response time
- Reduction in vehicles accidents during an emergency response

Budget Estimate:

	Phase Budget Estimates	
	Capital Costs	**Operations and Maintenance Per Year**
Phase 1	$200K	$20K
Totals	$200K	$20K

Evaluation Criteria:

- Emergency response time
- Emergency vehicle related accident history

O&M Considerations: Operation and Maintenance of EVP detectors by traffic signal maintenance staff. Additional funds should be considered if traffic signal maintenance is outsourced.

1.2.1.10 City of Porterville Emergency Red Light Enforcement Project

General Description:

This project would provide law enforcement officials with the ability to enforce violations electronically through automated photo enforcement at high accident locations in the City. Photo enforcement involves the utilization of a fixed or CCTV positioned camera and a vehicle detection sensor to take a photograph or digital image of a vehicle that initiates an illegal activity. Typical uses of this application include railroad-crossing enforcement, red light violation enforcement, speed limit enforcement, and weigh station enforcement. Typically, the organizations that supply the technology generally take on the responsibility for retrieving the image from the system, processing the film (if necessary), and issuing warnings or citations, depending on the issuing agency. Select intersections in the city of Porterville should be identified and considered for automated photo enforcement for red light violations.

Project Objectives:

- Reduce accidents related to red light violations

Sponsorship: City of Porterville

Deployment Phasing: This project is a single-phase deployment.

	Phase Components
Phase 1	➢ See Above

Deployment Locations: City of Porterville police department

Deployment Timeframes: The first phase of this project is a near term deployment.

	Phase Timelines
Phase 1	Near Term

Benefits:

- Reduced accident rates at major intersections

Budget Estimate:

	Phase Budget Estimates	
	Capital Costs	**Operations and Maintenance Per Year**
Phase 1	$50K	Privatized
Totals	$50K	Privatized

Evaluation Criteria:

- Reduction in accident rates

O&M Considerations: The vendor may provide Operation and Maintenance for a portion of the red light citation revenue.

1.2.2 INCIDENT MANAGEMENT/EMERGENCY SERVICES

1.2.2.1 Alternate Route Signing

General Description:

This project would include the installation of 70 static alternate route signs within the County for designated detour routes.

This project would implement changeable message signs specifically sited, and primarily devoted, to detouring traffic onto alternate routes during incidents, including accidents and weather related road closures. These signs could differ from the large, permanent changeable message signs deployed by Caltrans at key decision points in several respects. First, they would be sited in conjunction with a specific alternate route/detour strategy developed for a particular route and alternate routes. Second, the signs could be smaller than the Caltrans signs. Third, the signs could include features, such as arrows or flashing beacons that are not included on the traditional CMS. Finally, the alternate routes signs could be deployed as trailblazers along the alternate route, rather than merely in advance of the main route/alternate route decision point. The objective of this project would be to improve compliance with detours and reduce driver uncertainty along detour routes. If successful in reducing the volume of vehicles entering hazardous or congested roadway segments, this project holds the potential to reduce congestion, delay and accidents. In order to be successful, it would be critical that this project include development of an alternate route plan and procedures to support the usage of the signs, and that this plan be effectively linked to an overall multi-agency coordinated incident management strategy. This project would also require a commitment on behalf of the operating agency to devote the time and

attention necessary to utilize the signs effectively. Even more so than a single CMS, keeping the dynamic message signs current and accurate would be critical.

Project Objectives:

- Provide efficient routing around major incidents on the highway system.
- Design and deploy alternate route signs.

Sponsorship: Tulare County Association of Governments (TCAG)

Deployment Phasing: This project is a single-phase deployment.

	Phase Components
Phase 1	➢ Identify potential sign locations. ➢ Design and deploy CMS at strategic locations.

Deployment Locations: Visalia Tulare Goshen FUA Traffic Corridors

Deployment Timeframes: This project is a mid term deployment.

	Phase Timelines
Phase 1	Mid Term

Benefits:

- Improved mobility
- Reduced congestion related to highway incidents
- Improved traffic management
- Reduced delay time to major incidents
- Reduced impact on adjacent communities

Budget Estimate:

	Phase Budget Estimates	
	Capital Costs	**Operations and Maintenance Per Year**
Phase 1	$3,000K	$200K
Totals	$3,000K	$200K

Evaluation Criteria:

- *MOE*
  - Travel Time
  - Delay

- Incident work zone safety

O&M Considerations: Operational and maintenance costs were estimated at $2,000 per location.

1.2.2.2 Traffic Safety Task Force

General Description:

This project would develop, for a specific focused area within the County, an interjurisdictional and cross-agency teaming arrangement that would be mobilized to respond to any major traffic related incident in the team's coverage area. Once a specific geographic area has been selected for this project (due in large part to the presence of a project champion), an ad-hoc working group would be established to bring this Traffic Safety Team into existence. In order to be self-sustaining, such a Team would need to be activated, on average, at least 4 times per year. Therefore, the coverage area should be large enough so that this would be achieved. The Team would need to have authority to activate itself. That is, within each organization where a Team member is employed, that Team member should have the capability to cease his/her routine and respond to a Team-declared incident when needed. The Team should be equipped with adequate and sufficient person-to-person communication devices (most likely cellular telephones with 3-way and/or conference calling capability) to contact other Team members as needed. Finally, a rigorous and extensive agency and staff networking outreach capability should be developed for use in this Team. The Team itself may or may not have independently owned and controlled traffic control devices for use in deployments responding to incidents. Each agency's own devices should be accessible if the Traffic Safety Team is created effectively. This Team creation would be a initiated as pilot project for duplication throughout all other areas of the Valley. The use of a contracted facilitator should be employed on this pilot project, with plenty of documentation, lessons learned, and formats to be followed for institutional acceptance of the IMT Team concept. Other areas within the Valley would then be able to model their own Team on the findings and documentation provided in this project.

Project Objectives:

- Provide a forum for emergency service agencies to propose needed projects, operational agreements, and cooperative efforts.
- Provide for inter-agency training.
- Fund some site visits to other regions implementing desirable incident management systems, policies, and/or procedures.

Sponsorship: TCAG, CHP, Caltrans, with heavy involvement from all other emergency service agencies.

Deployment Phasing: This project is a single-phase deployment.

	Phase Components
Phase 1	➢ Development of a Regional Traffic Safety Plan for large-scale interagency incidents. ➢ Funding of appropriate site visits to regions with desirable IM/ES deployments.

	➢ Inter-agency training support – the importance of this element should not be underestimated. ➢ IM/ES program management by agency/other staff.

Deployment Locations: Within the Urbanized Highway System

Deployment Timeframes: This project is a mid to long term deployment.

	Phase Timelines
Phase 1	Mid to Long Term

Benefits:

General Benefits:

- Enhanced interagency coordination and communications
- Provides an interagency structure upon which deployment efforts can be constituted
- Provides institutional structure necessary to support interagency incident management coordination.

Emissions Reduction:

- None directly associated with this project.

Budget Estimate:

	Phase Budget Estimates	
	Capital Costs	**Operations and Maintenance Per Year**
Phase 1	$150K	$70K
Totals	$150K	$70K

Evaluation Criteria:

- MOE
  - Participation of emergency service agencies.

O&M Considerations: Long-term programming and support should be provided to support the basic functions of the Task Force.

Architecture Considerations: The Task Force should follow and report to the ITS Deployment Steering and Review group on emerging important standards, as regional and State issues, relating to the area of incident management.

1.2.3 TRANSIT SYSTEMS

1.2.3.1 Visalia Transit AVL / Silent Alarm

General Description:

This project would equip transit vehicles in the Visalia area (Visalia City Coach's 8 routes) with ITS equipment to both track vehicles and give the bus operator the capability to send a silent alarm for an emergency condition. Automatic Vehicle Location (AVL) equipment generally utilizes satellite technology for pinpointing the exact (to within 20 meters) location of the tracked vehicle. Such tracking is ongoing all the time, and is not limited to the Visalia area. If a bus were removed from the area, it could still be located using the AVL equipment. Providing the bus operator with a silent alarm capability will increase the security level of both bus operators and transit patrons. Transit dispatchers in the dispatch office would view bus tracking. In many cases, the tracking information can be integrated into the same workstation that the dispatchers use in supervising and managing the transit vehicles.

Project Objectives:

- Design and implement an efficient AVL system

Sponsorship: Visalia City Coach

Deployment Phasing: This project is a single-phase deployment.

	Phase Components
Phase 1	➢ Deploy transit vehicles (including fixed route & paratransit) with standard AVL/GPS equipment. ➢ Procure new or additional workstations.

Deployment Locations: Countywide

Deployment Timeframes: This project is a near term deployment.

	Phase Timelines
Phase 1	Near Term

Benefits:

- Improved transit service
- Improved transit safety
- Enhanced information for transit managers.

Budget Estimate:

	Phase Budget Estimates	
	Capital Costs	Operations and Maintenance Per Year
Phase 1	$800K	$80K
Totals	$800K	$80K

1.2.3.2 Transit Management System

General Description:

This project would provide funding to implement a transit management system or provide additional funding for the expansion of an existing Transit Management System (TrMS). A TrMS typically includes automatic vehicle location (AVL), computer-aided scheduling and dispatch software, mobile data terminals, automated schedule adherence monitoring, computer report generation and data management, and maintenance management software. Transit management systems may also include traveler information elements such as automated itinerary planning systems, station signs showing real-time vehicle arrival information, and Internet web sites. The project shall be consistent with other regional systems and shall take into consideration other potential projects with overlapping components such as AVL.

Project Objectives:

- Develop/Expand regional TrMS deployment by using regional TrMS as a building block.
- Establish regional standards for the deployment of transit AVL equipment.
- Enhance the efficiency of transit services throughout the Region by deployment of a common TrMS.
- Allow transit agencies to remotely operate the core TrMS system with appropriate security features.
- Establish/Enhance the TrMS to effectively support demand based transit operations.

Sponsorship: Visalia City Coach and Tulare Transit

Deployment Phasing: This project is a single-phase deployment.

	Phase Components
Phase 1	➢ Perform a focused transit communications study to determine the specific communications needs of TrMS development or expansion. ➢ Deploy transit vehicles (including fixed route & paratransit) with standard AVL/GPS equipment. ➢ Deploy transit vehicles with enhanced equipment (passenger counting, etc.) ➢ Develop/procure software/upgrades for TrMS to support regional needs and paratransit services. ➢ Install radio/communications system upgrades. ➢ Procure new or additional workstations.

Deployment Locations: Countywide

Deployment Timeframes: This project is a mid to long term deployment.

	Phase Timelines
Phase 1	Mid to Long Term

Benefits:

General Benefits:

- Enhanced information for transit managers.
- Provides enhanced potential for real-time transit operations integration.
- Improved coordination between various transit agencies.
- Expands core for the TrMS deployment to support other ITS transit deployment efforts.

Emissions Reductions:

- Transit management systems generally have a significant potential for positive impacts on emissions reductions resulting from more effective use of the transit fleet.
- Enhanced management and dispatching could reduce out-of-direction travel and increased service effectiveness.

Budget Estimate:

	Phase Budget Estimates	
	Capital Costs	**Operations and Maintenance Per Year**
Phase 1	$2,000K	$200K
Totals	$2,000K	$200K

Based on deployments in other regions, the basic costs were conservatively assumed to be $7,500 for a standard vehicle deployment and $20,000 for an advanced vehicle deployment.

Evaluation Criteria:

- MOE
  - Transit O&M
  - Ridership
  - On-time performance
- MOS
  - Mean-time between failures
  - O&M costs

O&M Considerations: None

Architecture Considerations: The Transit Systems Workgroup should establish regional standards for TrMS deployment based on existing/emerging regional and national. Reference should be made to APTS 1 of the National Architecture.

1.2.3.3 Fast Pass Fare Equipment Study and Deployment

General Description:

This project would coordinate the fare payment systems of one or more transit systems, allowing riders to use the same fare media, such as a magnetic strip swipe card, interchangeably on any of the participating systems. The objective of this project would be to increase the convenience of fare payment for riders and promote transfers between systems. The introduction of electronic fare collection systems can also reduce fare-handling costs for transit operators

In addition to on-board fare collection equipment, this project would also include the computing and communications resources necessary to coordinate fare accounting among the participating agencies. This project could involve two or more agencies that do not have electronic fare payment systems (e.g., implement new equipment at all participating agencies), or expand upon a system already implemented by one or more agencies by equipping additional agencies.

Project Objectives:

- Improve transit efficiency
- Increase ridership

Sponsorship: TCAG, Visalia City Coach, and Tulare County Transit (STAGE)

Deployment Phasing: This project is a single-phase deployment.

	Phase Components
Phase 1	➢ Installation of fare equipment on transit system ➢ Installation of fare accounting system

Deployment Locations: Countywide

Deployment Timeframes: This project is a near to mid term deployment.

	Phase Timelines
Phase 1	Near to Mid Term

Benefits:

- Reduced fare handling costs
- Improved transit efficiency
- Increased ridership

Budget Estimate:

	Phase Budget Estimates	
	Capital Costs	**Operations and Maintenance Per Year**
Phase 1	$500K	$50K
Totals	$500K	$50K

1.2.3.4 City of Visalia Next Bus Arrival Signs

General Description:

This project would deploy dynamic message signs at selected higher-usage bus stops equipped with bus shelters. Currently, only one firm (NextBus) is providing this kind of service. Their equipment is placed on board transit vehicles, and GPS-derived current location and speed information is transmitted to NextBus computers at a remote location where the information is processed, and bus arrival prediction is then published to an Internet IP address. The IP address corresponds to a particular dynamic message sign. NextBus has a patent for this "arrival prediction using GPS coordinate data scheme, and their equipment combination uses a CDPD data modem to transmit the information from the bus to the NextBus servers. Their current coverage area does include the Merced area, but not with the CDPD provider that they have currently use (AT&T Wireless). Nonetheless, CDPD coverage is available in Merced, and the NextBus concept therefore may be workable there. The cost for the CDPD "air time" may make this more expensive than in AT&T's coverage area. Also, once an initial installation is completed (using capital funding from some source), then the agency would need to continue the payments for CDPD air time (currently ~$60 per month per bus, and $30 per month per dynamic message sign. Once the service is in place, transit patrons would be able to determine real-time bus locations and expected arrival times at their bus stop. The dynamic message sign at the bus stop would be one source of this information, but NextBus also publishes the information in map form to an Internet website, and in WAP form to hand-held PDAs. The information would therefore also be accessible to transit dispatchers as well as agencies that oversee and/or fund transit operations. NextBus can provide a broad cross-section of transit operations data that would be useful to these 2 management groups as well.

Project Objectives:

- Improve traveler information and increase ridership

Sponsorship: Visalia City Coach

Deployment Phasing: This project is a single-phase deployment.

	Phase Components
Phase 1	➢ Siting study for system ➢ Deployment of up to 30 sign locations

Deployment Locations: Countywide

Deployment Timeframes: This project is a mid term deployment.

	Phase Timelines
Phase 1	Mid Term

Benefits:

- Providing real-time transit information to user

Budget Estimate:

	Phase Budget Estimates	
	Capital Costs	**Operations and Maintenance Per Year**
Phase 1	$500K	$50K
Totals	$500K	$50K

1.2.3.5 Transit Information System

General Description:

This project would implement a system for collecting, processing and disseminating transit information, including "static" information such as routes and schedules, and in the cases of those operators with vehicle tracking systems, real-time information such as estimated vehicle arrival times at specific locations. The objective of the project would be to improve the availability and accessibility of transit information, thereby making transit more convenient and increasing transit utilization. Uncertainty about transit schedules, transit non-users as impediments often cite stops, fares and the timing of arrivals at specific stops. This project would establish a centralized transit information database, residing in a computer that would probably be housed at one of the San Joaquin Valley transit operations, or perhaps at a location, such as a Caltrans traffic management facility, where other traveler information is compiled. The project would include procedures and supporting communications infrastructure that would allow participating transit operators to submit information to the system. For static information, the communications system could be very minimal, such as via e-mail or Internet file transfer. The communications necessary to support real-time information would be more costly and elaborate and could include a dial-up or dedicated phone connection. The project would also include dissemination tools to make the information available to travelers. These tools could include an Internet web site, telephone information system, and kiosks.

Project Objectives:

- Provide real-time transit status information to transit patrons including delays, arrival times, and schedules.
- Promote transit ridership through enhanced information to the public.

Sponsorship: Visalia City Coach and Tulare Transit

Deployment Phasing: This project is a single-phase deployment.

	Phase Components
Phase 1	➢ Deploy real-time transit information displays at ten locations (2 displays each/secure casings). ➢ Procure or develop software to upgrade the TrMS to support the transit information displays. ➢ Provide communications for each of the locations. ➢ Provide monitoring/management workstations for the system.

Deployment Locations: Countywide

Deployment Timeframes: This project is a mid term deployment.

	Phase Timelines
Phase 1	Mid Term

Benefits:

General Benefits:

- Provides simple, accurate, and timely transit information to transit patrons on the status of the next bus, delays, schedules, etc.
- Promotes transit ridership by improving the perception of the service.

Emissions Reduction:

- Improved information for transit patrons should help to enhance ridership. Short- and Long-Range transit plans should include this project, and the anticipated impacts on ridership. These estimates could be used to determine emissions reduction potential.

Budget Estimate:

	Phase Budget Estimates	
	Capital Costs	**Operations and Maintenance Per Year**
Phase 1	$600K	$60K
Totals	$600K	$60K

Evaluation Criteria:

- MOE
  - Survey of transit patrons
- MOS
  - O&M costs
  - Mean time between failures

O&M Considerations: None

Architecture Considerations: Reference should be made to market packages APTS 4 and 8 of the National Architecture.

1.2.4 TRAVELER INFORMATION SYSTEMS

Currently, there are no Traveler Information System projects proposed for the County.

1.2.5 REGIONAL ITS CONFIGURATION MANAGEMENT/COORDINATION/PLANNING

1.2.5.1 Data Exchange Network (DEN)/ Communications Interties

General Description:

The project would develop logical data exchange network partnerships, initially focusing on the urbanized areas of the County. Presumably the County and Caltrans would also be involved in the partnerships. In addition, the logical interties between Caltrans District 6, the County and major cities of the County. The video feed would run from Caltrans District 6 along SR-99 and SR-198. In general, local agencies that partner and interconnect more than one agency with Caltrans have been more successful in obtaining state and federal funding than those proposals that intertie only one agency to Caltrans. Data exchange networks are typically set up in areas where several jurisdictions are interested in collectively sharing information from their respective traffic management systems. The most common information shared is from traffic signal systems. While information exchange on the network can be used to more efficiently monitor multiple signal systems, the network usually doesn't allow for field device control or system interoperability. However, those capabilities can be included depending on user needs.

Data exchange networks depend on some type of communication infrastructure (dedicated agency owned or leased line) and software to exchange information. Communication intertie projects can establish some of the necessary communication links for a data exchange network. Data exchange networks differ from interties in that data exchange networks typically focus on the network connectivity and "logical" protocols of sharing data among several agencies. Interties typically focus on the "physical" communication link between agencies. Both, interties and data exchange networks can form the basis and initial implementation of the "center to center" portion of a Regional Architecture.

Communications intertie projects typically take place between a Caltrans Transportation Management Center (TMC) and a local agency TMC/Traffic Operations Center (TOC). To be most effective, the Caltrans TMC and the local agency would be required to have centralized command and control of traffic management systems and field devices within their respective jurisdictions. In other areas of California, intertie projects allow Caltrans and the local agency to more efficiently share transportation management information, including but not limited to: traffic flow and congestion information, weather information, incident information, video images and in some cases, signal timing plans and modes. In some cases, shared control of a limited number and type of field devices has been arranged between agencies. While full control of one another's assets (field devices, signal systems, etc.) is technically possible it may not be a desired arrangement institutionally. The most important element of an intertie project is a communication link between the intertie agencies. This can either be a dedicated agency owned asset (fiber or copper wire) or some type of telco lease line technology (T1, ISDN or DSL).

Another major element of an intertie project is the software, protocols, and interfaces that would allow for the exchange of information between different systems. Interties differ from data exchange networks (see Data Exchange Network fact sheet) in that interties focus on the "physical" communication link between agencies. Data exchange networks typically focus on the network connectivity and "logical" protocols of sharing data among several agencies. Both, interties and data exchange networks can form the basis and initial implementation of the "center to center" portion of a Regional Architecture.

Project Objectives:

- Improve coordination and data sharing among agencies

Sponsorship: City of Visalia, City and County of Tulare and Caltrans District 6

Deployment Phasing: This project is a single-phase deployment.

	Phase Components
Phase 1	➢ System engineering design of the DEN development and deployment of DEN within the County

Deployment Locations: Countywide

Deployment Timeframes: This project is a long term deployment.

	Phase Timelines
Phase 1	Long Term

Benefits:

- Improve incident management and traffic management in the Visalia-Tulare-Goshen Urban Area

Budget Estimate:

	Phase Budget Estimates	
	Capital Costs	**Operations and Maintenance Per Year**
Phase 1	$300K	$0K
Totals	$300K	$0K

Table A.3: Summary of Visalia-Tulare-Goshen FUA ITS Projects

ID	Program Area/Project	Involved Agency	Brief Description	Project Initiation*			Capital Cost Estimates 2001 (Thousands of $)**		
				N	M	L	Total		
							Phase 1	Phase 2	Phase 3
TULARE COUNTY									
1.0 Traffic/Freeway Management Systems (ATMS)									
1.1T	**CENTRAL CONTROL OF TRAFFIC SIGNALS IN URBAN AREA**	City of Tulare County of Tulare	Basic signal coordination provides signal control for a series of signals on an independent basis, without bringing surveillance or monitoring information to a central location. Central control provides communications to a central point where monitoring and control functions can occur. The capabilities of the central system can vary widely, from simple monitoring of signal controller functions to full graphic display of intersection traffic movement. One of the strengths of central computer control is the ability to design and implement multiple signal timing plans that deal with particular times, or days of traffic that vary from the norm (special events, etc.). Enhanced maintenance monitoring functions can also be provided (immediate identification of failed loops, burned out lamps, etc.). System features will vary by city.	X			**$300**		
1.2T	**CENTRALIZED TRAFFIC SIGNAL CONTROL UPGRADE**	City of Visalia	This project would upgrade the current QuicNet BiTran 2 AMTS system to the Current QuicNet 4 system. The project would upgrade include hardware and software Basic signal coordination provides signal control for a series of signals on an independent basis, without bringing surveillance or monitoring information to a central location. Central control provides communications to a central point where monitoring and control functions can occur. The capabilities of the central system can vary widely, from simple monitoring of signal controller functions to full graphic display of intersection traffic movement. One of the strengths of central computer control is the ability to design and implement multiple signal timing plans that deal with particular times, or days of traffic that vary from the norm (special events, etc.). Enhanced maintenance monitoring functions can also be provided (immediate identification of failed loops, burned out lamps, etc.). System features will vary by city.	X			**$ 70**		
1.3T	**VISALIA ATMS EXPANSION**	City of Visalia	This project would provide for a variety of travel management enhancements that could include the installation of a sophisticated traffic control center that controls traffic signals, the installation of traffic surveillance using closed circuit TV, providing up to the minute information on traffic to travelers. The project would include the upgrade of existing Traffic Control Center into an advanced Traffic Management Center (TMC). The project would integrate the system components with other regional systems, including Caltrans. The project would include the study developing the ATMS plan, installation of the ATMS components including the integration of installation of fiber optic cable for improved communication and closed circuit TV, and the installation of a new traffic signal system in the TMC.		X		**$800**		
1.4T	**VISALIA-TULARE-GOSHEN URBAN AREA TRAFFIC SIGNAL INTERCONNECT AND COORDINATION PROJECT**	City of Visalia City of Tulare County of Tulare	This project would implement local traffic signal coordination plans at specific urbanized locations along regionally significant arterials in the County not currently developed. The objective of this project would primarily be to reduce delays at traffic signals by improving coordination between adjacent signals, with improved safety a possible secondary benefit depending on the specific improvements made. The specific improvements to be made would vary by location, which could include intra- and inter-jurisdictional efforts. The types of improvements that are possible include upgrading traffic signal controllers and detection, adding or upgrading signal interconnects, and communications systems enabling centralized (i.e., remote) timing plan updating and maintenance and malfunction monitoring. Although providing emergency vehicle preemption, transit vehicle priority or automated enforcement would not be the focus or justification for these improvements, the equipment installed as part of this project may support these features. This project would be led by local agency traffic operations staff. The provision of traffic signal coordination for small communities is most often initiated with use of either time-based coordination (TBC) or a closed-loop system (CLS). Depending on the type of controller equipment now in place, and depending on the level of staffing support that the City (or County) is able to make in the maintenance of signal coordination plans, the initial cost and recurring effort to achieve signal coordination in Hanford would vary from a very low cost, to a moderate cost. A number of communication alternatives are possible to tie the intersection controllers to a supervisory computer at City Hall (in the CLS alternative). With a CLS, the capability is created to remotely monitor intersection operation and the capability to remotely change both basic and coordination timing. A first step in the signal coordination capability would be the design and implementation of TBC timing plans. A feasibility study on possible and appropriate upgrade plans for creation and installation of a traffic signal system could be completed at the same time. Any small community that has more than 10 traffic signals would probably benefit from having signal coordination implemented along its heaviest-traveled street(s) so that vehicles can progress through a series of signalized intersections without stopping. The initial effort to achieve this basic level of coordination is relatively low, especially if it is contracted out. The resulting basic timing plans (perhaps just 2 or 3 plans which run between 7AM and 6 PM) can be left in place with very little subsequent retiming effort required or needed. Traffic signal coordination typically has one of the very highest benefit-to-cost ratios of any public works activity.	X	X		**$3,500**		
1.5T	**INTEGRATED SMART CORRIDORS**	Caltrans District 6 Visalia Tulare Goshen FUA	This project would implement a package of ITS applications in a highway corridor consisting of at least one main route and one parallel route. The focus of the project would be to improve the level of coordination of traffic management activities on the main route and parallel route(s); in effect to conduct corridor-level rather than facility-specific ITS traffic management. The range of ITS applications that could be included in a smart corridor application include essentially the full range of freeway management, arterial street management (e.g., traffic signalization) and traveler information strategies, including surveillance and detection; incident management, including coordinated and dynamic traffic detouring strategies utilizing both the main and parallel route(s); changeable message signs; dynamic trailblazer signs; highway advisory radio; and integrated traffic signal operations, including coordination between ramp meters and adjacent traffic signals. The smart corridor project would feature implementation of a combination of ITS applications, with the emphasis being on linking operations across multiple facilities serving a defined travel corridor. Given the multi-facility nature of this project, the multi-jurisdictional coordination aspects of the project will be critical, including developing consensus on the specific objectives of the project and on the individual coordination procedures and technques. The first step in the development of this project would be to identify a candidate project corridor, based on accidents and congestion, travel patterns, availability of alternate routes and interest among the potential project partcipants.			X	**$2,500**		

ID	Program Area/Project	Involved Agency	Brief Description	Project Initiation*			Capital Cost Estimates 2001 (Thousands of $)**		
				N	M	L	Total		
							Phase 1	Phase 2	Phase 3
1.6T	**EVP DEPLOYMENTS**	Visalia Tulare Goshen FUA	The project would implement Emergency Vehicle Preemption (EVP) along key arterials throughout the County for use by City and County fire departments. The implementation EVP at a traffic signal modifies normal signal operation to provide a nearly immediate green signal for an approaching emergency vehicle. This type of system is most often deployed on fire trucks because of the nature of the fire truck vehicle performance. The acceleration rate of fire trucks is rather slow due to their relatively low power-to-weight ratio. If fire trucks must slow down (and sometimes stop) when they encounter signalized intersections along their emergency run, the overall delay in responding to their emergency destination can easily exceed 1 to 2 minutes. For fire events, this delay can mean a significant difference in the level of destruction, the level of effort in suppressing the fire, the level of personal danger for firefighters at the scene, and the number and extent of injuries for victims. Depending on the level of congestion and the distance traveled, fire trucks can encounter many traffic signals, and heavy congestion. Driving in oncoming traffic lanes is a "last resort" maneuver, which fire departments rightly avoid. If the fire truck encounters a red signal, it can assert the right of way and go through, but only after gaining assurance that it can safely cross through the intersection. EVP isn't needed in every community. Only when traffic congestion is very significant, or only when long emergency vehicle runs are likely to encounter a large number of signalized intersections, would the provision of EVP be cost effective. Some cities in the Central Valley already have EVP in place, the 3M Opticom™ system being predominant. Priority request equipment would be installed in each fire truck and matching reception equipment would be installed at each signalized intersection where EVP is to be granted. Some larger agencies that have used EVP for many years have broadened the application to also equip ambulance vehicles and, in some cases, police vehicles with this on-board preemption request equipment. While these vehicles have much better acceleration characteristics, and the added delay at signals while on their emergency runs is much lower, granting EVP to these vehicles may provide another benefit. The crossing of very wide and very busy signalized intersections is very difficult in today's traffic. Each year, many such emergency vehicles are "totaled" after being T-boned when crossing a busy intersection. EVP helps reduce and prevent this occurrence. However, this project assumes only fire department vehicles would be equipped with EVP devices. This project would include the installation of EVP along major arterials in the Visalia-Tulare-Goshen FUA. Phase 1 of the project would include the installation of EVP at 34 intersections along key arterials throughout downtown Visalia Phase II of the project would expand EVP deployment throughout the rest of the FUA.	X	X		**$286**	**1,000**	
1.7T	**CALTRANS TRAFFIC OPERATION SYSTEMS (TOS) GAP CLOSURE PROJECT (REGION)**	District 6 Tulare County City of Visalia City of Tulare	Caltrans considers most field elements that aid in traffic surveillance and management activities to be part of the TOS. The most common field elements deployed as a comprehensive TOS in urbanized areas include, but are not limited to: traffic detection (inductive loops, video, acoustic), closed circuit television (CCTV) cameras, changeable message signs (CMS), highway advisory radio (HAR), communications systems and centralized command and control systems/centers with expert systems to aid in incident detection and response as well as automated ramp metering operations. Additional elements that are typically added to rural settings include, but are not limited to: road weather information systems (RWIS) and other systems that aid in improved emergency response times and dissemination of travel advisory information. In the context of the San Joaquin Valley ITS Strategic Deployment Plan, "Early Winners" exercise, the first step in expansion of the Caltrans TOS would be examination of the existing TOS/TSM Master Plans for Districts 6 and 10. From those Master Plans an Action Plan would be developed for the common sense integration of TOS elements into a seamless central operating system, presumably in the Caltrans TMC(s). One product of the Action Plan would be the development of a Program of Projects, with potential funding sources, to implement the Action Plan and Master Plan.		X		**$4,000**		
1.8T	**ADVANCED RAILROAD HIGHWAY INTERFACE TECHNOLOGY DEPLOYMENT**	Tulare County	This project would deploy railroad-highway grade crossing technology at needed grade crossings with safety (high accident) and/or high volume and delay concerns. The objective of the project would use field validated strategies for improving safety, reducing delay and/or providing travelers with improved real-time information on grade crossing statu developed by the Kings County Advanced HRI Technology Deployment Demonstration project. The project could feature any combination of detection (both for trains and approaching vehicles), warning/traveler information, and control devices. Many different strategies are possible. Possible strategies include sensors coupled with message signs, in-vehicle devices and/or highway advisory radio that would provide approaching travelers with information on the expected duration of a crossing blockage. Another possible application would tie sensors to emergency vehicle dispatching systems to provide dispatchers and drivers with real time crossing status information. This project would use the blueprint for applying technology to enhance grade crossing safety developed by the demonstration project. One major cause of crashes at railroad grade crossings is the persistent presence of the heavy Tule fog in the Valley, and the inability for drivers to see grade crossings which are occupied with a train, usually in motion, until they are too close to stop. If some kind of train presence detection could be devised, and tied to an advance-warning beacon, approaching drivers would be forewarned about the dangerous situation. Such an active presence could be detected by an advanced detector, and need not involve the cooperation / joint solution with the railroad. Because of liability, railroads are not eager to create new and unproven detection or safety mechanisms; they have a well-defined program for active warning devices at the crossing which are very involved "systems" tied in with the railroad's own advance detection systems. The possibility of deploying an advanced technology solution, especially at locations where no active warning devices now exist, would be the basis for this project. Highway traffic at highway-rail intersections (HRIs) could be managed, where operational requirements demand advanced features (e.g., where rail operational speeds are greater than 80 miles per hour). This would include all capabilities from the Standard Railroad Grade Crossing and augments these with additional safety features to mitigate the risks associated with higher rail speeds. The active warning systems would include positive barrier systems, which preclude entrance into the intersection when the barriers are activated. Like the Standard Package, the HRI equipment is activated on notification by wayside interface equipment, which detects, or communicates with, the approaching train. The wayside interface equipment would provide additional information about the arriving train so that the train's direction of travel, estimated time of arrival, and the estimated duration of closure may be derived. This enhanced information may be conveyed to the driver prior to, or in context with, warning system activation. This would also include additional detection capabilities, enabling it to detect an entrapped or otherwise immobilized vehicle within the HRI and provide an immediate notification to highway and railroad officials.		X		**$400**		
1.9T	**CITY OF PORTERVILLE EMERGENCY PRE-EMPTION SIGNAL PROJECT**	City of Porterville	The project would implement Emergency Vehicle Preemption (EVP) along key arterials throughout the City of Porterville for use by the City fire department. The implementation EVP at a traffic signal modifies normal signal operation to provide a nearly immediate green signal for an approaching emergency vehicle. This type of system is most often deployed on fire trucks because of the nature of the fire truck vehicle performance. The acceleration rate of fire trucks is rather slow due to their relatively low power-to-weight ratio. If fire trucks must slow down (and sometimes stop) when they encounter signalized intersections along their emergency run, the overall delay in responding to their emergency destination can easily exceed 1 to 2 minutes. For fire events, this delay can mean a significant difference in the level of destruction, the level of effort in suppressing the fire, the level of personal danger for firefighters at the scene, and the number and extent of injuries for victims. Depending on the level of congestion and the distance traveled, fire trucks can encounter many traffic signals, and heavy congestion. Driving in oncoming traffic lanes is a "last resort" maneuver, which fire departments rightly avoid. If the fire truck encounters a red signal, it can assert the right of way and go through, but only after gaining assurance that it can safely cross through the intersection. Priority request equipment would be installed in each fire truck and matching reception equipment would be installed at each signalized intersection where EVP is to be granted. The provision of EVP is cost effective when traffic congestion is very significant, or when long emergency vehicle runs are likely to encounter a large number of signalized intersections. Some cities in the San Joaquin Valley already have EVP in place, the 3M Opticom™ system being predominant. Some larger agencies that have used EVP for many years have broadened the application to also equip ambulance vehicles and, in some cases, police vehicles with this on-board preemption request equipment. While these vehicles have much better acceleration characteristics, and the added delay at signals while on their emergency runs is much lower, granting EVP to these vehicles may provide another benefit. The crossing of very wide and very busy signalized intersections is very difficult in today's traffic. Each year, many such emergency vehicles are "totaled" after being T-boned when crossing a busy intersection. EVP helps reduce and prevent this occurrence. However, this project assumes only fire department vehicles would be equipped with EVP devices.	X			**$300**		

ID	Program Area/Project	Involved Agency	Brief Description	Project Initiation*			Capital Cost Estimates 2001 (Thousands of $)**		
				N	M	L	Total		
							Phase 1	Phase 2	Phase 3
1.10T	**CITY OF PORTERVILLE RED LIGHT ENFORCEMENT PROJECT**	City of Porterville	This project would provide law enforcement officials with the ability to enforce violations electronically through automated photo enforcement. Photo enforcement involves the utilization of a fixed or CCTV positioned camera and a vehicle detection sensor to take a photograph or digital image of a vehicle that initiates an illegal activity. Typical uses of this application include railroad-crossing enforcement, red light violation enforcement, speed limit enforcement, and weigh station enforcement. Typically, the organizations that supply the technology generally take on the responsibility for retrieving the image from the system, processing the film (if necessary), and issuing warnings or citations, depending on the issuing agency. Select intersections in the cities of Ceres and Modesto should be identified and considered for automated photo enforcement for red light violations within key intersections in the City of Porterville..	X			**$ 50**		
2.0 Incident Management/Emergency Services									
2.1T	**ALTERNATE ROUTE SIGNING**	Visalia Tulare Goshen FUA Traffic Corridors	This project would include the installation of 70 static alternate route signs within the County for designated detour routes. This project would implement changeable message signs specifically sited, and primarily devoted, to detouring traffic onto alternate routes during incidents, including accidents and weather related road closures. These signs could differ from the large, permanent changeable message signs deployed by Caltrans at key decision points in several respects. First, they would be sited in conjunction with a specific alternate route/detour strategy developed for a particular route and alternate routes. Second, the signs could be smaller than the Caltrans signs. Third, the signs could include features, such as arrows or flashing beacons, that are not included on the traditional CMS. Finally, the alternate routes signs could be deployed as trailblazers along the alternate route, rather than merely in advance of the main route/alternate route decision point. The objective of this project would be to improve compliance with detours and reduce driver uncertainty along detour routes. If successful in reducing the volume of vehicles entering hazardous or congested roadway segments, this project holds the potential to reduce congestion, delay and accidents. In order to be successful, it would be critical that this project include development of an alternate route plan and procedures to support the usage of the signs, and that this plan be effectively linked to an overall multi-agency coordinated incident management strategy. This project would also require a commitment on behalf of the operating agency to devote the time and attention necessary to utilize the signs effectively. Even more so than a single CMS, keeping the dynamic message signs current and accurate would be critical.		X		**$ 3,000**		
2.2T	**TRAFFIC SAFETY TASK FORCE**	TCAG, CHP, Caltrans, with heavy involvement from all other emergency service agencies.	This project would develop, for a specific focused area within the County, an interjurisdictional and cross-agency teaming arrangement that would be mobilized to respond to any major traffic related incident in the team's coverage area. Once a specific geographic area has been selected for this project (due in large part to the presence of a project champion), an ad-hoc working group would be established to bring this Traffic Safety Team into existence. In order to be self-sustaining, such a Team would need to be activated, on average, at least 4 times per year. Therefore, the coverage area should be large enough so that this would be achieved. The Team would need to have authority to activate itself. That is, within each organization where a Team member is employed, that Team member should have the capability to cease his/her routine and respond to a Team-declared incident when needed. The Team should be equipped with adequate and sufficient person-to-person communication devices (most likely cellular telephones with 3-way and/or conference calling capability) to contact other Team members as needed. Finally, a rigorous and extensive agency and staff networking outreach capability should be developed for use in this Team. The Team itself may or may not have independently owned and controlled traffic control devices for use in deployments responding to incidents. Each agency's own devices should be accessible if the Traffic Safety Team is created effectively. This Team creation would be a initiated as pilot project for duplication throughout all other areas of the Valley. The use of a contracted facilitator should be employed on this pilot project, with plenty of documentation, lessons learned, and formats to be followed for institutional acceptance of the IMT Team concept. Other areas within the Valley would then be able to model their own Team on the findings and documentation provided in this project.		X	X	**$200**		
3.0 Transit Systems									
3.1T	**VISALIA TRANSIT AVL / SILENT ALARM**	Visalia City Coach	This project would equip transit vehicles in the Visalia area (Visalia City Coach's 8 routes) with ITS equipment to both track vehicles and give the bus operator the capability to send a silent alarm for an emergency condition. Automatic Vehicle Location (AVL) equipment generally utilizes satellite technology for pinpointing the exact (to within 20 meters) location of the tracked vehicle. Such tracking is ongoing all the time, and is not limited to the Visalia area. If a bus were removed from the area, it could still be located using the AVL equipment. Providing the bus operator with a silent alarm capability will increase the security level of both bus operators and transit patrons. Bus tracking would be viewed by transit dispatchers in the dispatch office. In many cases, the tracking information can be integrated into the same workstation that the dispatchers use in supervising and managing the transit vehicles.	X			**$800**		
3.2T	**TRANSIT MANAGEMENT SYSTEM**	Visalia City Coach Tulare Transit	This project would provide funding to implement a transit management system or provide additional funding for the expansion of an existing Transit Management System (TrMS). A TrMS typically includes automatic vehicle location (AVL), computer-aided scheduling and dispatch software, mobile data terminals, automated schedule adherence monitoring, computer report generation and data management, and maintenance management software. Transit management systems may also include traveler information elements such as automated itinerary planning systems, station signs showing real-time vehicle arrival information, and Internet web sites. The project shall be consistent with other regional systems and shall take into consideration other potential projects with overlapping components such as AVL.		X	X	**$2,000**		
3.3T	**FAST PASS FARE EQUIPMENT STUDY AND DEVELOPMENT**	TCAG, Visalia City Coach, Tulare County Transit (STAGE)	This project would coordinate the fare payment systems of one or more transit systems, allowing riders to use the same fare media, such as a magnetic strip swipe card, interchangeably on any of the participating systems. The objective of this project would be to increase the convenience of fare payment for riders and promote transfers between systems. The introduction of electronic fare collection systems can also reduce fare handling costs for transit operators. In addition to on-board fare collection equipment, this project would also include the computing and communications resources necessary to coordinate fare accounting among the participating agencies. This project could involve two or more agencies that do not have electronic fare payment systems (e.g., implement new equipment at all participating agencies), or expand upon a system already implemented by one or more agencies by equipping additional agencies.	X	X		**$ 500**		
3.4T	**CITY OF VISALIA NEXT BUS ARRIVAL SIGNS**	Visalia City Coach	This project would deploy dynamic message signs at selected higher-usage bus stops equipped with bus shelters. Currently, only one firm (NextBus) is providing this kind of service. Their equipment is placed on board transit vehicles, and GPS-derived current location and speed information is transmitted to NextBus computers at a remote location where the information is processed, and bus arrival prediction is then published to an Internet IP address. The IP address corresponds to a particular dynamic message sign. NextBus has a patent for this "arrival prediction using GPS coordinate data scheme, and their equipment combination uses a CDPD data modem to transmit the information from the bus to the NextBus servers. Their current coverage area does include the Merced area, but not with the CDPD provider that they have currently use (AT&T Wireless). Nonetheless, CDPD coverage is available in Merced, and the NextBus concept therefore may be workable there. The cost for the CDPD "air time" may make this more expensive than in AT&T's coverage area. Also, once an initial installation is completed (using capital funding from some source), then the agency would need to continue the payments for CDPD air time (currently ~$60 per month per bus, and $30 per month per dynamic message sign. Once the service is in place, transit patrons would be able to determine real-time bus locations and expected arrival times at their bus stop. The dynamic message sign at the bus stop would be one source of this information, but NextBus also publishes the information in map form to an internet website, and in WAP form to hand-held PDAs. The information would therefore also be accessible to transit dispatchers as well as agencies that oversee and/or fund transit operations. NextBus can provide a broad cross-section of transit operations data that would be useful to these 2 management groups as well.		X		**$500**		

ID	Program Area/Project	Involved Agency	Brief Description	Project Initiation*			Capital Cost Estimates 2001 (Thousands of $)**		
				N	M	L	Total		
							Phase 1	Phase 2	Phase 3
3.5SJ	**TRANSIT INFORMATION SYSTEM**	Visalia City Coach Tulare Transit	This project would implement a system for collecting, processing and disseminating transit information, including "static" information such as routes and schedules, and in the cases of those operators with vehicle tracking systems, real-time information such as estimated vehicle arrival times at specific locations. The objective of the project would be to improve the availability and accessibility of transit information, thereby making transit more convenient and increasing transit utilization. Uncertainty about transit schedules, stops, fares and the timing of arrivals at specific stops are often cited by transit non-users as impediments. This project would establish a centralized transit information database, residing in a computer that would probably be housed at one of the San Joaquin Valley transit operations, or perhaps at a location, such as a Caltrans traffic management facility, where other traveler information is compiled. The project would include procedures and supporting communications infrastructure that would allow participating transit operators to submit information to the system. For static information, the communications system could be very minimal, such as via e-mail or Internet file transfer. The communications necessary to support real-time information would be more costly and elaborate and could include a dial-up or dedicated phone connection. The project would also include dissemination tools to make the information available to travelers. These tools could include an Internet web site, telephone information system, and kiosks.		X		**$600**		
4.0 Traveler Information Systems									
5.0 Regional ITS Configuration Management/Coordination/Planning									
5.1T	**DATA EXCHANGE NETWORK (DEN)/ COMMUNICATIONS INTERTIES**	City of Visalia City of Tulare Tulare County Caltrans District 6	The project would develop logical data exchange network partnerships, initially focus on the urbanized areas of the County. Presumably the County and Caltrans would also be involved in the partnerships. In addition, the logical interties between Caltrans District 6, the County and major cities of the County. The video feed would run from Caltrans District 6 along SR-99 and SR-198. In general, local agencies that partner and interconnect more than one agency with Caltrans have been more successful in obtaining state and federal funding than those proposals that intertie only one agency to Caltrans. Data exchange networks are typically set up in areas where several jurisdictions are interested in collectively sharing information from their respective traffic management systems. The most common information shared is from traffic signal systems. While information exchange on the network can be used to more efficiently monitor multiple signal systems, the network usually doesn't allow for field device control or system interoperability. However, those capabilities can be included depending on user needs. Data exchange networks depend on some type of communication infrastructure (dedicated agency owned or leased line) and software to exchange information. Communication intertie projects can establish some of the necessary communication links for a data exchange network. Data exchange networks differ from interties in that data exchange networks typically focus on the network connectivity and "logical" protocols of sharing data among several agencies. Interties typically focus on the "physical" communication link between agencies. Both, interties and data exchange networks can form the basis and initial implementation of the "center to center" portion of a Regional Architecture. Communications intertie projects typically take place between a Caltrans Transportation Management Center (TMC) and a local agency TMC/Traffic Operations Center (TOC). To be most effective, the Caltrans TMC and the local agency would be required to have centralized command and control of traffic management systems and field devices within their respective jurisdictions. In other areas of California, intertie projects allow Caltrans and the local agency to more efficiently share transportation management information, including but not limited to: traffic flow and congestion information, weather information, incident information, video images and in some cases, signal timing plans and modes. In some cases, shared control of a limited number and type of field devices has been arranged between agencies. While full control of one another's assets (field devices, signal systems, etc.) is technically possible it may not be a desired arrangement institutionally. The most important element of an intertie project is a communication link between the intertie agencies. This can either be a dedicated agency owned asset (fiber or copper wire) or some type of telco lease line technology (T1, ISDN or DSL). Another major element of an intertie project is the software, protocols, and interfaces that would allow for the exchange of information between different systems. Interties differ from data exchange networks (see Data Exchange Network fact sheet) in that interties focus on the "physical" communication link between agencies. Data exchange networks typically focus on the network conectivity and "logical" protocols of sharing data among several agencies. Both, interties and data exchange networks can form the basis and initial implementation of the "center to center" portion of a Regional Architecture.			X	**$300**		
			Total Estimated Capital Deployment Costs for All Potential ITS Projects Over 20 Years						**$20,956**

Notes:

* Project initiation timeframes - N = Years 1-5, M = Years 6-10, L = Years 11+

**All capital costs are approximate and rounded for purposes of this table.

Table A.4: Timeline of Visalia-Tulare-Goshen FUA ITS Projects

	PROGRAM AREAS/PROJECTS	NEAR TERM					MID-TERM					LONG TERM										TOTAL COSTS
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
	1.0 Traffic/Freeway Management Systems (ATMS)																					
1.1T	CENTRAL CONTROL OF TRAFFIC SIGNALS IN URBAN AREA																					$300
1.2T	CENTRALIZED TRAFFIC SIGNAL CONTROL UPGRADE																					$70
1.3T	VISALIA ATMS EXPANSION																					$800
1.4T	VISALIA-TULARE-GOSHEN URBAN AREA TRAFFIC SIGNAL INTERCONNECT AND COORDINATION PROJECT																					$3,500
1.5T	INTEGRATED SMART CORRIDORS																					$2,500
1.6T	EVP DEPLOYMENTS																					$1,280
1.7T	CALTRANS TRAFFIC OPERATION SYSTEMS (TOS) GAP CLOSURE PROJECT (REGION)																					$4,000
1.8T	ADVANCED RAILROAD HIGHWAY INTERFACE TECHNOLOGY DEPLOYMENT																					$400
1.9T	CITY OF PORTERVILLE EMERGENCY PRE EMPTION SIGNAL PROJECT																					$200
1.10T	CITY OF PORTERVILLE RED LIGHT ENFORCEMENT PROJECT																					$80
	2.0 Incident Management/Emergency Services																					
2.1T	ALTERNATE ROUTE SIGNING																					$3,000
2.2T	TRAFFIC SAFETY TASK FORCE																					$150
	3.0 Transit Systems																					
3.1T	VISALIA TRANSIT AVL / SILENT ALARM																					$600
3.2T	TRANSIT MANAGEMENT SYSTEM (TMS)																					$2,000
3.3T	FAST PASS FARE EQUIPMENT STUDY AND DEVELOPMENT																					$500
3.4T	CITY OF VISALIA NEXT BUS ARRIVAL SIGNS																					$500
3.5T	TRANSIT INFORMATION SYSTEM																					$600
	4.0 Traveler Information System																					
	5.0 Regional ITS Configuration Management/ Coordination/ Planning																					
5.1T	DATA EXCHANGE NETWORK (DEN) COMMUNICATIONS INTERFACE																					$300
	TOTAL ESTIMATED EXPENDITURES																					
																						$20,956

Revised September 13, 2001

Phase 1 Deployment
Phase 2 Deployment
Phase 3 Deployment

Notes:

1. All values are displayed in 2001 dollars
2. Timeline does not reflect operations and maintenance timeframes
3. All budget estimates are preliminary and should be utilized for planning purposes only

Figure A.3: Sequence of Proposed ITS Implementation Activities for Visalia-Tulare-Goshen FUA

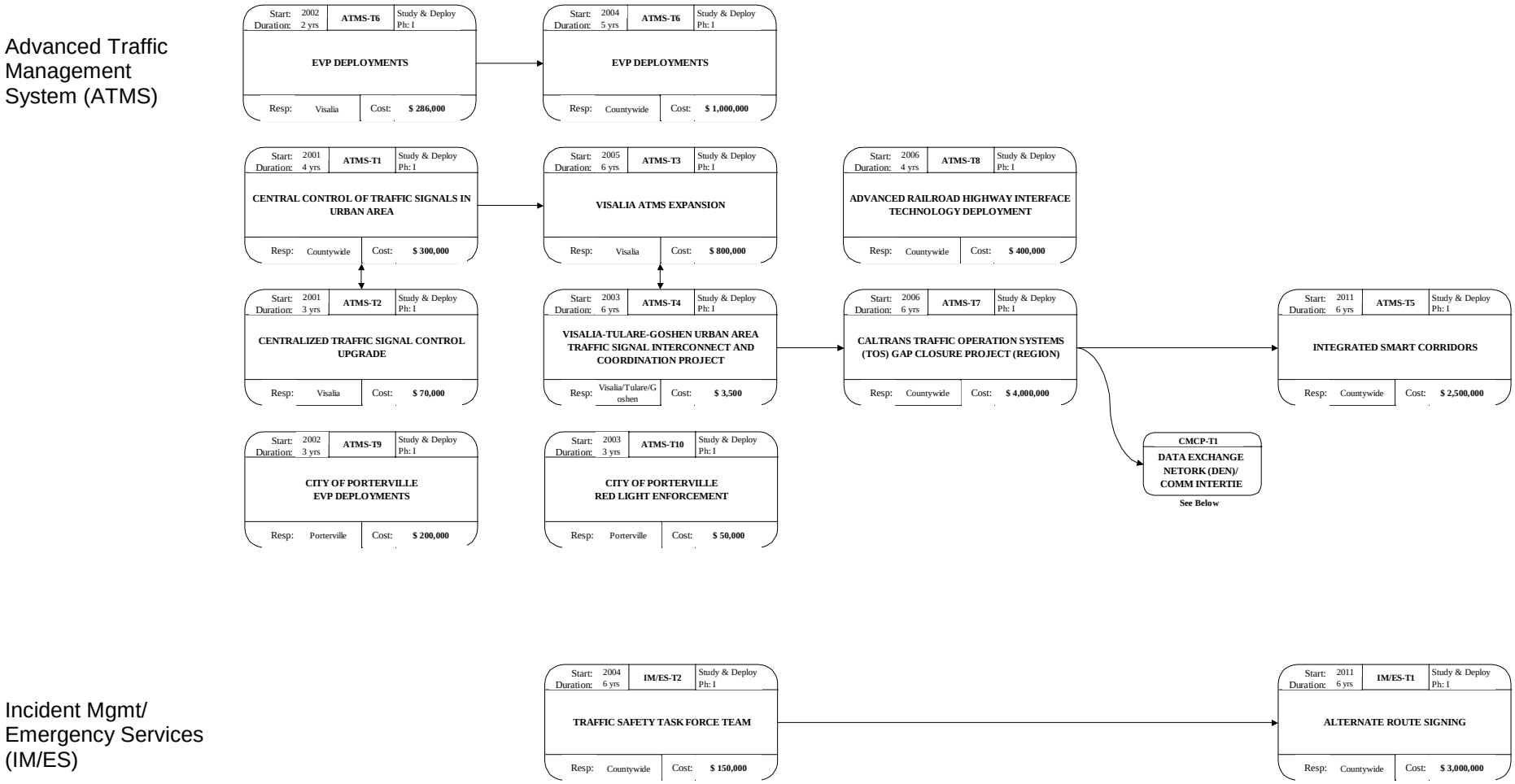
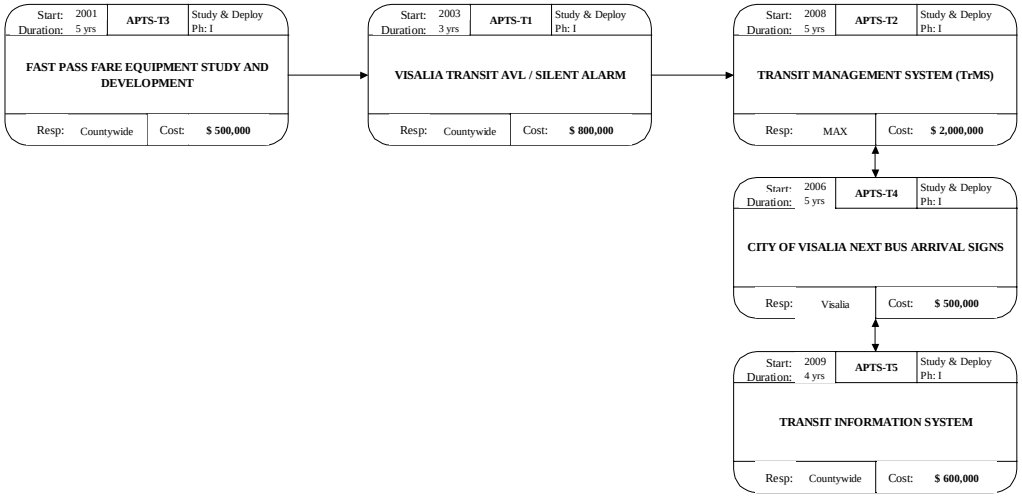


Figure 3.3: Sequence of Proposed ITS Implementation Activities for the Modesto-Ceres FUA (cont)

Transit Systems (APTS)



Traveler Information Systems (ATIS)

Regional ITS Config./ Mgmt./ Coordination Planning

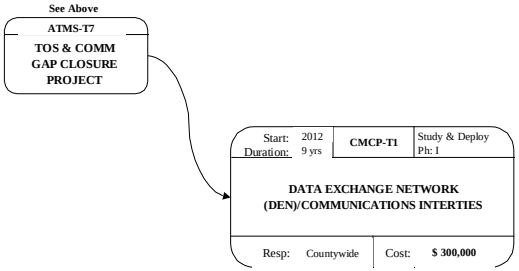


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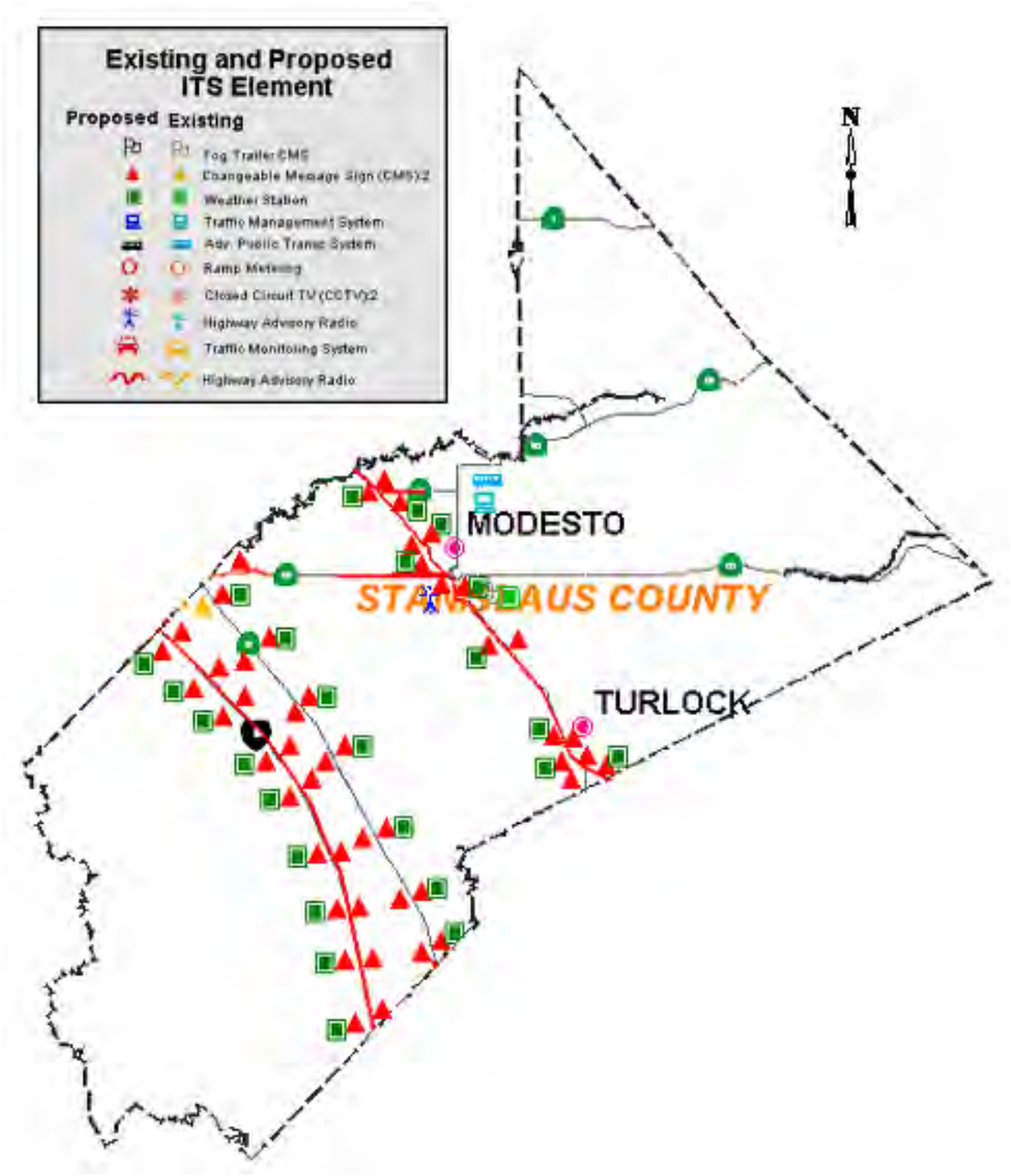
Figure A.4: Existing and Proposed ITS Elements for Stanislaus County



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1.3 Merced County

The remaining pages of this Section contain the specific ITS project definitions for the Merced-Atwater FUA within Merced County. The total estimated capital deployment costs for all potential ITS projects over 20 years is $19,350,000.

1.3.1 TRAFFIC/FREEWAY MANAGEMENT SYSTEMS (ATMS)

1.3.1.1 Merced County Railroad Grade Crossing Treatments

General Description:

This project would seek to implement advanced technology to reduce the accident experience at railroad grade crossings in Merced County. The Kern County demonstration project could provide a blueprint for applying technology to enhance grade crossing safety throughout the entire San Joaquin Valley area. One major cause of crashes at railroad grade crossings is the persistent presence of the heavy Thule fog in the Valley, and the inability for drivers to see grade crossings which are occupied with a train, usually in motion, until they are too close to stop. If some kind of train presence detection could be devised, and tied to an advance-warning beacon, approaching drivers would be forewarned about the dangerous situation. Such an active presence could be detected by an advanced detector, and need not involve the cooperation / joint solution with the railroad. Because of liability, railroads are not eager to create new and unproven detection or safety mechanisms; they have a well-defined program for active warning devices at the crossing which are very involved "systems" tied in with the railroad's own advance detection systems. The possibility of deploying an advanced technology solution, especially at locations where no active warning devices now exist, would be the basis for this project.

Project Objectives:

- Design and deploy either a single or a series of systems, which enhance safety at high activity railroad crossings.
- Develop traveler information systems, which display accurate, timely, and useful information on expected train crossings and anticipated delays.
- Consider inexpensive options to enhance RR crossing safety

Sponsorship: City of Merced, City of Atwater, and Merced County

Deployment Phasing: This project is a single-phase deployment.

	Phase Components
Phase 1	➢ Analyze locations of Smart crossing sites within project area ➢ Deploy Smart Crossing Sites

Deployment Locations: Countywide

Deployment Timeframes: This project is a mid to long term deployment.

	Phase Timelines
Phase 1	Mid to Long Term

Benefits:

General Benefits:

- Enhanced safety at grade crossings through improved warning of approaching trains.
- Decreased travel delays to travelers through enhanced information.

Emissions Reductions:

- Emissions reductions may result from these types of projects through the diversion of some traffic to alternative routes not delayed by train traffic. Based on the site being deployed, the volume of traffic, and availability of alternative routes to reach the same destination it should be possible to estimate the emissions reductions resulting from anticipated traffic diversions.
- Deployment of this type of equipment along high volume routes with viable alternative paths of travel should improve the emissions reduction potential of these projects.

Budget Estimate:

	Phase Budget Estimates	
	Capital Costs	**Operations and Maintenance Per Year**
Phase 1	$1,200K	$120K
Totals	$1,200K	$120K

Evaluation Criteria:

- MOE
  - Traffic delays at RR-xings
  - Number of incidents at crossings
  - Number of illegal crossings
  - Emissions reduction
  - Diverted traffic volumes
  - Survey of public perceptions

O&M Considerations: Concurrence of the California Public Utilities Commission (CPUC) and property owners will be required to place devices within the railroad right-of-way.

Architecture Considerations: Readers may want to review market packages ATMS 14 and 15 of the National Architecture.

1.3.1.2 EVP Deployments

General Description:

The project would implement Emergency Vehicle Preemption (EVP) along key arterials throughout the County for use by City and County fire departments. The implementation EVP at a traffic signal

modifies normal signal operation to provide a nearly immediate green signal for an approaching emergency vehicle. This type of system is most often deployed on fire trucks because of the nature of the fire truck vehicle performance. The acceleration rate of fire trucks is rather slow due to their relatively low power-to-weight ratio. If fire trucks must slow down (and sometimes stop) when they encounter signalized intersections along their emergency run, the overall delay in responding to their emergency destination can easily exceed 1 to 2 minutes. For fire events, this delay can mean a significant difference in the level of destruction, the level of effort in suppressing the fire, the level of personal danger for firefighters at the scene, and the number and extent of injuries for victims. Depending on the level of congestion and the distance traveled, fire trucks can encounter many traffic signals, and heavy congestion. Driving in oncoming traffic lanes is a "last resort" maneuver, which fire departments rightly avoid. If the fire truck encounters a red signal, it can assert the right of way and go through, but only after gaining assurance that it can safely cross through the intersection. EVP isn't needed in every community. Only when traffic congestion is very significant, or only when long emergency vehicle runs are likely to encounter a large number of signalized intersections, would the provision of EVP be cost effective. Some cities in the Central Valley already have EVP in place, the 3M Opticom™ systems being predominant. Priority request equipment would be installed in each fire truck and matching reception equipment would be installed at each signalized intersection where EVP is to be granted.

Some larger agencies that have used EVP for many years have broadened the application to also equip ambulance vehicles and, in some cases, police vehicles with this on-board preemption request equipment. While these vehicles have much better acceleration characteristics, and the added delay at signals while on their emergency runs is much lower, granting EVP to these vehicles may provide another benefit. The crossing of very wide and very busy signalized intersections is very difficult in today's traffic. Each year, many such emergency vehicles are "totaled" after being T-boned when crossing a busy intersection. EVP helps reduce and prevent this occurrence. However, this project assumes only fire department vehicles would be equipped with EVP devices.

Project Objectives:

- Improved emergency response time

Sponsorship: City of Merced, City of Atwater and Merced County

Deployment Phasing: This project is a single-phase deployment.

	Phase Components
Phase 1	➢ EVP detectors at key intersections ➢ EVP emitters on emergency response vehicles

Deployment Locations: Countywide

Deployment Timeframes: This project is a near to mid term deployment.

	Phase Timelines
Phase 1	Near to Mid Term

Benefits:

- Improved emergency response time
- Reduction in vehicles accidents during an emergency response

Budget Estimate:

	Phase Budget Estimates	
	Capital Costs	Operations and Maintenance Per Year
Phase 1	$2,500K	$250K
Totals	$2,500K	$250K

Evaluation Criteria:

- Emergency response time
- Emergency vehicle related accident history

O&M Considerations: Operation and Maintenance of EVP detectors by traffic signal maintenance staff. Additional funds should be considered if traffic signal maintenance is outsourced.

1.3.1.3 Central Control of Traffic Signals in Urban Area

General Description:

Basic signal coordination provides signal control for a series of signals on an independent basis, without bringing surveillance or monitoring information to a central location. Central control provides communications to a central point where monitoring and control functions can occur. The capabilities of the central system can vary widely, from simple monitoring of signal controller functions to full graphic display of intersection traffic movement. One of the strengths of central computer control is the ability to design and implement multiple signal timing plans that deal with particular times, or days of traffic that vary from the norm (special events, etc.). Enhanced maintenance monitoring functions can also be provided (immediate identification of failed loops, burned out lamps, etc.). System features will vary by city.

Project Objectives:

- Design and deploy appropriate communications infrastructure along key arterial in the urbanized area
- Design and deploy a regionally integrated signal system to improve interagency coordination and cooperation.
- Establish regional signal system standards.

Sponsorship: City of Merced, City of Atwater, and Merced County

Deployment Phasing: This project is a single-phase deployment.

	Phase Components
Phase 1	➢ Local fiber communications. ➢ Deployment of centralized signal software ➢ Deployment of signal workstations to smaller cities. ➢ Upgrade of outdated controllers. ➢ Network equipment & services for communications between signal systems & with remote cities.

Deployment Locations: Countywide

Deployment Timeframes: This project is a near term deployment.

	Phase Timelines
Phase 1	Near Term

Benefits:

General Benefits:

- Communications infrastructure along key arterials will allow for improved signal coordination along those corridors.
- Traffic signals coordination can improve the flow of traffic, even during unexpected traffic conditions.
  - In Los Angeles, traffic signals can adjust for current traffic conditions, even when incidents divert traffic from the freeways. As a result, 41% fewer vehicles are stopped at red lights.
- By using improved communications and control techniques, traffic management can reduce delay in both uncongested and congested situations.
  - The Automated Traffic Surveillance and Control (ATSAC) program in Los Angeles reported an 18% reduction in travel time, a 16% increase in speed, and a 44% decrease in delay.
  - Toronto, Canada evaluated a computerized signal control system on two corridors and the central business district network, totaling about 75 signals. The two-month evaluation period compared the computerized system to a "best effort" fixed timing plan, and showed that the computerized control system resulted in an 8% decrease in travel time, as well as a 17% decrease in delay.
  - The City of Abilene, Texas installed a closed-loop computerized signal system, and reported that the travel times decreased by 14%, the delays decreased by 37%, and the travel speeds increased by 22%.
- Regional system standards will ease the process of coordination among systems in the different agencies, such as cities, counties, and Caltrans by providing a common base for all of the agencies to work from.

Emission Reductions:

- Emissions reductions from signal coordination and centralized signal control have been well established through testing and evaluation. A notable example of background information on the emissions and fuel reduction of signal coordination is California's FETSIM program.
- Emissions reductions from signal coordination and control result from increased travel speeds, fewer stops, and decreased acceleration cycles.

- In order for signal interconnection projects to provide emissions reductions, it is essential that an effective operational plan be put in place to implement improved signal timing.

Budget Estimate:

	Phase Budget Estimates	
	Capital Costs	**Operations and Maintenance Per Year**
Phase 1	$200K	$20K
Totals	$200K	$20K

Fiber-optic deployment costs based on a unit cost of $25/LF. Design costs were assumed to be 15% of capital costs, and contingencies were 15% of capital costs for traditional project components and 30% for software development. The fiber-optic interconnect portions of this project represent approximately 60% of the total estimated budget.

Evaluation Criteria:

- MOE
  - Intersection delay
  - Arterial travel times
  - Average time to diagnose and resolve a signal problem at a remote location
  - Emissions reduction
  - Data traffic between cities and other signal control agencies
  - Number of interjurisdictional coordinated signals
- MOP
  - Time to access information on another agency's signal
- MOS
  - Mean-time between failures
  - O&M costs

O&M Considerations: The Traffic Systems Workgroup should develop a set of informal guidelines to assist agencies in interjurisdictional signal coordination. In addition, the Workgroup should draft some example bi-lateral letters of agreement between agencies to share signal information, timing plans, and (in some cases) control.

Architecture Considerations:

Throughout the nation there are significant efforts underway to enhance signal interconnectivity and operations between jurisdictions. Three efforts are of primary importance to the project outlined in this Plan.

- Development of CT-Net – CT-Net is the Caltrans developed version of a centralized signal control system. The main software is free to Caltrans Districts, and it is generally being adopted by Districts throughout most of the State, including District 6. There is some discussion that the CT-Net software will be available for free to local jurisdictions that request it, however the controller firmware (C8 v4) is not. It is not clear at this time whether or not CT-Net will be fully compatible with the Bi-Trans QuicNet 4

software currently being deployed by the area. Interested jurisdictions should contact their District office for further information.

- Development of QuicNet 4+ - QuicNet 4.0 is the central signal control software currently available from Bi-Trans. A more advanced version of QuicNet is about to enter development in the San Diego Region. This development may offer opportunities for the region and should be carefully followed.
- NTCIP – Class E - Many signal software packages are beginning to support the new NTCIP– Class E standard for center to center communications. The continued adoption of this standard by vendors may simplify signal integration efforts in the Region. Compliance with this standard should be an important consideration for any future signal control system.

Reference should be made to market package ATMS 3 in the National Architecture.

1.3.1.4 UC Merced ATMS

General Description:

This project would provide for a variety of travel management enhancements that could include the installation of a sophisticated traffic control center that controls traffic signals, the installation of traffic surveillance using closed circuit TV, providing up to the minute information on traffic to travelers. The project would include the development or an advanced Traffic Management Center (TMC).The project would integrate the system components with other regional systems, including Caltrans. The project would include the study developing the ATMS plan, installation of the ATMS components including the integration of installation of fiber optic cable for improved communication and closed circuit TV, and the installation of a new traffic signal system in the TMC.

Project Objectives:

- Improve mobility
- Decrease traffic congestion

Sponsorship: City of Merced, City of Atwater, Merced County, and District 10.

Deployment Phasing: This project is a single-phase deployment.

	Phase Components
Phase 1	➢ Centralized Signal Control Systems ➢ Communications Links

Deployment Locations: Countywide

Deployment Timeframes: This project is a long term deployment.

	Phase Timelines
Phase 1	Long Term

Benefits:

- Improved mobility and reduction in congestion and delays

Budget Estimate:

	Phase Budget Estimates	
	Capital Costs	Operations and Maintenance Per Year
Phase 1	$800K	$80K
Totals	$800K	$80K

Evaluation Criteria:

- Travel Time
- Emissions

O&M Considerations: An increase in Operation and Maintenance budget should be considered to provide the proper level of system maintenance.

1.3.1.5 Caltrans Traffic Operations Systems (TOS) Gap Closure Project (Regional)

General Description:

Caltrans considers most field elements that aid in traffic surveillance and management activities to be part of the TOS. The most common field elements deployed as a comprehensive TOS in urbanized areas include, but are not limited to: traffic detection (inductive loops, video, acoustic), closed circuit television (CCTV) cameras, changeable message signs (CMS), highway advisory radio (HAR), communications systems and centralized command and control systems/centers with expert systems to aid in incident detection and response as well as automated ramp metering operations. Additional elements that are typically added to rural settings include, but are not limited to: road weather information systems (RWIS) and other systems that aid in improved emergency response times and dissemination of travel advisory information.

In the context of the San Joaquin Valley ITS Strategic Deployment Plan, "Early Winners" exercise, the first step in expansion of the Caltrans TOS would be examination of the existing TOS/TSM Master Plans for Districts 6 and 10. From those Master Plans an Action Plan would be developed for the common sense integration of TOS elements into a seamless central operating system, presumably in the Caltrans TMC(s). One product of the Action Plan would be the development of a Program of Projects, with potential funding sources, to implement the Action Plan and Master Plan.

Project Objectives:

- Develop an action plan based on existing Caltrans District 6 and 10 Master Plans to allow for common sense integration of TOS elements into a seamless central operating system, presumably in the Caltrans TMC(s)

- Develop Program of Projects, with potential funding sources, to implement the Action Plan and Master Plan.
- Design and deploy appropriate communications infrastructure along State facilities to eliminate existing gaps and to provide a communications backbone for the Region.
- Design and deploy appropriate field elements that aid in traffic surveillance and management activities.

Sponsorship: City of Merced, City of Atwater, Merced County, and District 10

Deployment Phasing: This project is a single-phase deployment.

	Phase Components
Phase 1	➢ Develop Implementation Plan ➢ Design and construct TDS elements

Deployment Locations: Countywide

Deployment Timeframes: This project is a mid to long term deployment.

	Phase Timelines
Phase 1	Mid to Long Term

Benefits:

General Benefits:

- Closing the gaps in the communication systems will improve the flow transportation conditions information from roadway sensors, potentially reduce costs, and allow improved cooperation between various agencies within the Region.
- Improving the communications systems will improve roadway monitoring, as well as lower incident detection frequencies assuming appropriate sensors are in place.

Emission Reductions:

- Communications projects have traditionally been considered as supportive of emissions reductions as long as they provide the capability to install traffic management or signal coordination equipment. Project proponents should work with the regional COG on a case by case basis. To support emissions reduction goals, it may be appropriate to require that communications projects clearly define what traffic management equipment will be connected and what benefits this equipment provides.

Budget Estimate:

	Phase Budget Estimates	
	Capital Costs	**Operations and Maintenance Per Year**
Phase 1	$4,000K	$200K
Totals	$4,000K	$200K

Fiber-optic deployment costs were based on a unit cost of $25/LF. Design costs were assumed to be 15% of capital costs, and contingencies were 15% of capital costs for traditional project components and 30% for software development.

Evaluation Criteria:

- MOE
  - Miles of congested freeway
  - Freeway travel times
  - Amount of transportation conditions information delivered to the public over the proposed fiber network
  - Reduction in freeway accidents near metered interchanges
  - Incident detection/response time (ATMS)
  - Time needed for traffic operations staff to monitor/control field devices (ATMS)
- MOP
  - Connection/data transfer times/rates from field devices to the TMC
  - Communications packet loss
  - Time to access data from the database (ATMS)
  - Screen refresh rates (ATMS)
- MOS
  - Mean-time between system failures
  - O&M costs

O&M Considerations:

There are no particular O&M considerations for this project. However, if the communications backbone is to be shared by agencies other than Caltrans then some form of cost-sharing agreement may be necessary.

Architecture Considerations:

The infrastructure items in this project are not a concern, however the ATMS deployment and the flexibility of the communications backbone are. Caltrans should discuss its standards with Regional stakeholders to assist in ensuring that some common standards are utilized. Note that communications have many different standards or protocol "layers" that may impact the ability of systems to communicate over any given network. Many of these layers are not necessarily discussed in the National Architecture, but are commonly used in the computer networking world. For example, the Internet utilizes the TCP-IP standard, which is only one of many of the standards that make the Internet work. Common fiber network standards include SONET and ATM. Additional discussion of this information can be found in the Technology Options Document (available under separate cover).

Within the National Architecture, it may prove helpful for readers to review market packages ATMS 1, 4, and 6.

1.3.1.6 Urban Area Traffic Signal Coordination Project

General Description:

This project would implement local traffic signal coordination plans at specific urbanized locations along regionally significant arterials in the County not currently developed. The objective of this project would primarily be to reduce delays at traffic signals by improving coordination between adjacent signals, with improved safety a possible secondary benefit depending on the specific improvements made. The specific improvements to be made would vary by location, which could include intra- and inter-jurisdictional efforts. The types of improvements that are possible include upgrading traffic signal controllers and detection, adding or upgrading signal interconnects, and communications systems enabling centralized (i.e., remote) timing plan updating and maintenance and malfunction monitoring. Although providing emergency vehicle preemption, transit vehicle priority or automated enforcement would not be the focus or justification for these improvements, the equipment installed as part of this project may support these features. Local agency traffic operations staff would lead this project.

The provision of traffic signal coordination for small communities is most often initiated with use of either time-based coordination (TBC) or a closed-loop system (CLS). Depending on the type of controller equipment now in place, and depending on the level of staffing support that the City (or County) is able to make in the maintenance of signal coordination plans, the initial cost and recurring effort to achieve signal coordination in Hanford would vary from a very low cost, to a moderate cost. A number of communication alternatives are possible to tie the intersection controllers to a supervisory computer at City Hall (in the CLS alternative). With a CLS, the capability is created to remotely monitor intersection operation and the capability to remotely change both basic and coordination timing.

A first step in the signal coordination capability would be the design and implementation of TBC timing plans. A feasibility study on possible and appropriate upgrade plans for creation and installation of a traffic signal system could be completed at the same time.

Any small community that has more than 10 traffic signals would probably benefit from having signal coordination implemented along its heaviest-traveled street(s) so that vehicles can progress through a series of signalized intersections without stopping. The initial effort to achieve this basic level of coordination is relatively low, especially if it is contracted out. The resulting basic timing plans (perhaps just 2 or 3 plans which run between 7AM and 6 PM) can be left in place with very little subsequent retiming effort required or needed. Traffic signal coordination typically has one of the very highest benefit-to-cost ratios of any public works activity.

Project Objectives:

- Provide improved signal coordination that one upgrades for revised traffic conditions.

Sponsorship: Merced Atwater FUA·City and County of Merced, and City of Atwater

Deployment Phasing: This project is a single-phase deployment.

	Phase Components
Phase 1	➢ Develop time based traffic timing plans ➢ Develop alternative solutions for signal communication such as fiber

	optic cable and wireless spectrum signal interconnect ➢ Upgrade signal controllers as necessary

Deployment Locations: Countywide

Deployment Timeframes: This project is a mid to long term deployment.

	Phase Timelines
Phase 1	Mid to Long Term

Benefits:

- Improved mobility
- Reduction in congestion and delays
- Reduced emissions

Budget Estimate:

	Phase Budget Estimates	
	Capital Costs	**Operations and Maintenance Per Year**
Phase 1	$3,500K	$350K
Totals	$3,500K	$350K

Evaluation Criteria:

- LOS and overall delay
- Travel Time
- Emissions

O&M Considerations: An increase in Operation and Maintenance budget should be considered to provide the proper level of system maintenance.

1.3.2 INCIDENT MANAGEMENT/EMERGENCY SERVICES

1.3.2.1 Alternate Route Signing

General Description:

This project would include the installation of 70 static alternate route signs within the County for designated detour routes.

This project would implement changeable message signs specifically sited, and primarily devoted, to detouring traffic onto alternate routes during incidents, including accidents and weather related road closures. These signs could differ from the large, permanent changeable message signs deployed by

Caltrans at key decision points in several respects. First, they would be sited in conjunction with a specific alternate route/detour strategy developed for a particular route and alternate routes. Second, the signs could be smaller than the Caltrans signs. Third, the signs could include features, such as arrows or flashing beacons that are not included on the traditional CMS. Finally, the alternate routes signs could be deployed as trailblazers along the alternate route, rather than merely in advance of the main route/alternate route decision point. The objective of this project would be to improve compliance with detours and reduce driver uncertainty along detour routes. If successful in reducing the volume of vehicles entering hazardous or congested roadway segments, this project holds the potential to reduce congestion, delay and accidents. In order to be successful, it would be critical that this project include development of an alternate route plan and procedures to support the usage of the signs, and that this plan be effectively linked to an overall multi-agency coordinated incident management strategy. This project would also require a commitment on behalf of the operating agency to devote the time and attention necessary to utilize the signs effectively. Even more so than a single CMS, keeping the dynamic message signs current and accurate would be critical.

Project Objectives:

- Provide efficient routing around major incidents on the highway system.
- Design and deploy alternate route signs.

Sponsorship: City of Merced, City of Atwater, Merced County, and Caltrans District 10

Deployment Phasing: This project is a single-phase deployment.

	Phase Components
Phase 1	➢ Identify potential sign locations. ➢ Design and deploy CMS at strategic locations.

Deployment Locations: Merced-Atwater FUA Traffic Corridors

Deployment Timeframes: This project is a mid to long term deployment.

	Phase Timelines
Phase 1	Mid to Long Term

Benefits:

- Improved mobility
- Reduced congestion related to highway incidents
- Improved traffic management
- Reduced delay time to major incidents
- Reduced impact on adjacent communities

Budget Estimate:

	Phase Budget Estimates	
	Capital Costs	**Operations and Maintenance Per Year**
Phase 1	$3,000K	$300K
Totals	$3,000K	$300K

Evaluation Criteria:

- *MOE*
  - Travel Time
  - Delay
  - Incident work zone safety

O&M Considerations: Operational and maintenance costs were estimated at $2,000 per location.

1.3.2.2 Traffic Safety Task Force

General Description:

This project would develop, for a specific focused area within the County, an interjurisdictional and cross-agency teaming arrangement that would be mobilized to respond to any major traffic related incident in the team's coverage area. Once a specific geographic area has been selected for this project (due in large part to the presence of a project champion), an ad-hoc working group would be established to bring this Traffic Safety Team into existence.

In order to be self-sustaining, such a Team would need to be activated, on average, at least 4 times per year. Therefore, the coverage area should be large enough so that this would be achieved. The Team would need to have authority to activate itself. That is, within each organization where a Team member is employed, that Team member should have the capability to cease his/her routine and respond to a Team-declared incident when needed. The Team should be equipped with adequate and sufficient person-to-person communication devices (most likely cellular telephones with 3-way and/or conference calling capability) to contact other Team members as needed. Finally, a rigorous and extensive agency and staff networking outreach capability should be developed for use in this Team. The Team itself may or may not have independently owned and controlled traffic control devices for use in deployments responding to incidents. Each agency's own devices should be accessible if the Traffic Safety Team is created effectively.

This Team creation would be a initiated as pilot project for duplication throughout all other areas of the Valley. The use of a contracted facilitator should be employed on this pilot project, with plenty of documentation, lessons learned, and formats to be followed for institutional acceptance of the IMT Team concept. Other areas within the Valley would then be able to model their own Team on the findings and documentation provided in this project.

Project Objectives:

- Provide a forum for emergency service agencies to propose needed projects, operational agreements, and cooperative efforts.
- Provide for inter-agency training.
- Fund some site visits to other regions implementing desirable incident management systems, policies, and/or procedures.

Sponsorship: MCAG, CHP, Caltrans, with heavy involvement from all other emergency service agencies.

Deployment Phasing: This project is a single-phase deployment.

	Phase Components
Phase 1	➢ Development of a Regional Traffic Safety Plan for large-scale interagency incidents. ➢ Funding of appropriate site visits to regions with desirable IM/ES deployments. ➢ Inter-agency training support – the importance of this element should not be underestimated. ➢ IM/ES program management by agency/other staff.

Deployment Locations: Countywide

Deployment Timeframes: This project is a mid to long term deployment.

	Phase Timelines
Phase 1	Mid to Long Term

Benefits:

General Benefits:

- Enhanced interagency coordination and communications
- Provides an interagency structure upon which deployment efforts can be constituted
- Provides institutional structure necessary to support interagency incident management coordination.

Emissions Reduction:

- None direct associated with this project.

Budget Estimate:

	Phase Budget Estimates	
	Capital Costs	Operations and Maintenance Per Year
Phase 1	$150K	$70K
Totals	$150K	$70K

Evaluation Criteria:

- MOE
  - Participation of emergency service agencies.

O&M Considerations: Long-term programming and support should be provided to support the basic functions of the Task Force.

Architecture Considerations: The Task Force should follow and report to the ITS Deployment Steering and Review group on emerging important standards, as regional and State issues, relating to the area of incident management.

1.3.3 TRANSIT SYSTEMS

1.3.3.1 Merced County Next Bus Arrival Signs

General Description:

This project would deploy dynamic message signs at selected higher-usage bus stops equipped with bus shelters. Currently, only one firm (NextBus) is providing this kind of service. Their equipment is placed on board transit vehicles, and GPS-derived current location and speed information is transmitted to NextBus computers at a remote location where the information is processed, and bus arrival prediction is then published to an Internet IP address. The IP address corresponds to a particular dynamic message sign. NextBus has a patent for this "arrival prediction using GPS coordinate data scheme, and their equipment combination uses a CDPD data modem to transmit the information from the bus to the NextBus servers. Their current coverage area does include the Merced area, but not with the CDPD provider that they have currently use (AT&T Wireless). Nonetheless, CDPD coverage is available in Merced, and the NextBus concept therefore may be workable there. The cost for the CDPD "air time" may make this more expensive than in AT&T's coverage area. Also, once an initial installation is completed (using capital funding from some source), then the agency would need to continue the payments for CDPD air time (currently ~$60 per month per bus, and $30 per month per dynamic message sign.

Once the service is in place, transit patrons would be able to determine real-time bus locations and expected arrival times at their bus stop. The dynamic message sign at the bus stop would be one source of this information, but NextBus also publishes the information in map form to an Internet website, and in WAP form to hand-held PDAs. The information would therefore also be accessible to transit dispatchers as well as agencies that oversee and/or fund transit operations. NextBus can provide a broad cross-section of transit operations data that would be useful to these 2 management groups as well.

Project Objectives:

- Improve traveler information and increase ridership

Sponsorship: Merced County Transit (The Bus)

Deployment Phasing: This project is a single-phase deployment.

	Phase Components
Phase 1	➢ Siting study for system ➢ Deployment of Nextbus system

Deployment Locations: Countywide

Deployment Timeframes: This project is a mid to long term deployment.

	Phase Timelines
Phase 1	Mid to Long Term

Benefits:

- Providing real-time transit information to user

Budget Estimate:

	Phase Budget Estimates	
	Capital Costs	**Operations and Maintenance Per Year**
Phase 1	$400K	$40K
Totals	$400K	$40K

1.3.3.2 Merced Transit AVL / Silent Alarm

General Description:

This project would equip transit vehicles in the Merced area with ITS equipment to both track vehicles and give the bus operator the capability to send a silent alarm for an emergency condition. Automatic Vehicle Location (AVL) equipment generally utilizes satellite technology for pinpointing the exact (to within 20 meters) location of the tracked vehicle. Such tracking is ongoing all the time, and is not limited to the Merced area. If a bus were removed from the area, it could still be located using the AVL equipment. Providing the bus operator with a silent alarm capability will increase the security level of both bus operators and transit patrons.

Bus tracking would be performed by transit dispatchers at the dispatch office. In many cases, the tracking information can be integrated into the same workstation that the dispatchers use in supervising and managing the transit vehicles.

Project Objectives:

- Design and implement an efficient AVL system

Sponsorship: Merced County Transit (The Bus)

Deployment Phasing: This project is a single-phase deployment.

	Phase Components
Phase 1	➢ Deploy transit vehicles (including fixed route & paratransit) with standard AVL/GPS equipment. ➢ Procure new or additional workstations

Deployment Locations: Countywide

Deployment Timeframes: This project is a near to mid term deployment.

	Phase Timelines
Phase 1	Near to Mid Term

Benefits:

- Improved transit service
- Improved transit safety
- Enhanced information for transit managers.

Budget Estimate:

	Phase Budget Estimates	
	Capital Costs	**Operations and Maintenance Per Year**
Phase 1	$1,000K	$100K
Totals	$1,000K	$100K

1.3.3.3 Transit Management System (TrMS)

General Description:

This project would provide funding to implement a transit management system. A transit management system typically includes automatic vehicle location (AVL), computer-aided scheduling and dispatch software, mobile data terminals, automated schedule adherence monitoring, computer report generation and data management, and maintenance management software. Transit management systems may also include traveler information elements such as automated itinerary planning systems, station signs showing real-time vehicle arrival information, and Internet web sites. The project shall be consistent with other regional systems including Fresno Area Express, Golden Empire Transit and San Joaquin

Regional Transit. In addition, the Transit Management System shall take into consideration other potential projects with overlapping components such as AVL.

Project Objectives:

- Develop/Expand regional TrMS deployment by using regional TrMS as a building block.
- Establish regional standards for the deployment of transit AVL equipment.
- Enhance the efficiency of transit services throughout the Region by deployment of a common TrMS.
- Allow transit agencies to remotely operate the core TrMS system with appropriate security features.
- Establish/Enhance the TrMS to effectively support demand based transit operations.

Sponsorship: Merced County Transit (The Bus)

Deployment Phasing: This project is a single-phase deployment.

	Phase Components
Phase 1	➢ Perform a focused transit communications study to determine the specific communications needs of TrMS development or expansion. ➢ Deploy transit vehicles (including fixed route & paratransit) with standard AVL/GPS equipment. ➢ Deploy transit vehicles with enhanced equipment (passenger counting, etc.) ➢ Develop/procure software/upgrades for TrMS to support regional needs and paratransit services. ➢ Install radio/communications system upgrades. ➢ Procure new or additional workstations.

Deployment Locations: Countywide

Deployment Timeframes: This project is a long term deployment.

	Phase Timelines
Phase 1	Long Term

Benefits:

General Benefits:

- Enhanced information for transit managers.
- Provides enhanced potential for real-time transit operations integration.
- Improved coordination between various transit agencies.
- Expands core for the TrMS deployment to support other ITS transit deployment efforts.

Emissions Reductions:

- Transit management systems generally have a significant potential for positive impacts on emissions reductions resulting from more effective use of the transit fleet.
- Enhanced management and dispatching could reduce out-of-direction travel and increased service effectiveness.

Budget Estimate:

	Phase Budget Estimates	
	Capital Costs	**Operations and Maintenance Per Year**
Phase 1	$1,500K	$150K
Totals	$1,500K	$150K

Based on deployments in other regions, the basic costs were conservatively assumed to be $7,500 for a standard vehicle deployment and $20,000 for an advanced vehicle deployment.

Evaluation Criteria:

- MOE
  - Transit O&M
  - Ridership
  - On-time performance
- MOS
  - Mean-time between failures
  - O&M costs

O&M Considerations: None

Architecture Considerations: The Transit Systems Workgroup should establish regional standards for TrMS deployment based on existing/emerging regional and national. Reference should be made to APTS 1 of the National Architecture.

1.3.3.4 Transit Information System

General Description:

This project would implement a system for collecting, processing and disseminating transit information, including "static" information such as routes and schedules, and in the cases of those operators with vehicle tracking systems, real-time information such as estimated vehicle arrival times at specific locations. The objective of the project would be to improve the availability and accessibility of transit information, thereby making transit more convenient and increasing transit utilization. Transit users often site uncertainty in transit schedules, stops, fares and the timing of arrivals at specific stops as impediments.

This project would establish a centralized transit information database, residing in a computer that would probably be housed at one of the San Joaquin Valley transit operations, or perhaps at a location,

such as a Caltrans traffic management facility, where other traveler information is compiled. The project would include procedures and supporting communications infrastructure that would allow participating transit operators to submit information to the system. For static information, the communications system could be very minimal, such as via e-mail or Internet file transfer. The communications necessary to support real-time information would be more costly and elaborate and could include a dial-up or dedicated phone connection. The project would also include dissemination tools to make the information available to travelers. These tools could include an Internet web site, telephone information system, and kiosks.

Project Objectives:

- Provide real-time transit status information to transit patrons including delays, arrival times, and schedules.
- Promote transit ridership through enhanced information to the public.

Sponsorship: Merced County Transit (The Bus)

Deployment Phasing: This project is a single-phase deployment.

	Phase Components
Phase 1	➢ Deploy real-time transit information displays at ten locations (2 displays each/secure casings). ➢ Procure or develop software to upgrade the TrMS to support the transit information displays. ➢ Provide communications for each of the locations. ➢ Provide monitoring/management workstations for the system.

Deployment Locations: Countywide

Deployment Timeframes: This project is a long term deployment.

	Phase Timelines
Phase 1	Long Term

Benefits:

General Benefits:

- Provides simple, accurate, and timely transit information to transit patrons on the status of the next bus, delays, schedules, etc.
- Promotes transit ridership by improving the perception of the service.

Emissions Reduction:

- Improved information for transit patrons should help to enhance ridership. Short- and Long-Range transit plans should include this project, and the anticipated impacts on ridership. These estimates could be used to determine emissions reduction potential.

Budget Estimate:

	Phase Budget Estimates	
	Capital Costs	**Operations and Maintenance Per Year**
Phase 1	$600K	$60K
Totals	$600K	$60K

Evaluation Criteria:

- MOE
  - Survey of transit patrons
- MOS
  - O&M costs
  - Mean time between failures

O&M Considerations: None

Architecture Considerations: Reference should be made to market packages APTS 4 and 8 of the National Architecture.

1.3.4 TRAVELER INFORMATION SYSTEMS

1.3.4.1 YOSEMITE.COM

General Description:

This project would implement a traveler information system oriented to visitors of Yosemite National Park. This traveler information system would expand upon the current system oriented to Yosemite National Park (www.yosemite.com). The overall objective would be to work with private sector sponsors to operate and maintain the website.

The National Park Traveler Information System would include a centralized information database, or series of linked databases that operate as a single virtual database, containing comprehensive traveler information for the attractions served by the system, including information on road and weather conditions. The system would include procedures and the supporting infrastructure necessary for the individual attraction operators to submit information on an on-going basis. For static, or non-real time information, e-mails, Internet file transfers or even faxes could suffice. For real-time information, such as congestion information based on traffic detector data or weather information based on weather station data, more sophisticated communication channels would be required, such as dedicated phone lines. The information collected through the system would be disseminated through a variety of channels, such as an Internet web site, highway advisory radio and changeable message signs. This project would be led by a coalition including Caltrans, county transportation departments and representatives from the parks and any other attractions included in the system.

Project Objectives:

- Improve mobility and make more efficient use of the arterial street system

Sponsorship: MCAG

Deployment Phasing: This project is a single-phase deployment.

	Phase Components
Phase 1	➢ Develop traveler information website for Yosemite National Park

Deployment Locations: Urbanized area of the County

Deployment Timeframes: This project is a near to mid term deployment.

	Phase Timelines
Phase 1	Near to Mid Term

Benefits:

- Reduce congestion
- Improve air quality

Budget Estimate:

	Phase Budget Estimates	
	Capital Costs	**Operations and Maintenance Per Year**
Phase 1	$200K	$0K
Totals	$200K	$0K

1.3.5 REGIONAL ITS CONFIGURATION MANAGEMENT/COORDINATION/PLANNING

1.3.5.1 Data Exchange Network (DEN)/Communications Interties

General Description:

The project would develop logical data exchange network partnerships, initially focusing on the urbanized areas of the County. Presumably the County and Caltrans would also be involved in the partnerships. In addition, the logical interties between Caltrans District 6, the County and major cities of the County. In general, local agencies that partner and interconnect more than one agency with Caltrans have been more successful in obtaining state and federal funding than those proposals that intertie only one agency to Caltrans.

Data exchange networks are typically set up in areas where several jurisdictions are interested in collectively sharing information from their respective traffic management systems. The most common information shared is from traffic signal systems. While information exchange on the network can be

used to more efficiently monitor multiple signal systems, the network usually doesn't allow for field device control or system interoperability. However, those capabilities can be included depending on user needs.

Data exchange networks depend on some type of communication infrastructure (dedicated agency owned or leased line) and software to exchange information. Communication intertie projects can establish some of the necessary communication links for a data exchange network. Data exchange networks differ from interties in that data exchange networks typically focus on the network connectivity and "logical" protocols of sharing data among several agencies. Interties typically focus on the "physical" communication link between agencies. Both, interties and data exchange networks can form the basis and initial implementation of the "center to center" portion of a Regional Architecture.

Communications intertie projects typically take place between a Caltrans Transportation Management Center (TMC) and a local agency TMC/Traffic Operations Center (TOC). To be most effective, the Caltrans TMC and the local agency would be required to have centralized command and control of traffic management systems and field devices within their respective jurisdictions. In other areas of California, intertie projects allow Caltrans and the local agency to more efficiently share transportation management information, including but not limited to: traffic flow and congestion information, weather information, incident information, video images and in some cases, signal timing plans and modes. In some cases, shared control of a limited number and type of field devices has been arranged between agencies. While full control of one another's assets (field devices, signal systems, etc.) is technically possible it may not be a desired arrangement institutionally. The most important element of an intertie project is a communication link between the intertie agencies. This can either be a dedicated agency owned asset (fiber or copper wire) or some type of telco lease line technology (T1, ISDN or DSL). Another major element of an intertie project is the software, protocols, and interfaces that would allow for the exchange of information between different systems. Interties differ from data exchange networks (see Data Exchange Network fact sheet) in that interties focus on the "physical" communication link between agencies. Data exchange networks typically focus on the network conectivity and "logical" protocols of sharing data among several agencies. Both, interties and data exchange networks can form the basis and initial implementation of the "center to center" portion of a Regional Architecture.

Project Objectives:

- Improve coordination and data sharing among agencies

Sponsorship: City of Merced, City of Atwater, Merced County, and Caltrans District 10

Deployment Phasing: This project is a single-phase deployment.

	Phase Components
Phase 1	➢ System engineering design of the DEN development and deployment of DEN within the County

Deployment Locations: Urban area through Regional TMC's

Deployment Timeframes: This project is a long term deployment.

	Phase Timelines
Phase 1	Long Term

Benefits:

- Improve incident management and traffic management in the Merced-Atwater Urban Area

Budget Estimate:

	Phase Budget Estimates	
	Capital Costs	**Operations and Maintenance Per Year**
Phase 1	$300K	$0K
Totals	$300K	$0K

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Table A.5: Summary of Merced-Atwater FUA ITS Projects

ID	Program Area/Project	Involved Agency	Brief Description	Project Initiation*			Capital Cost Estimates 2001 (Thousands of $)**		
				N	M	L	Total		
							Phase 1	Phase 2	Phase 3
MERCED COUNTY									
1.0 Traffic/Freeway Management Systems (ATMS)									
1.1ME	**MERCED COUNTY RAILROAD GRADE CROSSING TREATMENTS**	City of Merced City of Atwater Merced County	This project would seek to implement advanced technology to reduce the accident experience at railroad grade crossings in Merced County. The Kern County demonstration project could provide a blueprint for applying technology to enhance grade crossing safety throughout the entire San Joaquin Valley area. One major cause of crashes at railroad grade crossings is the persistent presence of the heavy Thule fog in the Valley, and the inability for drivers to see grade crossings which are occupied with a train, usually in motion, until they are too close to stop. If some kind of train presence detection could be devised, and tied to an advance-warning beacon, approaching drivers would be forewarned about the dangerous situation. Such an active presence could be detected by an advanced detector, and need not involve the cooperation / joint solution with the railroad. Because of liability, railroads are not eager to create new and unproven detection or safety mechanisms; they have a well-defined program for active warning devices at the crossing which are very involved "systems" tied in with the railroad's own advance detection systems. The possibility of deploying an advanced technology solution, especially at locations where no active warning devices now exist, would be the basis for this project.		X	X	**$1,200**		
1.2ME	**EVP DEPLOYMENTS**	City of Merced City of Atwater Merced County	The project would implement Emergency Vehicle Preemption (EVP) along key arterials throughout the County for use by City and County fire departments. The implementation EVP at a traffic signal modifies normal signal operation to provide a nearly immediate green signal for an approaching emergency vehicle. This type of system is most often deployed on fire trucks because of the nature of the fire truck vehicle performance. The acceleration rate of fire trucks is rather slow due to their relatively low power-to-weight ratio. If fire trucks must slow down (and sometimes stop) when they encounter signalized intersections along their emergency run, the overall delay in responding to their emergency destination can easily exceed 1 to 2 minutes. For fire events, this delay can mean a significant difference in the level of destruction, the level of effort in suppressing the fire, the level of personal danger for firefighters at the scene, and the number and extent of injuries for victims. Depending on the level of congestion and the distance traveled, fire trucks can encounter many traffic signals, and heavy congestion. Driving in oncoming traffic lanes is a "last resort" maneuver, which fire departments rightly avoid. If the fire truck encounters a red signal, it can assert the right of way and go through, but only after gaining assurance that it can safely cross through the intersection. EVP isn't needed in every community. Only when traffic congestion is very significant, or only when long emergency vehicle runs are likely to encounter a large number of signalized intersections, would the provision of EVP be cost effective. Some cities in the Central Valley already have EVP in place, the 3M Opticom™ systems being predominant. Priority request equipment would be installed in each fire truck and matching reception equipment would be installed at each signalized intersection where EVP is to be granted. Some larger agencies that have used EVP for many years have broadened the application to also equip ambulance vehicles and, in some cases, police vehicles with this on-board preemption request equipment. While these vehicles have much better acceleration characteristics, and the added delay at signals while on their emergency runs is much lower, granting EVP to these vehicles may provide another benefit. The crossing of very wide and very busy signalized intersections is very difficult in today's traffic. Each year, many such emergency vehicles are "totaled" after being T-boned when crossing a busy intersection. EVP helps reduce and prevent this occurrence. However, this project assumes only fire department vehicles would be equipped with EVP devices.	X	X		**$2,500**		
1.3ME	**CENTRAL CONTROL OF TRAFFIC SIGNALS IN URBAN AREAS**	City of Merced City of Atwater Merced County	Basic signal coordination provides signal control for a series of signals on an independent basis, without bringing surveillance or monitoring information to a central location. Central control provides communications to a central point where monitoring and control functions can occur. The capabilities of the central system can vary widely, from simple monitoring of signal controller functions to full graphic display of intersection traffic movement. One of the strengths of central computer control is the ability to design and implement multiple signal timing plans that deal with particular times, or days of traffic that vary from the norm (special events, etc.). Enhanced maintenance monitoring functions can also be provided (immediate identification of failed loops, burned out lamps, etc.). System features will vary by city.	X			**$200**		
1.4ME	**UC MERCED ATMS**	City of Merced City of Atwater Merced County District 10	This project would provide for a variety of travel management enhancements that could include the installation of a sophisticated traffic control center that controls traffic signals, the installation of traffic surveillance using closed circuit TV, providing up to the minute information on traffic to travelers. The project would include the development or an advanced Traffic Management Center (TMC). The project would integrate the system components with other regional systems, including Caltrans. The project would include the study developing the ATMS plan, installation of the ATMS components including the integration of installation of fiber optic cable for improved communication and closed circuit TV, and the installation of a new traffic signal system in the TMC.			X	**$800**		
1.5ME	**CALTRANS TRAFFIC OPERATION SYSTEMS (TOS) GAP CLOSURE PROJECT (REGION)**	City of Merced City of Atwater Merced County District 10	Caltrans considers most field elements that aid in traffic surveillance and management activities to be part of the TOS. The most common field elements deployed as a comprehensive TOS in urbanized areas include, but are not limited to: traffic detection (inductive loops, video, acoustic), closed circuit television (CCTV) cameras, changeable message signs (CMS), highway advisory radio (HAR), communications systems and centralized command and control systems/centers with expert systems to aid in incident detection and response as well as automated ramp metering operations. Additional elements that are typically added to rural settings include, but are not limited to: road weather information systems (RWIS) and other systems that aid in improved emergency response times and dissemination of travel advisory information. In the context of the San Joaquin Valley ITS Strategic Deployment Plan, "Early Winners" exercise, the first step in expansion of the Caltrans TOS would be examination of the existing TOS/TSM Master Plans for Districts 6 and 10. From those Master Plans an Action Plan would be developed for the common sense integration of TOS elements into a seamless central operating system, presumably in the Caltrans TMC(s). One product of the Action Plan would be the development of a Program of Projects, with potential funding sources, to implement the Action Plan and Master Plan.		X	X	**$4,000**		

ID	Program Area/Project	Involved Agency	Brief Description	Project Initiation*			Capital Cost Estimates 2001 (Thousands of $)**		
				N	M	L	Total		
							Phase 1	Phase 2	Phase 3
1.6ME	**URBAN AREA TRAFFIC SIGNAL COORDINATION PROJECT**	Merced Atwater FUA City of Merced City of Atwater Merced County	This project would implement local traffic signal coordination plans at specific urbanized locations along regionally significant arterials in the County not currently developed. The objective of this project would primarily be to reduce delays at traffic signals by improving coordination between adjacent signals, with improved safety a possible secondary benefit depending on the specific improvements made. The specific improvements to be made would vary by location, which could include intra- and inter-jurisdictional efforts. The types of improvements that are possible include upgrading traffic signal controllers and detection, adding or upgrading signal interconnects, and communications systems enabling centralized (i.e., remote) timing plan updating and maintenance and malfunction monitoring. Although providing emergency vehicle preemption, transit vehicle priority or automated enforcement would not be the focus or justification for these improvements, the equipment installed as part of this project may support these features. This project would be led by local agency traffic operations staff. The provision of traffic signal coordination for small communities is most often initiated with use of either time-based coordination (TBC) or a closed-loop system (CLS). Depending on the type of controller equipment now in place, and depending on the level of staffing support that the City (or County) is able to make in the maintenance of signal coordination plans, the initial cost and recurring effort to achieve signal coordination in Hanford would vary from a very low cost, to a moderate cost. A number of communication alternatives are possible to tie the intersection controllers to a supervisory computer at City Hall (in the CLS alternative). With a CLS, the capability is created to remotely monitor intersection operation and the capability to remotely change both basic and coordination timing. A first step in the signal coordination capability would be the design and implementation of TBC timing plans. A feasibility study on possible and appropriate upgrade plans for creation and installation of a traffic signal system could be completed at the same time. Any small community that has more than 10 traffic signals would probably benefit from having signal coordination implemented along its heaviest-traveled street(s) so that vehicles can progress through a series of signalized intersections without stopping. The initial effort to achieve this basic level of coordination is relatively low, especially if it is contracted out. The resulting basic timing plans (perhaps just 2 or 3 plans which run between 7AM and 6 PM) can be left in place with very little subsequent retiming effort required or needed. Traffic signal coordination typically has one of the very highest benefit-to-cost ratios of any public works activity.		X	X	**$3,500**		
2.0 Incident Management/Emergency Services									
2.1ME	**ALTERNATE ROUTE SIGNING**	City of Merced City of Atwater Merced County Caltrans District 10	This project would include the installation of 70 static alternate route signs within the County for designated detour routes. This project would implement changeable message signs specifically sited, and primarily devoted, to detouring traffic onto alternate routes during incidents, including accidents and weather related road closures. These signs could differ from the large, permanent changeable message signs deployed by Caltrans at key decision points in several respects. First, they would be sited in conjunction with a specific alternate route/detour strategy developed for a particular route and alternate routes. Second, the signs could be smaller than the Caltrans signs. Third, the signs could include features, such as arrows or flashing beacons, that are not included on the traditional CMS. Finally, the alternate routes signs could be deployed as trailblazers along the alternate route, rather than merely in advance of the main route/alternate route decision point. The objective of this project would be to improve compliance with detours and reduce driver uncertainty along detour routes. If successful in reducing the volume of vehicles entering hazardous or congested roadway segments, this project holds the potential to reduce congestion, delay and accidents. In order to be successful, it would be critical that this project include development of an alternate route plan and procedures to support the usage of the signs, and that this plan be effectively linked to an overall multi-agency coordinated incident management strategy. This project would also require a commitment on behalf of the operating agency to devote the time and attention necessary to utilize the signs effectively. Even more so than a single CMS, keeping the dynamic message signs current and accurate would be critical		X	X	**$ 3,000**		
2.2ME	**TRAFFIC SAFETY TASK FORCE**	MCAG, CHP, Caltrans, with heavy involvement from all other emergency service agencies.	This project would develop, for a specific focused area within the County, an interjurisdictional and cross-agency teaming arrangement that would be mobilized to respond to any major traffic related incident in the team's coverage area. Once a specific geographic area has been selected for this project (due in large part to the presence of a project champion), an ad-hoc working group would be established to bring this Traffic Safety Team into existence. In order to be self-sustaining, such a Team would need to be activated, on average, at least 4 times per year. Therefore, the coverage area should be large enough so that this would be achieved. The Team would need to have authority to activate itself. That is, within each organization where a Team member is employed, that Team member should have the capability to cease his/her routine and respond to a Team-declared incident when needed. The Team should be equipped with adequate and sufficient person-to-person communication devices (most likely cellular telephones with 3-way and/or conference calling capability) to contact other Team members as needed. Finally, a rigorous and extensive agency and staff networking outreach capability should be developed for use in this Team. The Team itself may or may not have independently owned and controlled traffic control devices for use in deployments responding to incidents. Each agency's own devices should be accessible if the Traffic Safety Team is created effectively. This Team creation would be a initiated as pilot project for duplication throughout all other areas of the Valley. The use of a contracted facilitator should be employed on this pilot project, with plenty of documentation, lessons learned, and formats to be followed for institutional acceptance of the IMT Team concept. Other areas within the Valley would then be able to model their own Team on the findings and documentation provided in this project.		X	X	**$150**		
3.0 Transit Systems									
3.1ME	**MERCED COUNTY NEXT BUS ARRIVAL SIGNS**	Merced County Transit (The Bus)	This project would deploy dynamic message signs at selected higher-usage bus stops equipped with bus shelters. Currently, only one firm (NextBus) is providing this kind of service. Their equipment is placed on board transit vehicles, and GPS-derived current location and speed information is transmitted to NextBus computers at a remote location where the information is processed, and bus arrival prediction is then published to an Internet IP address. The IP address corresponds to a particular dynamic message sign. NextBus has a patent for this "arrival prediction using GPS coordinate data scheme, and their equipment combination uses a CDPD data modem to transmit the information from the bus to the NextBus servers. Their current coverage area does include the Merced area, but not with the CDPD provider that they have currently use (AT&T Wireless). Nonetheless, CDPD coverage is available in Merced, and the NextBus concept therefore may be workable there. The cost for the CDPD "air time" may make this more expensive than in AT&T's coverage area. Also, once an initial installation is completed (using capital funding from some source), then the agency would need to continue the payments for CDPD air time (currently ~$60 per month per bus, and $30 per month per dynamic message sign. Once the service is in place, transit patrons would be able to determine real-time bus locations and expected arrival times at their bus stop. The dynamic message sign at the bus stop would be one source of this information, but NextBus also publishes the information in map form to an internet website, and in WAP form to hand-held PDAs. The information would therefore also be accessible to transit dispatchers as well as agencies that oversee and/or fund transit operations. NextBus can provide a broad cross-section of transit operations data that would be useful to these 2 management groups as well.		X	X	**$400**		
3.2ME	**MERCED TRANSIT AVL / SILENT ALARM**	Merced County Transit (The Bus)	This project would equip transit vehicles in the Merced area with ITS equipment to both track vehicles and give the bus operator the capability to send a silent alarm for an emergency condition. Automatic Vehicle Location (AVL) equipment generally utilizes satellite technology for pinpointing the exact (to within 20 meters) location of the tracked vehicle. Such tracking is ongoing all the time, and is not limited to the Merced area. If a bus were removed from the area, it could still be located using the AVL equipment. Providing the bus operator with a silent alarm capability will increase the security level of both bus operators and transit patrons. Bus tracking would be viewed by transit dispatchers in the dispatch office. In many cases, the tracking information can be integrated into the same workstation that the dispatchers use in supervising and managing the transit vehicles.	X	X		**$1,000**		
3.3ME	**TRANSIT MANAGEMENT SYSTEM (TRMS)**	Merced County Transit (The Bus)	This project would provide funding to implement a transit management system. A transit management system typically includes automatic vehicle location (AVL), computer-aided scheduling and dispatch software, mobile data terminals, automated schedule adherence monitoring, computer report generation and data management, and maintenance management software. Transit management systems may also include traveler information elements such as automated itinerary planning systems, station signs showing real-time vehicle arrival information, and Internet web sites. The project shall be consistent with other regional systems including Fresno Area Express, Golden Empire Transit and San Joaquin Regional Transit. In addition, the Transit Management System shall take into consideration other potential projects with overlapping components such as AVL.			X	**$1,500**		

ID	Program Area/Project	Involved Agency	Brief Description	Project Initiation*			Capital Cost Estimates 2001 (Thousands of $)**		
				N	M	L	Total		
							Phase 1	Phase 2	Phase 3
3.4ME	**TRANSIT INFORMATION SYSTEM**	Merced County Transit (The Bus)	This project would implement a system for collecting, processing and disseminating transit information, including "static" information such as routes and schedules, and in the cases of those operators with vehicle tracking systems, real-time information such as estimated vehicle arrival times at specific locations. The objective of the project would be to improve the availability and accessibility of transit information, thereby making transit more convenient and increasing transit utilization. Transit users often site uncertainty in transit schedules, stops, fares and the timing of arrivals at specific stops as impediments. This project would establish a centralized transit information database, residing in a computer that would probably be housed at one of the San Joaquin Valley transit operations, or perhaps at a location, such as a Caltrans traffic management facility, where other traveler information is compiled. The project would include procedures and supporting communications infrastructure that would allow participating transit operators to submit information to the system. For static information, the communications system could be very minimal, such as via e-mail or Internet file transfer. The communications necessary to support real-time information would be more costly and elaborate and could include a dial-up or dedicated phone connection. The project would also include dissemination tools to make the information available to travelers. These tools could include an Internet web site, telephone information system, and kiosks.			X	**$600**		
4.0 Traveler Information Systems									
4.1ME	**YOSEMITE.COM**	MCAG	This project would implement a traveler information system oriented to visitors of Yosemite National Park. This traveler information system would expand upon the current system oriented to Yosemite National Park (www.yosemite.com). The overall objective would be to work with private sector sponsors to operate and maintain the website. The National Park Traveler Information System would include a centralized information database, or series of linked databases that operate as a single virtual database, containing comprehensive traveler information for the attractions served by the system, including information on road and weather conditions. The system would include procedures and the supporting infrastructure necessary for the individual attraction operators to submit information on an on-going basis. For static, or non-real time information, e-mails, Internet file transfers or even faxes could suffice. For real-time information, such as congestion information based on traffic detector data or weather information based on weather station data, more sophisticated communication channels would be required, such as dedicated phone lines. The information collected through the system would be disseminated through a variety of channels, such as an Internet web site, highway advisory radio and changeable message signs. This project would be led by a coalition including Caltrans, county transportation departments and representatives from the parks and any other attractions included in the system	X	X		**$200**		
5.0 Regional ITS Configuration Management/Coordination/Planning									
5.1ME	**DATA EXCHANGE NETWORK (DEN)/** **COMMUNICATIONS INTERTIES**	Valleywide through Regional TMC's City of Merced City of Atwater Merced County Caltrans District 10	The project would develop logical data exchange network partnerships, initially focus on the urbanized areas of the County. Presumably the County and Caltrans would also be involved in the partnerships. In addition, the logical interties between Caltrans District 6, the County and major cities of the County. In general, local agencies that partner and interconnect more than one agency with Caltrans have been more successful in obtaining state and federal funding than those proposals that intertie only one agency to Caltrans. Data exchange networks are typically set up in areas where several jurisdictions are interested in collectively sharing information from their respective traffic management systems. The most common information shared is from traffic signal systems. While information exchange on the network can be used to more efficiently monitor multiple signal systems, the network usually doesn't allow for field device control or system interoperability. However, those capabilities can be included depending on user needs. Data exchange networks depend on some type of communication infrastructure (dedicated agency owned or leased line) and software to exchange information. Communication intertie projects can establish some of the necessary communication links for a data exchange network. Data exchange networks differ from interties in that data exchange networks typically focus on the network connectivity and "logical" protocols of sharing data among several agencies. Interties typically focus on the "physical" communication link between agencies. Both, interties and data exchange networks can form the basis and initial implementation of the "center to center" portion of a Regional Architecture. Communications intertie projects typically take place between a Caltrans Transportation Management Center (TMC) and a local agency TMC/Traffic Operations Center (TOC). To be most effective, the Caltrans TMC and the local agency would be required to have centralized command and control of traffic management systems and field devices within their respective jurisdictions. In other areas of California, intertie projects allow Caltrans and the local agency to more efficiently share transportation management information, including but not limited to: traffic flow and congestion information, weather information, incident information, video images and in some cases, signal timing plans and modes. In some cases, shared control of a limited number and type of field devices has been arranged between agencies. While full control of one another's assets (field devices, signal systems, etc.) is technically possible it may not be a desired arrangement institutionally. The most important element of an intertie project is a communication link between the intertie agencies. This can either be a dedicated agency owned asset (fiber or copper wire) or some type of telco lease line technology (T1, ISDN or DSL). Another major element of an intertie project is the software, protocols, and interfaces that would allow for the exchange of information between different systems. Interties differ from data exchange networks (see Data Exchange Network fact sheet) in that interties focus on the "physical" communication link between agencies. Data exchange networks typically focus on the network conectivity and "logical" protocols of sharing data among several agencies. Both, interties and data exchange networks can form the basis and initial implementation of the "center to center" portion of a Regional Architecture.			X	**$300**		
			Total Estimated Capital Deployment Costs for All Potential ITS Projects Over 20 Years						**$19,350**

Notes:

* Project initiation timeframes - N = Years 1-5, M = Years 6-10, L = Years 11+

**All capital costs are approximate and rounded for purposes of this table.

Table A.6: Timeline of Merced-Atwater FUA ITS Projects

Figure A.5: Sequence of Proposed ITS Implementation Activities for Merced-Atwater FUA

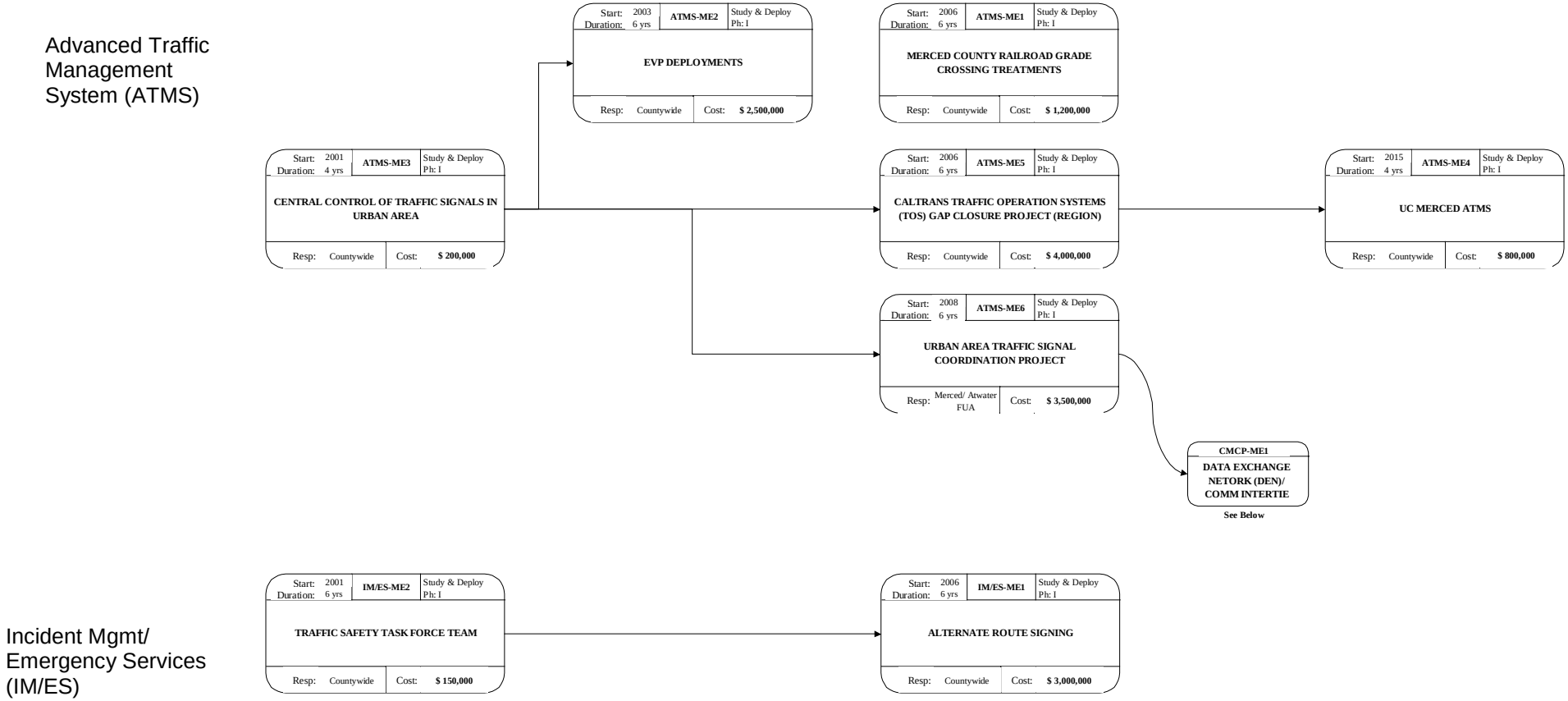


Figure A.5: Sequence of Proposed ITS Implementation Activities for the Merced-Atwater FUA (cont)

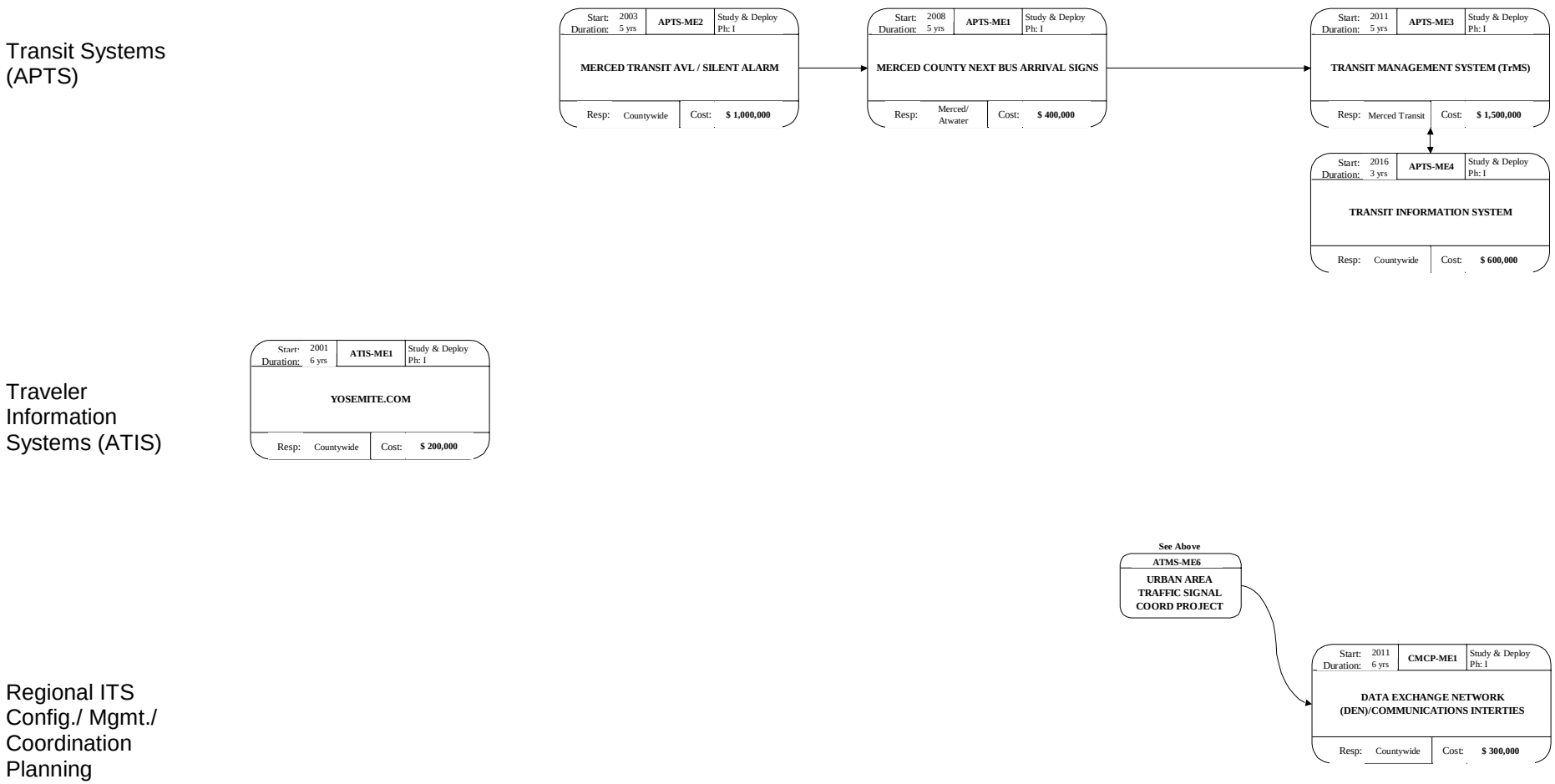
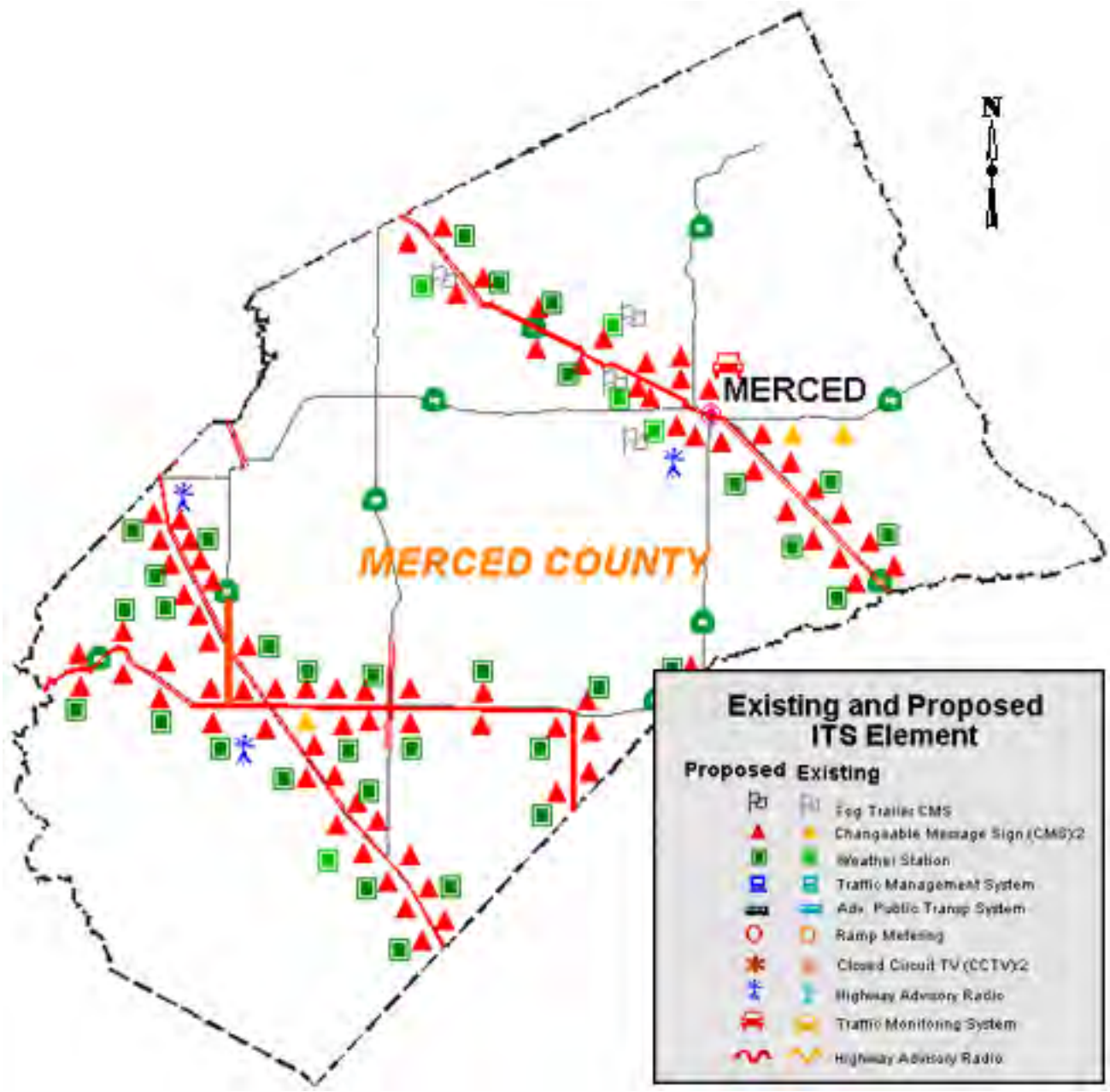


Figure A.6: Existing and Proposed ITS Elements for Merced County



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1.4 Stanislaus County

The total estimated capital deployment costs for all potential ITS projects within the next 20 years is over $42,520,000.

1.4.1 TRAFFIC/FREEWAY MANAGEMENT SYSTEMS (ATMS)

1.4.1.1 Modesto/Ceres ATMS Completion

City of Modesto CCTV System Master Plan:

The city of Modesto CCTV system will assume a multi-purpose role in providing monitoring and surveillance capabilities to traffic management operators. The Master Plan is intended to conceptually depict the long-term traffic control & surveillance system to be implemented in the City. The major functions of the CCTV system are:

- Incident Detection
- Incident Verification & Response
- Monitoring of traffic signal coordination along major corridors
- Monitoring high volume intersection operation, queue build-up and high accident locations
- Evaluate Traffic Management Strategies

The development of the CCTV system will make use of the existing City fiber optic communication network, which will provide opportunities for a cost-effective communications media for video signals and control signal transmission. The CCTV camera site locations will be identified based on established camera site selection criteria. The CCTV cameras are located at strategic locations throughout the City to provide surveillance and monitoring capabilities for the operators at the Traffic Management Center in the City. A total of 33 preliminary CCTV camera locations were identified throughout the City as part of the CCTV system Master Plan to provide surveillance and monitoring capabilities. After a more detailed field video survey, 10 critical locations were identified for design and the viewing ranges for the remaining locations were determined. The following are the ten locations identified for design as part of this phase of the project:

- Briggsmore Ave./McHenry Ave.
- Briggsmore Ave./SR 99
- Oakdale Rd./Scenic Dr.
- Downey Ave./Needham St./McHenry Ave.
- 9th/H St.
- Sylvan Ave./McHenry Ave
- Briggsmore Ave./Oakdale Rd.
- Standiford Ave./SR 99
- Standiford Ave./Prescott Rd.
- L St./5th St./Washington St.

The following 23 locations were identified as potential CCTV camera site locations for future installations:

- Standiford Ave./Dale Rd./Sisk Rd.
- Standiford Ave./Tully Rd.
- Briggsmore Ave./Sisk Rd./Orangeburg Ave
- Briggsmore Ave./Coffee Rd.
- Coffee Rd./Scenic Dr.
- Sylvan Ave./Oakdale Rd.
- Sylvan Ave./Coffee Rd.
- Briggsmore Ave./Tully Rd.
- Briggsmore Ave./Claus Rd.
- Claus Rd./Yosemite Blvd.

- El Vista Ave./Mitchell Rd.
- 19th St./H St.
- Yosemite Blvd./Santa Cruz Ave.
- Woodland Ave./Carpenter Rd.
- McHenry Ave./Roseburg Ave.
- Floyd Ave./Oakdale Rd.
- Floyd Ave./Coffee Rd.
- L St./5th St./Washington St.
- 9th St./L St.
- Yosemite Blvd./Lincoln Ave.
- Yosemite Blvd./Carpenter Rd.
- Coffee Rd./Fairmont Ave.
- Briggsmore Ave./Roselle Ave.
- Floyd Ave./Oakdale Rd.
- McHenry Ave./Floyd Ave.

The proposed CCTV camera implementation in Modesto should be coordinated with the existing ATMS deployment. The video and control signals from the proposed CCTV cameras will interface with existing hubs and existing splice equipment in the field before being transmitted to the City TMC along existing fiber optic communication paths. Each of the proposed cameras will use one existing single-mode fiber along different existing communication paths, carrying video and control signals. At locations where communication paths do not exist appropriate splice equipment and new fiber will be installed. Each of the cameras will be connected by a point-to-point application, with appropriate fiber optic equipment installed at the TMC capable of receiving full-motion video control signals.

The recommended CCTV system Master Plan for the City of Modesto is based on the functional requirements, review of existing systems, City requirements and currently available technologies and hardware/software.

City of Ceres CCTV Master Plan

The City of Ceres CCTV system will also serve the role of providing monitoring and surveillance capabilities to the traffic management operators. The CCTV system in the City will perform the same major functions of incident detection, verification and response, monitoring of critical intersection operational and preliminary CCTV camera traffic signal coordination along major corridors. Six (6) locations were identified along major corridors in the City. Based on the video reviews, four critical locations were identified for design as part of this phase of the project. The four design locations are:

- Whitmore Ave./Mitchell Rd.
- Hatch Rd./Central Ave.
- Hatch Rd./Mitchell Rd.
- Hatch Rd./SR 99

The following two CCTV camera locations were identified as potential future installations:

- Service Rd./Mitchell Rd.
- Whitmore Ave./Central Ave.

The proposed CCTV camera implementation in Ceres is coordinated with the proposed City ATMS implementation. Each of the proposed cameras shall be capable of transmitting full motion video and control signals making use of proposed communication cable fibers and communication hubs. The video and control signals shall make use of different communications paths from each of the proposed cameras to the City TMC. Appropriate fiber optic and other communication equipment shall be

installed in the proposed hubs and the TMC such that full-motion video and control signals can be transmitted and received.

The Ceres CCTV system is currently linked to the Modesto CCTV system providing traffic management operators in both Cities monitoring the capabilities at critical locations and along major traffic corridors in both Modesto and Ceres. The recommended CCTV system Master Plan for the City of Ceres is based on the functional requirements, reviews of existing systems, city requirements and currently available technologies and hardware/software.

Ceres ATMS Communication Network Alternative

The primary elements of the recommended communication alternative are:

- A 24-strand single-mode fiber optic cable will be installed for the trunk line with redundancy ring considerations.
- The majority of the existing cables and planned intersections will be connected to communication hubs via twisted pair cables. Every six controllers will be connected by a pair of twisted wires of six-pair cable, employing a multi-drop network structure. The remaining four pairs will be used as voice communication media and spares.
- Communication hubs are located that are generally more than ½ mile apart, are designed to be connected to the center via spread spectrum radio.
- The system has the capability of transmitting video signals of the potential CCTV camera installations throughout the City through the fiber optic trunk line.

Ceres Communication Hubs

With the use of fiber optic in a hybrid network with twisted pair cable as well as wireless means (spread spectrum radio), interfaces will be needed to convert digital light wave energy to electrical energy. This is performed via "communication hubs." The hubs are housed in a suitable controller cabinet.

The locations of the hubs were determined by two factors:

- Consideration of immediate and long-range network expansion
- Present routing of communication media

In the short-term, three hub locations are proposed, to be located at the following locations:

- Mitchell Road/Service Road intersection
- Mitchell Road/Hatch Road
- Hatch Road/Herndon Road/SR 99

In the long-term, one hub location is proposed, to be located at the following location:

- Morgan Road/Service Road intersection

Implementation Plan

The previous sections of this report provided information about existing conditions in the City of Ceres and an evaluation of communication alternatives, evaluation of available camera and lens technologies, CCTV camera site selection in Modesto and Ceres and the recommendations based on the evaluations.

This section of the document provides the next step towards a concise implementation plan based on the evaluation, functional and agency requirements.

The implementation plan may be broadly classified into three time span, namely:

- Short-term Plan
- Medium-term Plan
- Long-term Plan

The short-term implementation plan covers the following projects in Modesto and Ceres:

- Design and implementation of identified short-term CCTV locations in Ceres
- Design and implementation of CCTV locations in Modesto
- Design and implementation of communication links between CCTV cameras and hubs/splice boxes in Modesto
- Training for system operation in Ceres and Modesto

The medium-term implementation plan covers the following projects in Modesto and Ceres:

- Install CCTV cameras at identified future locations in Ceres
- Expansion of Ceres ATMS to cover future identified communication to provide redundancy ring features
- Install CCTV cameras at identified future locations in Modesto
- Expansion of communication infrastructure in Modesto

The long-term implementation plan covers the following projects in Modesto and Ceres:

- Upgrade of city TMC to incorporate sophisticated Decision Support System software, to enable decision making for TMC operators for various incidents in conjunction with implemented CCTV cameras

Project Objectives:

- Improved mobility
- Decreased traffic congestion

Sponsorship: Stanislaus County, City of Modesto, City of Ceres, and District 10

Deployment Phasing: This project is a three-phase deployment.

	Phase Components
Phase 1	➢ CCTV Deployment ➢ Communication Links

Deployment Locations: Ceres and Modesto City Limits

Deployment Timeframes: This project is a near-term through long-term deployment.

	Phase Timelines
Phase 1	Near-term to Long-term

Benefits:

- Improved mobility and reduction in congestion and delays.

Budget Estimate:

	Phase Budget Estimates	
	Capital Costs	**Operations and Maintenance Per Year**
Phase 1	$4,100K	$400K
Totals	$4,100K	$400K

Evaluation Criteria:

- Travel Time
- Emissions

O&M Considerations: An increase in operations and maintenance budget should be considered to provide proper level of system maintenance.

1.4.1.2 Modesto-Ceres Urban Area Traffic Signal Interconnect And Coordination Project

General Description:

This project would implement local traffic signal coordination plans at specific urbanized locations along regionally significant arterials in the County not currently developed. The objective of this project would primarily be to reduce delays at traffic signals by improving coordination between adjacent signals, with improved safety a possible secondary benefit depending on the specific improvements made. The specific improvements to be made would vary by location, which could include intra- and inter-jurisdictional efforts. The types of improvements that are possible include upgrading traffic signal controllers and detection, adding or upgrading signal interconnects, and communications systems enabling centralized (i.e., remote) timing plan updating and maintenance and malfunction monitoring. Although providing emergency vehicle preemption, transit vehicle priority or automated enforcement would not be the focus or justification for these improvements, the equipment installed as part of this project may support these features. Local agency traffic operations staff would lead this project.

The provision of traffic signal coordination for small communities is most often initiated with use of either time-based coordination (TBC) or a closed-loop system (CLS). Depending on the type of controller equipment now in place, and depending on the level of staffing support that the City (or County) is able to make in the maintenance of signal coordination plans, the initial cost and recurring effort to achieve signal coordination in Hanford would vary from a very low cost, to a moderate cost. A number of communication alternatives are possible to tie the intersection controllers to a supervisory computer at City Hall (in the CLS alternative). With a CLS, the capability is created to remotely

monitor intersection operation and the capability to remotely change both basic and coordination timing. A first step in the signal coordination capability would be the design and implementation of TBC timing plans. A feasibility study on possible and appropriate upgrade plans for creation and installation of a traffic signal system could be completed at the same time. Any small community that has more than 10 traffic signals would probably benefit from having signal coordination implemented along its heaviest-traveled street(s) so that vehicles can progress through a series of signalized intersections without stopping. The initial effort to achieve this basic level of coordination is relatively low, especially if it is contracted out. The resulting basic timing plans (perhaps just 2 or 3 plans which run between 7AM and 6 PM) can be left in place with very little subsequent retiming effort required or needed. Traffic signal coordination typically has one of the very highest benefit-to-cost ratios of any public works activity.

Project Objectives:

- Provide improved signal coordination that are upgraded for revised traffic conditions.

Sponsorship: City of Modesto, City of Ceres, and Stanislaus County

Deployment Phasing: This project is a single-phase deployment.

	Phase Components
Phase 1	➢ Develop traffic timing plans

Deployment Locations: Along major arterials with two city Urban Areas.

Deployment Timeframes: This project is a near to mid-term deployment.

	Phase Timelines
Phase 1	Near to Mid-term

Benefits:

- Improved mobility and reduced emissions

Budget Estimate:

	Phase Budget Estimates	
	Capital Costs	**Operations and Maintenance Per Year**
Phase 1	$3,000K	$300K
Totals	$3,000K	$300K

1.4.1.3 Integrated Smart Corridors

General Description:

This project would implement a package of ITS applications in a highway corridor consisting of at least one main route and one parallel route. The focus of the project would be to improve the level of coordination of traffic management activities on the main route and parallel route(s); in effect to conduct corridor-level rather than facility-specific ITS traffic management. The range of ITS applications that could be included in a smart corridor application include essentially the full range of freeway management, arterial street management (e.g., traffic signalization) and traveler information strategies, including surveillance and detection; incident management, including coordinated and dynamic traffic detouring strategies utilizing both the main and parallel route(s); changeable message signs; dynamic trailblazer signs; highway advisory radio; and integrated traffic signal operations, including coordination between ramp meters and adjacent traffic signals. The smart corridor project would feature implementation of a combination of ITS applications, with the emphasis being on linking operations across multiple facilities serving a defined travel corridor. Given the multi-facility nature of this project, the multi-jurisdictional coordination aspects of the project will be critical, including developing consensus on the specific objectives of the project and on the individual coordination procedures and techniques. The first step in the development of this project would be to identify a candidate project corridor, based on accidents and congestion, travel patterns, availability of alternate routes and interest among the potential project participants.

Project Objectives:

- Design and deploy appropriate ITS infrastructure along the proposed smart corridors.
- Develop common standards for ATMS functions.
- Consider the integration of freeway and major arterial operations (managing the overall transportation network).
- Design and develop integrated corridor system tools that can be deployed throughout the Region.

Sponsorship: City of Modesto, City of Ceres, Stanislaus County, and Caltrans District 10

Deployment Phasing: This project is a single-phase deployment.

	Phase Components
Phase 1	➢ Fiber communications ➢ Smart corridor including appropriate (CMS, CCTV, HAR, and freeway/arterial integration)

Deployment of smart corridors is a complex undertaking task for any region. The San Joaquin Valley has the advantage of a less complex institutional arena than the Los Angeles region, but it also has far fewer funds available. While the smart corridors project is outlined in a separate definition, it is important to note that many of the project efforts build towards or support the smart corridor concept. It is important that the Region consider its future goal for smart corridors when deploying smaller-scale ITS efforts in order to move towards that goal

Deployment Locations: Modesto Ceres FUA

Deployment Timeframes: This project is a long term deployment.

	Phase Timelines
Phase 1	Long-Term

Benefits:

General Benefits:

- The Smart Corridor Project for the City of Los Angeles involving I-10 and adjacent arterials is an example of an "integrated" ITS system. A preliminary evaluation of this system was performed to evaluate its impacts. It was estimated that total travel time along the Smart Corridor will be reduced by 11 to 15%. Intersection delay is expected to be reduced by nearly 20%. Vehicle emission will generally decrease as follows: CO (15%), HC (8%). Freeway speeds during peak hours will increase by nearly 70 to 80 %. Stop-and-go freeway conditions will decrease substantially. Average surface street speeds during peak periods will increase by nearly 11%. These same benefits are anticipated for the Fresno County project. A conservative 8% reduction in travel time is assumed for benefit-cost analysis.
- The Information for Motorist (INFORM) program in Long Island, New York, is an integrated program using changeable message signs, ramp meters, in-road traffic detectors, and signal coordination on parallel streets. INFORM has increased rush hour speeds on Long Island from 34 mph to 46 mph. Drivers will divert to an alternate route 5% to 10% of the time when passive messages are displayed on electronic signs, and will divert even more frequently when the message recommends an alternate route.
- Integrated systems have the ability to lower costs by sharing infrastructure, staff, and equipment cost among a number of services and agencies. An analysis performed for the US DOT ITS Joint Program Office indicated that incorporation of the full metropolitan ITS infrastructure into a regional transportation improvement plan could reduce the cost of infrastructure expansion by approximately one-half. The analysis was based on published data regarding VMT growth, infrastructure component benefits, and FHWA cost estimates.
- In Detroit, Michigan, an expansion of the freeway management system is expected to reduce delays from incidents by about 40%. This could lead to an annual reduction of 41.3 million gallons of fuel used, a reduction of 122,000 tons of carbon monoxide, 1,400 tons hydrocarbons, and 1,200 tons of nitrogen oxides.

Emissions Reductions:

- See above.
- Smart Corridor projects reduce emissions by decreasing delay and traffic flow breakdown along congested facilities. The extent of emissions reduction is largely a function of the extent of congestion, volume of traffic, type of traffic management devices/operations, and the number of incidents along the facility in question. Generally, it should be possible to estimate emissions reduction by determining the likely reduction in either the number of incidents or the duration of these incidents and applying this to the affected vehicles.

- As with signal coordination, Smart Corridors are implementations of devices and the operation of those devices. It is essential that a sound operational plan be in place to take full advantage of Smart Corridor operations.

Budget Estimate:

	Phase Budget Estimates	
	Capital Costs	**Operations and Maintenance Per Year**
Phase 1	$3,500K	$220K
Totals	$3,500K	$220K

Fiber-optic deployment costs based on a unit cost of $25/LF. Design costs were assumed to be 15% of capital costs, and contingencies were 15% of capital costs for traditional project components and 30% for software development.

Evaluation Criteria:

- MOE
  - Traffic delays (arterial/freeway)
  - Number of primary and secondary incidents
  - Emissions reduction
  - Diverted traffic volumes
  - Survey of public perceptions

O&M Considerations: Smart Corridors are very dependent on interagency cooperation and coordination. Generally, specific response plans must be developed for each portion of the corridor to prescribe how agencies will react in certain situations. Continued coordination and the setting and following of common standards throughout ITS deployment will greatly assist the development of the Smart Corridor concept.

Architecture Considerations: Prerequisite efforts include software integration/systems elements of county projects. It may also prove helpful to review market packages ATMS 1, 3, 4, 6, and 7, as well as ATMS 8.

1.4.1.4 Advanced Railroad Highway Interface Technology Deployment Including a SR 132 IR/RIS Demonstration Project

General Description:

This project would deploy railroad-highway grade crossing technology at fourteen (14) grade crossings with safety (high accident) and/or high volume and delay concerns. The objective of the project would use field validated strategies for improving safety, reducing delay and/or providing travelers with improved real-time information on grade crossing status. The project could feature any combination of detection (both for trains and approaching vehicles), warning/traveler information, and control devices. Many different strategies are possible. Possible strategies include sensors coupled with message signs, in-vehicle devices and/or highway advisory radio that would provide approaching travelers with information on the expected duration of a crossing blockage. Another possible application would tie

sensors to emergency vehicle dispatching systems to provide dispatchers and drivers with real time crossing status information.

Highway traffic at highway-rail intersections (HRIs) could be managed, where operational requirements demand advanced features (e.g., where rail operational speeds are greater than 80 miles per hour). This would include all capabilities from the Standard Railroad Grade Crossing and augments these with additional safety features to mitigate the risks associated with higher rail speeds. The active warning systems would include positive barrier systems, which preclude entrance into the intersection when the barriers are activated. Like the Standard Package, the HRI equipment is activated on notification by wayside interface equipment, which detects, or communicates with, the approaching train.

The wayside interface equipment would provide additional information about the arriving train so that the train's direction of travel, estimated time of arrival, and the estimated duration of closure may be derived. This enhanced information may be conveyed to the driver prior to, or in context with, warning system activation. This would also include additional detection capabilities, enabling it to detect an entrapped or otherwise immobilized vehicle within the HRI and provide an immediate notification to highway and railroad officials.

The demonstration project at SR-132 in Empire would provide advanced RR detection technologies along the trades, which would be used to actuate the crossing and Dynamic Message Signs (DMS) in advance of the intersection. The DMS will notify motorists of the blockage with an estimated time of closure and direct them to an alternate route around the crossing. The project will require additional equipment at the crossing and DMS and physical improvements along the approximately one mile detour. The detour is expected to only be necessary when switching operations take place.

Project Objectives:

- Design and deploy either a single or a series of systems, which enhance safety at high activity railroad crossings.
- Develop traveler information systems, which display accurate, timely, and useful information on expected train crossings and anticipated delays.
- Consider inexpensive options to enhance RR crossing safety

Sponsorship: Stanislaus County, City of Modesto, City of Ceres, Caltrans District 10, and StanCOG

Deployment Phasing: This project is a single-phase deployment.

	Phase Components
Phase 1	➢ Analyze locations of Smart crossing sites within project area ➢ Deploy Smart Crossing Sites

Deployment Locations: Urban Areas of County

Deployment Timeframes: This project is a mid term deployment.

	Phase Timelines
Phase 1	Mid Term

Benefits:

General Benefits:

- Enhanced safety at grade crossings through improved warning of approaching trains.
- Decreased travel delays to travelers through enhanced information.

Emissions Reductions:

- Emissions reductions may result from these types of projects through the diversion of some traffic to alternative routes not delayed by train traffic. Based on the site being deployed, the volume of traffic, and availability of alternative routes to reach the same destination it should be possible to estimate the emissions reductions resulting from anticipated traffic diversions.
- Deployment of this type of equipment along high volume routes with viable alternative paths of travel should improve the emissions reduction potential of these projects.

Budget Estimate:

	Phase Budget Estimates	
	Capital Costs	**Operations and Maintenance Per Year**
Phase 1	$750K	$75K
Totals	$750K	$75K

Evaluation Criteria:

- MOE
  - Traffic delays at RR-xings
  - Number of incidents at crossings
  - Number of illegal crossings
  - Emissions reduction
  - Diverted traffic volumes
  - Survey of public perceptions

O&M Considerations: Concurrence of the California Public Utilities Commission (CPUC) and property owners will be required to place devices within the railroad right-of-way.

Architecture Considerations: Readers may want to review market packages ATMS 14 and 15 of the National Architecture.

1.4.1.5 Red Light Running/ Photo Enforcement

General Description:

This project would provide law enforcement officials with the ability to enforce violations electronically through automated photo enforcement at ten of the highest accident locations in the FUA. Photo enforcement involves the utilization of a fixed or CCTV positioned camera and a vehicle detection sensor to take a photograph or digital image of a vehicle that initiates an illegal activity. Typical uses of this application include railroad-crossing enforcement, red light violation enforcement, speed limit enforcement, and weigh station enforcement. Typically, the organizations that supply the technology generally take on the responsibility for retrieving the image from the system, processing the film (if necessary), and issuing warnings or citations, depending on the issuing agency. Select intersections in the cities of Ceres and Modesto should be identified and considered for automated photo enforcement for red light violations within the FUA.

Project Objectives:

- Reduce accidents related to red light violations

Sponsorship: Cities of Modesto and Ceres

Deployment Phasing: This project is a two-phase deployment. The first phase will include the installation of photo enforcement equipment at the intersection of Hatch and Mitchell. Other photo enforcement equipment would be added in 5 to 10 years.

	Phase Components
Phase 1	➢ See Above
Phase 2	➢ See Above

Deployment Locations: Cities of Modesto and Ceres, Police Departments

Deployment Timeframes: The first phase of this project is a near term deployment. The second phase will be a mid to long term deployment.

	Phase Timelines
Phase 1	Near Term
Phase 2	Mid to Long Term

Benefits:

- Reduced accident rates at major intersections

Budget Estimate:

	Phase Budget Estimates	
	Capital Costs	**Operations and Maintenance Per Year**
Phase 1	$20K	Privatized
Phase 1	$150K	Privatized
Totals	$160K	Privatized

1.4.1.6 TOS and Communications Gap Closure Project

General Description:
This project would close the existing communications infrastructure gaps along SR 99 to the Caltrans, District 10 Transportation Management Center (CVTMC). In addition, ramp meters would be deployed in existing gap areas along the above facilities. The project also includes communications to the ramp meter locations, and may include the update and deployment of ramp metering software at the TMC.

Project Objectives:

- Develop an action plan based on existing Caltrans District 10 Master Plan to allow for common sense integration of TOS elements into a seamless central operating system, presumably in the Caltrans TMC(s)
- Develop Program of Projects, with potential funding sources, to implement the Action Plan and Master Plan.
- Design and deploy appropriate communications infrastructure along State facilities to eliminate existing gaps and to provide a communications backbone for the Region.
- Design and deploy appropriate field elements that aid in traffic surveillance and management activities.

Sponsorship: Caltrans District 10

Deployment Phasing: This project is a single-phase deployment.

	Phase Components
Phase 1	➢ Develop implementation plan ➢ Design and construct TDS elements

Deployment Locations: Countywide

Deployment Timeframes: This project is a mid to long term deployment.

	Phase Timelines
Phase 1	Mid to Long Term

Benefits:

General Benefits:

- Closing the gaps in the communication systems will improve the flow transportation conditions information from roadway sensors, potentially reduce costs, and allow improved cooperation between various agencies within the Region.
- Improving the communications systems will improve roadway monitoring, as well as lower incident detection frequencies assuming appropriate sensors are in place.

Emission Reductions:

- Communications projects have traditionally been considered as supportive of emissions reductions as long as they provide the capability to install traffic management or signal coordination equipment. Project proponents should work with the regional COG on a case by case basis. To support emissions reduction goals, it may be appropriate to require that communications projects clearly define what traffic management equipment will be connected and what benefits this equipment provides.

Budget Estimate:

	Phase Budget Estimates	
	Capital Costs	**Operations and Maintenance Per Year**
Phase 1	$5,000K	$250K
Totals	$5,000K	$250K

Fiber-optic deployment costs were based on a unit cost of $25/LF. Design costs were assumed to be 15% of capital costs, and contingencies were 15% of capital costs for traditional project components and 30% for software development.

Evaluation Criteria:

- MOE
  - Miles of congested freeway
  - Freeway travel times
  - Amount of transportation conditions information delivered to the public over the proposed fiber network
  - Reduction in freeway accidents near metered interchanges
  - Incident detection/response time (ATMS)
  - Time needed for traffic operations staff to monitor/control field devices (ATMS)
- MOP
  - Connection/data transfer times/rates from field devices to the TMC
  - Communications packet loss
  - Time to access data from the database (ATMS)
  - Screen refresh rates (ATMS)
- MOS

- Mean-time between system failures
- O&M costs

O&M Considerations:

There are no particular O&M considerations for this project. However, if the communications backbone is to be shared by agencies other than Caltrans then some form of cost-sharing agreement may be necessary.

Architecture Considerations:

The infrastructure items in this project are not a concern, however the ATMS deployment and the flexibility of the communications backbone are. Caltrans should discuss its standards with Regional stakeholders to assist in ensuring that some common standards are utilized. Note that communications have many different standards or protocol "layers" that may impact the ability of systems to communicate over any given network. Many of these layers are not necessarily discussed in the National Architecture, but are commonly used in the computer networking world. For example, the Internet utilizes the TCP-IP standard, which is only one of many of the standards, which make the Internet work. Common fiber network standards include SONET and ATM. Additional discussion of this information can be found in the Technology Options Document (available under separate cover).

Within the National Architecture, it may prove helpful for readers to review market packages ATMS 1, 4, and 6.

1.4.1.7 Integrated Surveillance Stations/Smart Call Box Deployment (Regional)

General Description:

The basic premise behind integrated surveillance stations/callbox deployments, also known as "Smart Call Boxes" is the clustering of multiple capabilities at a single field location. Call Box locations can be equipped with traffic and weather surveillance devices, and utilize the communication capability of the call box to transmit the surveillance data back to a traffic management center or centralized database archive. The typical technology options that are attached to the call boxes include: traffic detection devices for operations (speed, volume) or planning (census, classification) purposes and road weather information systems (RWIS).

A Smart Call Box Traffic Monitoring Program can use the existing or planned call box system with integrated counter devices, existing Caltrans or other agency inductive loops, and various classification equipment. These call boxes could provide accurate, reliable, and timely traffic census and classification data throughout the Region. The count/classification data collected through Smart Call Boxes is needed to calibrate and validate regional and local transportation models. The count/classification data will also enable agencies in the FUA, especially Caltrans; to monitor heavily traveled corridors to determine the appropriate application of improvements and funding priority. In addition, the Smart Call Box can remotely sense an incident considering average speed data compared to actual speeds of vehicles along a State Route or local highway.

The "Smart" Call Box is very similar to permanent traffic counter equipment except that downloading the data occurs through a modem call via the cellular network to the "Smart" Call Box. Caltrans and other agencies currently retrieve or download the data manually in the field at traffic control stations or

sites to a laptop computer. Remote collection of traffic data allows the agency to reduce staff collection costs and collect year-round data.

Project Objectives:

- Design and deploy remote surveillance stations with a common architecture, standards, and interface.
- Design and deploy a regional callbox system along applicable facilities.
- Provide for multi-jurisdictional access to the surveillance components of the system.
- Develop an institutional structure to provide continued support and maintenance of the overall system.

Sponsorship: Stanislaus County, StanCOG (SAFE), City of Ceres, and Caltrans District 10

Deployment Phasing: This project is a single-phase deployment.

	Phase Components
Phase 1	➢ Study for location of remote sensors, Smart Callboxes, and callboxes. ➢ Answering center start-up & support. ➢ Callbox program support. ➢ Deployment of normal and Smart Callboxes/remote sensing stations along I-5 and SR99, as well as in some regional parks/trails. ➢ Procurement of supporting software.

Deployment Locations: Countywide along major highways

Deployment Timeframes: This project is a mid to long term deployment.

	Phase Timelines
Phase 1	Mid to Long Term

Benefits:

General Benefits:

- Reduced incident detection times, especially in rural areas.
- Enhanced motorist aide services.
- Positive public perception of public services and support.
- Low-cost provision of remote transportation conditions information.
- Additional data to be obtained from other regions.

Emissions Reductions:

- Emissions reductions from this project are likely to be somewhat limited due to the dispersed and rural character of the proposed deployment. Emissions reduction potential should not serve as a primary purpose for deploying this project type.

Budget Estimate:

	Phase Budget Estimates	
	Capital Costs	Operations and Maintenance Per Year
Phase 1	$3,000K	$450K
Totals	$3,000K	$450K

Based on deployments in other regions, the basic costs were conservatively assumed to be $8,000 for a basic callbox installation and $12,000 (+ $10,000 for sensing devices) for Smart Callboxes installed.

Once the basic motorist aide and Smart Callbox systems are in place, funds obtained through the regional fee can be applied to maintenance, replacement, and deployment of additional motorist aide and transportation management devices.

Evaluation Criteria:

- MOE
  - Number of calls
  - Number of secondary incidents
  - Clearance time for disabled vehicles
  - Call answer/response times
  - Number of incidents
- MOP
  - Time to answer/respond to calls
  - Connect times to remote devices
  - Reliability of remote connections
- MOS
  - Mean-time between failures
  - O&M costs

O&M Considerations: This project involves a substantial operational program and funding requirements. It also provides a funding mechanism for continued operations. Many existing callbox deployments have displayed a lifespan in excess of that originally anticipated (approx. 15 years could now be assumed applicable with regular maintenance).

Architecture Considerations: Refer to market package ATMS 1 in the National Architecture.

1.4.1.8 Communications Intertie Project Between Modesto and Ceres, County, and Caltrans

General Description:

This project would establish/complete the backbone wireline communications between the largest transportation players in the County. A fiber optic backbone is already in place within the cities of Modesto and Ceres. Communications would likely utilize fiber optic cable, however other opportunities should be reviewed for the various needs. This project should consider the establishment of regional

standards for fiber communications deployment, including consideration of modes, capacity needs, communications protocols, and perhaps equipment types.

Project Objectives:

- Provide improved communication, coordination and data sharing among traffic operations agencies

Sponsorship: Stanislaus County, City of Modesto, City of Ceres, and District 10

Deployment Phasing: This project is a single-phase deployment.

	Phase Components
Phase 1	➢ Develop Master Plan for Call Boxes ➢ Design and implement call box system

Deployment Locations: Countywide

Deployment Timeframes: This project is a near to mid term deployment.

	Phase Timelines
Phase 1	Near to Mid Term

Budget Estimate:

	Phase Budget Estimates	
	Capital Costs	**Operations and Maintenance Per Year**
Phase 1	$1,500K	$150K
Totals	$1,500K	$150K

1.4.2 INCIDENT MANAGEMENT/EMERGENCY SERVICES

1.4.2.1 Traffic Safety Task Force

General Description:

This project would develop, for a specific focused area within the County, an interjurisdictional and cross-agency teaming arrangement that would be mobilized to respond to any major traffic related incident in the team's coverage area. Once a specific geographic area has been selected for this project (due in large part to the presence of a project champion), an ad-hoc working group would be established to bring this Traffic Safety Team into existence. In order to be self-sustaining, such a Team would need to be activated, on average, at least 4 times per year. Therefore, the coverage area should be large enough so that this would be achieved. The Team would need to have authority to activate itself. That is, within each organization where a Team member is employed, that Team member should have the capability to cease his/her routine and respond to a Team-declared incident when needed. The Team should be equipped with adequate and sufficient person-to-person communication devices (most likely cellular telephones with 3-way and/or conference calling capability) to contact other Team members as

needed. Finally, a rigorous and extensive agency and staff networking outreach capability should be developed for use in this Team. The Team itself may or may not have independently owned and controlled traffic control devices for use in deployments responding to incidents. Each agency's own devices should be accessible if the Traffic Safety Team is created effectively. This Team creation would be a initiated as pilot project for duplication throughout all other areas of the Valley. The use of a contracted facilitator should be employed on this pilot project, with plenty of documentation, lessons learned, and formats to be followed for institutional acceptance of the IMT Team concept. Other areas within the Valley would then be able to model their own Team on the findings and documentation provided in this project.

Project Objectives:

- Provide a forum for emergency service agencies to propose needed projects, operational agreements, and cooperative efforts.
- Provide for inter-agency training.
- Fund some site visits to other regions implementing desirable incident management systems, policies, and/or procedures.

Sponsorship: StanCOG, CHP, and Caltrans, with heavy involvement from all other emergency service agencies.

Deployment Phasing: This project is a single-phase deployment.

	Phase Components
Phase 1	➢ Development of a Regional Traffic Safety Plan for large-scale interagency incidents. ➢ Funding of appropriate site visits to regions with desirable IM/ES deployments. ➢ Inter-agency training support – the importance of this element should not be underestimated. ➢ IM/ES program management by agency/other staff.

Deployment Locations: Within the urbanized area highway system

Deployment Timeframes: This project is near to mid term deployment.

	Phase Timelines
Phase 1	Near to Mid Term

Benefits:

General Benefits:

- Enhanced interagency coordination and communications
- Provides an interagency structure upon which deployment efforts can be constituted
- Provides institutional structure necessary to support interagency incident management coordination.

Emissions Reduction:

- None directly associated with this project.

Budget Estimate:

	Phase Budget Estimates	
	Capital Costs	**Operations and Maintenance Per Year**
Phase 1	$150K	$70K
Totals	$150K	$70K

Evaluation Criteria:

- MOE
  - Participation of emergency service agencies.

O&M Considerations: Long-term programming and support should be provided to support the basic functions of the Task Force.

Architecture Considerations: The Task Force should follow and report to the ITS Deployment Steering and Review group on emerging important standards, as regional and State issues, relating to the area of incident management.

1.4.2.2 EVP Deployments

General Description:

The project would implement Emergency Vehicle Preemption (EVP) along key arterials throughout the County for use by City and County fire departments. The implementation EVP at a traffic signal modifies normal signal operation to provide a nearly immediate green signal for an approaching emergency vehicle. This type of system is most often deployed on fire trucks because of the nature of the fire truck vehicle performance. The acceleration rate of fire trucks is rather slow due to their relatively low power-to-weight ratio. If fire trucks must slow down (and sometimes stop) when they encounter signalized intersections along their emergency run, the overall delay in responding to their emergency destination can easily exceed 1 to 2 minutes. For fire events, this delay can mean a significant difference in the level of destruction, the level of effort in suppressing the fire, the level of personal danger for firefighters at the scene, and the number and extent of injuries for victims.

Depending on the level of congestion and the distance traveled, fire trucks can encounter many traffic signals, and heavy congestion. Driving in oncoming traffic lanes is a “last resort” maneuver, which fire departments rightly avoid. If the fire truck encounters a red signal, it can assert the right of way and go through, but only after gaining assurance that it can safely cross through the intersection. EVP isn’t needed in every community. Only when traffic congestion is very significant, or only when long emergency vehicle runs are likely to encounter a large number of signalized intersections, would the provision of EVP be cost effective. Some cities in the Central Valley, including the City of Ceres, already have EVP in place, the 3M Opticom™ system being predominant. Priority request equipment

would be installed in each fire truck and matching reception equipment would be installed at each signalized intersection where EVP is to be granted.

Some larger agencies that have used EVP for many years have broadened the application to also equip ambulance vehicles and, in some cases, police vehicles with this on-board preemption request equipment. While these vehicles have much better acceleration characteristics, and the added delay at signals while on their emergency runs is much lower, granting EVP to these vehicles may provide another benefit. The crossing of very wide and very busy signalized intersections is very difficult in today's traffic. Each year, many such emergency vehicles are "totaled" after being T-boned when crossing a busy intersection. EVP helps reduce and prevent this occurrence. However, this project assumes only fire department vehicles would be equipped with EVP devices.

Project Objectives:

- Improve emergency response to major accidents

Sponsorship: City of Modesto

Deployment Phasing: This project is a single-phase deployment.

	Phase Components
Phase 1	➢ Evaluate and deploy EVP at up to 24 major intersections

Deployment Locations: City of Modesto

Deployment Timeframes: This project is a near to mid term deployment.

	Phase Timelines
Phase 1	Near to Mid Term

Benefits:

- Reduction in emergency vehicle related accidents

Budget Estimate:

	Phase Budget Estimates	
	Capital Costs	**Operations and Maintenance Per Year**
Phase 1	$2,500K	$10K
Totals	$2,500K	$10K

1.4.2.3 Alternate Route Signing

General Description:

This project would include the installation of 70 static alternate route signs within the County for designated detour routes. This project would implement extinguishable message signs specifically sited, and primarily devoted, to detouring traffic onto alternate routes during incidents, including accidents and weather related road closures. These signs could differ from the large, permanent changeable message signs deployed by Caltrans at key decision points in several respects. First, they would be sited in conjunction with a specific alternate route/detour strategy developed for a particular route and alternate routes. Second, the signs could be smaller than the Caltrans signs. Third, the signs could include features, such as arrows or flashing beacons that are not included on the traditional CMS. Finally, the alternate routes signs could be deployed as trailblazers along the alternate route, rather than merely in advance of the main route/alternate route decision point. The objective of this project would be to improve compliance with detours and reduce driver uncertainty along detour routes. If successful in reducing the volume of vehicles entering hazardous or congested roadway segments, this project holds the potential to reduce congestion, delay and accidents. In order to be successful, it would be critical that this project include development of an alternate route plan and procedures to support the usage of the signs, and that this plan be effectively linked to an overall multi-agency coordinated incident management strategy. This project would also require a commitment on behalf of the operating agency to devote the time and attention necessary to utilize the signs effectively. Even more so than a single CMS, keeping the dynamic message signs current and accurate would be critical.

Project Objectives:

- To provide efficient routing around major incidents on the highway system

Sponsorship: Stanislaus County, City of Modesto, and City of Merced and Caltrans District 10

Deployment Phasing: This project is a single-phase deployment.

	Phase Components
Phase 1	➢ Identify location of signs ➢ Design and deploy EMS

Deployment Locations: Countywide

Deployment Timeframes: This project is a mid to Long Term deployment.

	Phase Timelines
Phase 1	Mid to Long Term

Benefits:

- Improved mobility and reduced congestion related to highway incidents

Budget Estimate:

	Phase Budget Estimates	
	Capital Costs	Operations and Maintenance Per Year
Phase 1	$3,000K	$300K
Totals	$3,000K	$300K

1.4.2.4 Remote Surveillance And Incident Scene Management Project

General Description:

This new experimental program involves a video system capable of sending images via cellular or microwave technology to a TMC. The images are then put on the Internet and key experts who could provide technical advise to the responders at the scene can access the pictures with a password. This process would allow the expert to talk to the scene by telephone, look at the problems on the Internet, and help devise solutions for safe and timely resolution.

This technology has been purchased for the Washington State DOT and is being installed on their incident response trucks. There is also a handheld unit for getting close up images of truck equipment and other details. Trauma center doctors, hazardous materials specialists, recovery companies, and investigative specialists are some of the resource personnel that will be able to look at problems and give advice. This type of system has significant application for rural interstates. Problems that require special knowledge can now close roads for several hours while the experts respond to the scene. The two-way communication link with video going to the experts can potentially save hours of delay for motorists.

Project Objectives:

- Design and deploy remote surveillance stations with a common architecture, standards, and interface.
- Design and deploy a regional callbox system along applicable facilities.
- Provide for multi-jurisdictional access to the surveillance components of the system.
- Develop an institutional structure to provide continued support and maintenance of the overall system.

Sponsorship: Stanislaus County, City of Modesto, and City of Merced

Deployment Phasing: This project is a single-phase deployment.

	Phase Components
Phase 1	➢ Study for location of remote sensors, Smart Callboxes, and callboxes. ➢ Answering center start-up & support. ➢ Callbox program support. ➢ Deployment of normal and Smart callboxes/remote sensing stations along I-5 and SR99, as well as in some regional parks/trails. ➢ Procurement of supporting software.

Deployment Locations: Highways with urban area

Deployment Timeframes: This project is a long term deployment.

	Phase Timelines
Phase 1	Long Term

Benefits:

General Benefits:

- Reduced incident detection times, especially in rural areas.
- Enhanced motorist aide services.
- Positive public perception of public services and support.
- Low-cost provision of remote transportation conditions information.
- Additional data to be obtained from other regions.

Emissions Reductions:

- Emissions reductions from this project are likely to be somewhat limited due to the dispersed and rural character of the proposed deployment. Emissions reduction potential should not serve as a primary purpose for deploying this project type.

Budget Estimate:

	Phase Budget Estimates	
	Capital Costs	**Operations and Maintenance Per Year**
Phase 1	$400K	$40K
Totals	$400K	$40K

Evaluation Criteria:

- MOE
  - Number of calls
  - Number of secondary incidents
  - Clearance time for disabled vehicles
  - Call answer/response times
  - Number of incidents
- MOP
  - Time to answer/respond to calls
  - Connect times to remote devices
  - Reliability of remote connections
- MOS
  - Mean-time between failures

- O&M costs

O&M Considerations: This project involves a substantial operational program and funding requirements. It also provides a funding mechanism for continued operations. Many existing callbox deployments have displayed a lifespan in excess of that originally anticipated (approx. 15 years could now be assumed applicable with regular maintenance).

Architecture Considerations: Refer to market package ATMS 1 in the National Architecture.

1.4.2.5 Integration of Communications Channels Project

General Description:

There are currently common channels for state agencies to talk to each other. There are channels for county agencies and also for city agencies to talk to others within their own government, but they cannot always communicate with outside government agencies. Technology exists to allow cross communication for major incidents and consideration should be given to establishing a link to be used in case of large multi-agency incidents.

Project Objectives:

- Improved communication and coordination between emergency and law enforcement agencies

Sponsorship: StanCOG

Deployment Phasing: This project is a single-phase deployment.

	Phase Components
Phase 1	➢ Design and deployment of the integrated communications system

Deployment Locations: Countywide

Deployment Timeframes: This project is a mid to long term deployment.

	Phase Timelines
Phase 1	Mid to Long Term

Benefits:

- More efficient incident management

Budget Estimate:

	Phase Budget Estimates	
	Capital Costs	Operations and Maintenance Per Year
Phase 1	$2000K	$20K
Totals	$2000K	$20K

1.4.3 TRANSIT SYSTEMS

1.4.3.1 Modesto Transit AVL / Silent Alarm

General Description:

This project would equip transit vehicles in the Modesto area (43 busses) with ITS equipment to both track vehicles and give the bus operator the capability to send a silent alarm for an emergency condition. Automatic Vehicle Location (AVL) equipment generally utilizes satellite technology for pinpointing the exact (to within 20 meters) location of the tracked vehicle. Such tracking is ongoing all the time, and is not limited to the Visalia area. If a bus were removed from the area, it could still be located using the AVL equipment. Providing the bus operator with a silent alarm capability will increase the security level of both bus operators and transit patrons. Bus tracking would be viewed by transit dispatchers in the dispatch office. In many cases, the tracking information can be integrated into the same workstation that the dispatchers use in supervising and managing the transit vehicles.

Project Objectives:

- To design and implement an efficient AVL system

Sponsorship: Modesto Area Express (MAX)

Deployment Phasing: This project is a single-phase deployment.

	Phase Components
Phase 1	

Deployment Locations: Max service area

Deployment Timeframes: This project is a near term deployment.

	Phase Timelines
Phase 1	Near Term

Benefits:

- Improved transit service

Budget Estimate:

	Phase Budget Estimates	
	Capital Costs	Operations and Maintenance Per Year
Phase 1	$650K	$65K
Totals	$650K	$65K

1.4.3.2 Transit Management System (TrMS) Completion Project

General Description:

Transit agencies emphasized the point that they do not want to "recreate the wheel," and that MAX's transit management system deployment efforts should act as a building block for the rest of the region. This project would look at the most effective options for continuing MAX's TrMS deployment efforts by deploying AVL on uninstrumented rural and urban transit vehicles. Additional TrMS functions should be deployed with a view towards eventual region wide deployment. Options for deploying compatible components across all vehicles should be sought. MAX's system is J1708 compliant. The example provided was that fare equipment in a large bus may not be appropriate to a small rural service vehicle. Different devices may be used, but they should operate across a common software/system with completely compatible standards.

Project Objectives:

- Develop/Expand regional TrMS deployment by using regional TrMS as a building block.
- Establish regional standards for the deployment of transit AVL equipment.
- Enhance the efficiency of transit services throughout the Region by deployment of a common TrMS.
- Allow transit agencies to remotely operate the core TrMS system with appropriate security features.
- Establish/Enhance the TrMS to effectively support demand based transit operations.

Sponsorship: Modesto Area Express

Deployment Phasing: This project is a single-phase deployment.

	Phase Components
Phase 1	➢ Perform a focused transit communications study to determine the specific communications needs of TrMS development or expansion. ➢ Deploy transit vehicles (including fixed route & paratransit) with standard AVL/GPS equipment. ➢ Deploy transit vehicles with enhanced equipment (passenger counting, etc.) ➢ Develop/procure software/upgrades for TrMS to support regional needs and paratransit services. ➢ Install radio/communications system upgrades. ➢ Procure new or additional workstations.

Deployment Locations: Countywide

Deployment Timeframes: This project is a long term deployment.

	Phase Timelines
Phase 1	Long Term

Benefits:

General Benefits:

- Enhanced information for transit managers.
- Provides enhanced potential for real-time transit operations integration.
- Improved coordination between various transit agencies.
- Expands core for the TrMS deployment to support other ITS transit deployment efforts.

Emissions Reductions:

- Transit management systems generally have a significant potential for positive impacts on emissions reductions resulting from more effective use of the transit fleet.
- Enhanced management and dispatching could reduce out-of-direction travel and increased service effectiveness.

Budget Estimate:

	Phase Budget Estimates	
	Capital Costs	**Operations and Maintenance Per Year**
Phase 1	$2,000K	$200K
Totals	$2,000K	$200K

Based on deployments in other regions, the basic costs were conservatively assumed to be $7,500 for a standard vehicle deployment and $20,000 for an advanced vehicle deployment.

Evaluation Criteria:

- MOE
  - Transit O&M
  - Ridership
  - On-time performance
- MOS
  - Mean-time between failures
  - O&M costs

O&M Considerations: None

Architecture Considerations: The Transit Systems Workgroup should establish regional standards for TrMS deployment based on existing/emerging regional and national. Reference should be made to APTS 1 of the National Architecture.

1.4.3.3 Demand-Responsive Transit System Integration Study

General Description:

This project could fund a study of demand-responsive transit system integration strategies, culminating in a specific set of recommendations to implement strategies within specified transit agencies. The primary objective of integrating multiple demand-responsive transit services is to improve operating efficiency by reducing service redundancies and sharing vehicles, staff and scheduling/dispatch technology among agencies. These improvements result in an overall better quality of service to riders, and riders may benefit directly through enhanced schedule and/or destination options enabled through the integration of services across agencies. Typically, especially in county-based or rural oriented demand responsive transit environments, a number of different agencies operate within a given geographic area, providing service to many of the same destinations but often serving a slightly different client base. One of the primary objectives of demand-responsive transit service integration strategies is to reduce these redundancies and associated inefficiencies. Demand-responsive service integration includes a wide range of potential specific activities, ranging from simple coordination to full integration. Examples of specific strategies include consolidation of scheduling and/or dispatch functions (where multiple agencies can share the cost of improvements and share access), agreements to share access to vehicles under specified circumstances, and consolidation of ride reservation systems.

Project Objectives:

- To improve paratransit efficiency by providing coordinated operations and improved system purchasing power

Sponsorship: StanCOG with participation from local paratransit properities.

Deployment Phasing: This project is a single-phase deployment.

	Phase Components
Phase 1	➢ Prepare a study of the feasibility of integrated service

Deployment Locations: Countywide

Deployment Timeframes: This project is a mid to long term deployment.

	Phase Timelines
Phase 1	Mid to Long Term

Benefits:

- Improved paratransit service – Countrywide

Budget Estimate:

	Phase Budget Estimates	
	Capital Costs	Operations and Maintenance Per Year
Phase 1	$1,200K	$120K
Totals	$1,200K	$120K

1.4.3.4 Common Electronic Fare Payment System

General Description:

This project would create a transit fare payment system that would allow a single prepaid card to be used on all of the participating transit systems in the Stanislaus County area. Since a large number of County residents commute the San Francisco Bay/Silicon Valley Areas, it would be ideal to "piggyback" onto the systemwide electronic fare system now being developed for the Bay area (namely, TransLink). TransLink, a regional transit fare payment system using 'smart card' technology, is scheduled to launch as a demonstration project in the San Francisco Bay Area in mid-2001. The nine-county Bay Area will be first in the U.S. to have a single card that can be used on all forms of public transit in the region: buses, trains and ferries. The project began with the award of a contract to Motorola, Inc. in mid-1999. Motorola, Inc. is developing the system under contract to MTC. It is being developed in two phases to ensure that the system meets the needs of the riding public and transit Operators. The six-month demonstration project will include approximately 5,000 transit riders using TransLink on six Bay Area transit systems [AC Transit, BART, Caltrans, Golden Gate Transit, SF Muni, and Santa Clara Valley Transportation Authority (VTA)]. The results of this demonstration will be thoroughly evaluated before the system is implemented region wide (in 2002).

Project Objectives:

- Improved transit efficiency
- Increased ridership

Sponsorship: Modesto Area Express (MAX) and StanCOG

Deployment Phasing: This project is a single-phase deployment.

	Phase Components
Phase 1	➢ Develop the implementation plan based on lessons learned from the Bay Area ➢ Deploy limited amount of systems for interregional transit users

Deployment Locations: Countywide

Deployment Timeframes: This project is a near to mid term deployment.

	Phase Timelines
Phase 1	Near to Mid Term

Benefits:

- More efficient transit service

Budget Estimate:

	Phase Budget Estimates	
	Capital Costs	Operations and Maintenance Per Year
Phase 1	$4,000K	$400K
Totals	$4,000K	$400K

1.4.3.5 Stanislaus County Next Bus Arrival Signs

General Description:

This project would deploy dynamic message signs at selected higher-usage bus stops equipped with bus shelters. Currently, only one firm (NextBus) is providing this kind of service. Their equipment is placed on board transit vehicles, and GPS-derived current location and speed information is transmitted to NextBus computers at a remote location where the information is processed, and bus arrival prediction is then published to an Internet IP address. The IP address corresponds to a particular dynamic message sign. NextBus has a patent for this "arrival prediction using GPS coordinate data scheme, and their equipment combination uses a CDPD data modem to transmit the information from the bus to the NextBus servers. The cost for the CDPD "air time" may make this more expensive than in AT&T's coverage area. Also, once an initial installation is completed (using capital funding from some source), then the agency would need to continue the payments for CDPD air time (currently ~$60 per month per bus, and $30 per month per dynamic message sign.

Once the service is in place, transit patrons would be able to determine real-time bus locations and expected arrival times at their bus stop. The dynamic message sign at the bus stop would be one source of this information, but NextBus also publishes the information in map form to an Internet website, and in WAP form to hand-held PDAs. The information would therefore also be accessible to transit dispatchers as well as agencies that oversee and/or fund transit operations. NextBus can provide a broad cross-section of transit operations data that would be useful to these two management groups as well.

Project Objectives:

- Improve traveler information and increase ridership

Sponsorship: Modesto Area Express (MAX)

Deployment Phasing: This project is a single-phase deployment.

	Phase Components
Phase 1	➢ Siting study for system ➢ Deployment of up to 30 sign locations

Deployment Locations: Within the focused urban area

Deployment Timeframes: This project is a mid to long term deployment.

	Phase Timelines
Phase 1	Mid to Long Term

Benefits:

- Providing real-time transit information to user

Budget Estimate:

	Phase Budget Estimates	
	Capital Costs	**Operations and Maintenance Per Year**
Phase 1	$800K	$80K
Totals	$800K	$80K

1.4.3.6 Combined Transit Operations/Dispatch Center Project

General Description:

This project would bring together the various transit dispatching operations into a single and improved transit dispatch center. The application of scarce transit funds to a single center, versus the current system of independent centers, would allow for economies of scale and more effective dispatch through a coordinated single center.

Project Objectives:

- Enhance the level of cooperation and integration between various transit dispatch operations within the Region.
- Co-located dispatch operations.
- Provide remote communications and dispatch integration between transit agencies.

Sponsorship: Modesto Area Express (MAX) along with local transit service providers.

Deployment Phasing: This project is a single-phase deployment.

	Phase Components
Phase 1	➢ Procure/develop dispatch software enhancements to allow remote integration and communications. ➢ Procure needed workstations/communications/network equipment. ➢ Procure furniture/dispatch positions equipment. ➢ Additional software upgrades.

Deployment Locations: Countywide

Deployment Timeframes: This project is a long term deployment.

	Phase Timelines
Phase 1	Long Term

Benefits:

General Benefits:

- Enhanced interagency coordination and communications.
- Provides an interagency structure upon which deployment efforts can be constituted.
- Ability for improved time-transfers.
- True regional integrated transit operations.

Emissions Reduction:

- To the extent that coordinated operations results in service improvements and enhance ridership, this project could offer some emissions reduction benefits. When this project is proposed for funding, any hoped for service enhancements or adjustments should be noted in order to assess emission impacts.

Budget Estimate:

	Phase Budget Estimates	
	Capital Costs	**Operations and Maintenance Per Year**
Phase 1	$6,000K	$40K
Totals	$6,000K	$40K

Evaluation Criteria:

- MOE
  - Number of messages exchanged across the system
  - Number of timed transfers between agencies
  - Perception of transit dispatch operators
- MOP
  - Communications rates
  - Screen/message update/refresh rates
  - Ability to track a specified number of vehicles
- MOS
  - O&M costs
  - Mean time between failures

O&M Considerations: An institutional arrangement would be required between the various transit agencies to account for on-going operations and maintenance costs. The details of this agreement should be worked out by the Transit Systems Workgroup.

Architecture Considerations: The Workgroup should perform a review of existing and planned dispatch systems to determine potential integration difficulties. The Workgroup should seek to define regional standards for transit data definitions (objects) and ITS equipment. Readers may want to review market packages APTS 1, 2, and 3 of the National Architecture.

1.4.4 TRAVELER INFORMATION SYSTEMS

1.4.4.1 Modesto/Ceres Traveler Information System

General Description:

This project would implement a comprehensive Integrated Traveler Information System (ITIS) that includes the following systems:

- Closed Circuit Television (CCTV)·
- System Detection
- Changeable Message Signs (CMS)·
- Highway Advisory Radio (HAR)·
- Public Information Database (PIDB)·
- Traveler Advisory Telephones (TAT)·
- Community Access Television (CATV) information system
- HAR/HAT Voice-Response System
- Kiosks
- ·Communication Network

The goal of the system is to disseminate timely and reliable traffic congestion information along the major arterial streets within the FUA. System detector data would be collected, analyzed and disseminated via the ITIS. In addition, this information can be shared with the regional ATMS including Caltrans and other agencies in the region. This information can be provided to the public through an Internet website, a telephone advisory system, and interactive touch-screen kiosks located at strategic locations.

Project Objectives:

- Improve mobility and make more efficient use of the arterial street system

Sponsorship: City of Modesto, City of Ceres, and Stanislaus County

Deployment Phasing: This project is a single-phase deployment.

	Phase Components
Phase 1	➢ Develop an integrated traveler information system for the area.

Deployment Locations: Urbanized area of the County

Deployment Timeframes: This project is a long term deployment.

	Phase Timelines
Phase 1	Long Term

Benefits:

- Reduce congestion
- Improve air quality

Budget Estimate:

	Phase Budget Estimates	
	Capital Costs	**Operations and Maintenance Per Year**
Phase 1	$400K	$20K
Totals	$400K	$20K

1.4.5 REGIONAL ITS CONFIGURATION MANAGEMENT/COORDINATION/PLANNING

1.4.5.1 Data Exchange Network (DEN)/Communications Interties

General Description:

The project would develop logical data exchange network partnerships, initially focus on the urbanized areas of the County. Presumably the County and Caltrans would also be involved in the partnerships. In addition, the logical interties between Caltrans District 6, the County and major cities of the County. In general, local agencies that partner and interconnect more than one agency with Caltrans have been more successful in obtaining state and federal funding than those proposals that intertie only one agency to Caltrans.

Data exchange networks are typically set up in areas where several jurisdictions are interested in collectively sharing information from their respective traffic management systems. The most common information shared is from traffic signal systems. While information exchange on the network can be used to more efficiently monitor multiple signal systems, the network usually doesn't allow for field device control or system interoperability. However, those capabilities can be included depending on user needs.

Data exchange networks depend on some type of communication infrastructure (dedicated agency owned or leased line) and software to exchange information. Communication intertie projects can establish some of the necessary communication links for a data exchange network. Data exchange networks differ from interties in that data exchange networks typically focus on the network connectivity and "logical" protocols of sharing data among several agencies. Interties typically focus on the "physical" communication link between agencies. Both, interties and data exchange networks can form the basis and initial implementation of the "center to center" portion of a Regional Architecture.

Communications intertie projects typically take place between a Caltrans Transportation Management Center (TMC) and a local agency TMC/Traffic Operations Center (TOC). To be most effective, the Caltrans TMC and the local agency would be required to have centralized command and control of traffic management systems and field devices within their respective jurisdictions. In other areas of California, intertie projects allow Caltrans and the local agency to more efficiently share transportation management information, including but not limited to: traffic flow and congestion information, weather information, incident information, video images and in some cases, signal timing plans and modes. In some cases, shared control of a limited number and type of field devices has been arranged between agencies. While full control of one another's assets (field devices, signal systems, etc.) is technically possible it may not be a desired arrangement institutionally. The most important element of an intertie project is a communication link between the intertie agencies. This can either be a dedicated agency owned asset (fiber or copper wire) or some type of telco lease line technology (T1, ISDN or DSL).

Another major element of an intertie project is the software, protocols, and interfaces that would allow for the exchange of information between different systems. Interties differ from data exchange networks (see Data Exchange Network fact sheet) in that interties focus on the "physical" communication link between agencies. Data exchange networks typically focus on the network connectivity and "logical" protocols of sharing data among several agencies. Both, interties and data exchange networks can form the basis and initial implementation of the "center to center" portion of a Regional Architecture.

Project Objectives:

- Improve coordination and data sharing among agencies

Sponsorship: City of Modesto, City of Ceres, Stanislaus County, and Caltrans District 10

Deployment Phasing: This project is a single-phase deployment.

	Phase Components
Phase 1	➢ System engineering design of the DEN development and deployment of DEN within the County

Deployment Locations: Urban area through Regional TMC's

Deployment Timeframes: This project is a long term deployment.

	Phase Timelines
Phase 1	Long Term

Benefits:

- Improve incident management and traffic management in the Modesto-Ceres Urban Area

Budget Estimate:

	Phase Budget Estimates	
	Capital Costs	**Operations and Maintenance Per Year**
Phase 1	$200K	$0K
Totals	$200K	$0K

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Table A.7: Summary of Modesto-Ceres FUA ITS Projects

ID	Program Area/Project	Involved Agency	Brief Description	Project Initiation* N	Project Initiation* M	Project Initiation* L	Capital Cost Estimates 2001 (Thousands of $)** Total Phase 1	Total Phase 2	Total Phase 3
1.0 Traffic/Freeway Management Systems (ATMS)									
1.1ST	**MODESTO/CERES ATMS COMPLETION**	Stanislaus County City of Modesto City of Ceres District 10	City of Modesto CCTV System Master Plan The City of Modesto CCTV system will assume a multi-purpose role in providing monitoring and surveillance capabilities to traffic management operators. The Master Plan is intended to conceptually depict the long-term traffic control & surveillance system to be implemented in the City. The major functions of the CCTV system are Incident Detection, Incident Verification & Response, Monitoring of traffic signal coordination along major corridors, Monitoring high volume intersection operation, queue build-up and high accident locations, Evaluate Traffic Management Strategies. The development of the CCTV system will make use of the existing City fiber optic communication network, which will provide opportunities for a cost-effective communications media for video signals and control signal transmission. The CCTV camera site locations will be identified based on established camera site selection criteria. The CCTV cameras are located at strategic locations throughout the City to provide surveillance and monitoring capabilities for the operators at the Traffic Management Center in the City. A total of 33 preliminary CCTV camera locations were identified throughout the City as part of the CCTV system Master Plan to provide surveillance and monitoring capabilities. After a more detailed field video survey, 10 critical locations were identified for design and the viewing ranges for the remaining locations were determined. City of Ceres CCTV Master Plan The City of Ceres CCTV system will also serve the role of providing monitoring and surveillance capabilities to the traffic management operators. The CCTV system in the City will perform the same major functions of incident detection, verification and response, monitoring of critical intersection operation and preliminary CCTV camera traffic signal coordination along major corridors. Six (6) locations were identified along major corridors in the City. Based on the video reviews, four critical locations were identified for design as part of this phase of the project. ATMS implementation. Each of the proposed cameras shall be capable of transmitting full motion video and control signals making use of proposed communication cable fibers and communication hubs. The video and control signals shall make use of different communication paths from each of the proposed cameras to the City TMC. Appropriate fiber optic and other communication equipment shall be installed in the proposed hubs and the TMC such that full-motion video and control signals can be transmitted and received. Ceres ATMS Communication Network Alternative The primary elements of the recommended communication alternative iclude a 24-strand single–mode fiber optic cable will be installed for the trunk line with redundancy ring considerations. The majority of the existing and planned intersections will be connected to communication hubs via twisted pair cables. Every six controllers will be connected by a pair of twisted wires of six-pair cable, employing a multi-drop network structure. The remaining four pairs will be used as voice communication media and spares. The communication hubs will be located for point of conversion of various communication media and for future expansion. Remote intersections, intersections that are generally more than ½ mile apart, would be designed to be connected to the center via spread spectrum radio. The system has the capability of transmitting video signals of the potential CCTV camera installations throughout the City through the fiber optic trunk line. Ceres Communication Hubs With the use of fiber optic in a hybrid network with twisted pair cable as well as wireless means (spread spectrum radio), interfaces will be needed to convert digital light wave energy to electrical energy. This is performed via "communication hubs." The hubs are housed in a suitable controller cabinet.	X	X	X	**$ 4,100**		
1.2ST	**MODESTO-CERES URBAN AREA TRAFFIC SIGNAL INTERCONNECT AND COORDINATION PROJECT**	City of Modesto City of Ceres Stanislaus County	This project would implement local traffic signal coordination plans at specific urbanized locations along regionally significant arterials in the County not currently developed. The objective of this project would primarily be to reduce delays at traffic signals by improving coordination between adjacent signals, with improved safety a possible secondary benefit depending on the specific improvements made. The specific improvements to be made would vary by location, which could include intra- and inter-jurisdictional efforts. The types of improvements that are possible include upgrading traffic signal controllers and detection, adding or upgrading signal interconnects, and communications systems enabling centralized (i.e., remote) timing plan updating and maintenance and malfunction monitoring. Although providing emergency vehicle preemption, transit vehicle priority or automated enforcement would not be the focus or justification for these improvements, the equipment installed as part of this project may support these features. This project would be led by local agency traffic operations staff. The provision of traffic signal coordination for small communities is most often initiated with use of either time-based coordination (TBC) or a closed-loop system (CLS). Depending on the type of controller equipment now in place, and depending on the level of staffing support that the City (or County) is able to make in the maintenance of signal coordination plans, the initial cost and recurring effort to achieve signal coordination in Hanford would vary from a very low cost, to a moderate cost. A number of communication alternatives are possible to tie the intersection controllers to a supervisory computer at City Hall (in the CLS alternative). With a CLS, the capability is created to remotely monitor intersection operation and the capability to remotely change both basic and coordination timing. A first step in the signal coordination capability would be the design and implementation of TBC timing plans. A feasibility study on possible and appropriate upgrade plans for creation and installation of a traffic signal system could be completed at the same time. Any small community that has more than 10 traffic signals would probably benefit from having signal coordination implemented along its heaviest-traveled street(s) so that vehicles can progress through a series of signalized intersections without stopping. The initial effort to achieve this basic level of coordination is relatively low, especially if it is contracted out. The resulting basic timing plans (perhaps just 2 or 3 plans which run between 7AM and 6 PM) can be left in place with very little subsequent retiming effort required or needed. Traffic signal coordination typically has one of the very highest benefit-to-cost ratios of any public works activity.	X	X		**$3,000**		
1.3ST	**INTEGRATED SMART CORRIDORS**	City of Modesto City of Ceres Stanislaus County Caltrans District 10	This project would implement a package of ITS applications in a highway corridor consisting of at least one main route and one parallel route. The focus of the project would be to improve the level of coordination of traffic management activities on the main route and parallel route(s); in effect to conduct corridor-level rather than facility-specific ITS traffic management. The range of ITS applications that could be included in a smart corridor application include essentially the full range of freeway management, arterial street management (e.g., traffic signalization) and traveler information strategies, including surveillance and detection; incident management, including coordinated and dynamic traffic detouring strategies utilizing both the main and parallel route(s); changeable message signs; dynamic trailblazer signs; highway advisory radio; and integrated traffic signal operations, including coordination between ramp meters and adjacent traffic signals. The smart corridor project would feature implementation of a combination of ITS applications, with the emphasis being on linking operations across multiple facilities serving a defined travel corridor. Given the multi-facility nature of this project, the multi-jurisdictional coordination aspects of the project will be critical, including developing consensus on the specific objectives of the project and on the individual coordination procedures and technques. The first step in the development of this project would be to identify a candidate project corridor, based on accidents and congestion, travel patterns, availability of alternate routes and interest among the potential project partcipants.			X	**$3,500**		

ID	Program Area/Project	Involved Agency	Brief Description	Project Initiation* N	Project Initiation* M	Project Initiation* L	Capital Cost Estimates 2001 (Thousands of $)** Total Phase 1	Total Phase 2	Total Phase 3
1.4ST	**ADVANCED RAILROAD HIGHWAY INTERFACE TECHNOLOGY DEPLOYMENT** **SR 132 IR/RIS**	Stanislaus County City of Modesto City of Ceres Caltrans District 10 StanCOG	This project would deploy railroad-highway grade crossing technology at needed grade crossings with safety (high accident) and/or high volume and delay concerns. The objective of the project would use field validated strategies for improving safety, reducing delay and/or providing travelers with improved real-time information on grade crossing statu developed by the Kings County Advanced HRI Technology Deployment Demonstration project. The project could feature any combination of detection (both for trains and approaching vehicles), warning/traveler information, and control devices. Many different strategies are possible. Possible strategies include sensors coupled with message signs, in-vehicle devices and/or highway advisory radio that would provide approaching travelers with information on the expected duration of a crossing blockage. Another possible application would tie sensors to emergency vehicle dispatching systems to provide dispatchers and drivers with real time crossing status information. This project would use the blueprint for applying technology to enhance grade crossing safety developed by the demonstration project. One major cause of crashes at railroad grade crossings is the persistent presence of the heavy Tule fog in the Valley, and the inability for drivers to see grade crossings which are occupied with a train, usually in motion, until they are too close to stop. If some kind of train presence detection could be devised, and tied to an advance-warning beacon, approaching drivers would be forewarned about the dangerous situation. Such an active presence could be detected by an advanced detector, and need not involve the cooperation / joint solution with the railroad. Because of liability, railroads are not eager to create new and unproven detection or safety mechanisms; they have a well-defined program for active warning devices at the crossing which are very involved "systems" tied in with the railroad's own advance detection systems. The possibility of deploying an advanced technology solution, especially at locations where no active warning devices now exist, would be the basis for this project. Highway traffic at highway-rail intersections (HRIs) could be managed, where operational requirements demand advanced features (e.g., where rail operational speeds are greater than 80 miles per hour). This would include all capabilities from the Standard Railroad Grade Crossing and augments these with additional safety features to mitigate the risks associated with higher rail speeds. The active warning systems would include positive barrier systems, which preclude entrance into the intersection when the barriers are activated. Like the Standard Package, the HRI equipment is activated on notification by wayside interface equipment, which detects, or communicates with, the approaching train. The wayside interface equipment would provide additional information about the arriving train so that the train's direction of travel, estimated time of arrival, and the estimated duration of closure may be derived. This enhanced information may be conveyed to the driver prior to, or in context with, warning system activation. This would also include additional detection capabilities, enabling it to detect an entrapped or otherwise immobilized vehicle within the HRI and provide an immediate notification to highway and railroad officials.		X		**$750**		
1.5ST	**RED LIGHT RUNNING/ PHOTO ENFORCEMENT**	City of Modesto City of Ceres	This project would provide law enforcement officials with the ability to enforce violations electronically through automated photo enforcement. Photo enforcement involves the utilization of a fixed or CCTV positioned camera and a vehicle detection sensor to take a photograph or digital image of a vehicle that initiates an illegal activity. Typical uses of this application include railroad-crossing enforcement, red light violation enforcement, speed limit enforcement, and weigh station enforcement. Typically, the organizations that supply the technology generally take on the responsibility for retrieving the image from the system, processing the film (if necessary), and issuing warnings or citations, depending on the issuing agency. Select intersections in the cities of Ceres and Modesto should be identified and considered for automated photo enforcement for red light violations within the FUA. Hatch and Mitchell Sort term. Other loactions 5-10 years	X	X	X	**$ 20**	**$150**	
1.6ST	**TOS AND COMMUNICATIONS GAP CLOSURE PROJECT**	Stanislaus County City of Modesto City of Ceres District 10	This project would close the existing communications infrastructure gaps along SR 99 to the Caltrans, District 10 Transportation Management Center (CVTMC). In addition, ramp meters would be deployed in existing gap areas along the above facilities. The project also includes communications to the ramp meter locations, and may include the update and deployment of ramp metering software at the TMC.		X	X	**$5,000**		
1.1.7ST	**INTEGRATED SURVEILLANCE STATIONS/SMART CALL BOX DEPLOYMENT (REGIONAL)**	Stanislaus County City of Modesto City of Ceres District 10	The basic premise behind integrated surveillance stations/callbox deployments, also known as "Smart Call Boxes" is the clustering of multiple capabilities at a single field location. Call Box locations can be equipped with traffic and weather surveillance devices, and utilize the communication capability of the call box to transmit the surveillance data back to a traffic management center or centralized database archive. The typical technology options that are attached to the call boxes include: traffic detection devices for operations (speed, volume) or planning (census, classification) purposes and road weather information systems (RWIS). A Smart Call Box Traffic Monitoring Program can use the existing or planned call box system with integrated counter devices, existing Caltrans or other agency inductive loops, and various classification equipment. These call boxes could provide accurate, reliable, and timely traffic census and classification data throughout the Region. The count/classification data collected through Smart Call Boxes is needed to calibrate and validate regional and local transportation models. The count/classification data will also enable agencies in the FUA, especially Caltrans; to monitor heavily traveled corridors to determine the appropriate application of improvements and funding priority. In addition, the Smart Call Box can remotely sense an incident considering average speed data compared to actual speeds of vehicles along a State Route or local highway. The "Smart" Call Box is very similar to permanent traffic counter equipment except that downloading the data occurs through a modem call via the cellular network to the "Smart" Call Box. Caltrans and other agencies currently retrieve or download the data manually in the field at traffic control stations or sites to a laptop computer. Remote collection of traffic data allows the agency to reduce staff collection costs and collect year-round data.		X	X	**$3,000**		
1.8ST	**COMMUNICATIONS INTERTIE PROJECT BETWEEN MODESTO AND CERES, COUNTY, AND CALTRANS**	Stanislaus County City of Modesto City of Ceres District 10	This project would establish/complete the backbone wireline communications between the largest transportation players in the County. A fiber optic backbone is already in place within the cities of Modesto and Ceres. Communications would likely utilize fiber optic cable, however other opportunities should be reviewed for the various needs. This project should consider the establishment of regional standards for fiber communications deployment, including consideration of modes, capacity needs, communications protocols, and perhaps equipment types.	X	X		**$1,500**		

ID	Program Area/Project	Involved Agency	Brief Description	Project Initiation* N	Project Initiation* M	Project Initiation* L	Capital Cost Estimates 2001 (Thousands of $)** Total Phase 1	Total Phase 2	Total Phase 3
2.0 Incident Management/Emergency Services									
2.1ST	**TRAFFIC SAFETY TASK FORCE**	StanCOG, CHP, Caltrans, with heavy involvement from all other emergency service agencies.	This project would develop, for a specific focused area within the County, an interjurisdictional and cross-agency teaming arrangement that would be mobilized to respond to any major traffic related incident in the team's coverage area. Once a specific geographic area has been selected for this project (due in large part to the presence of a project champion), an ad-hoc working group would be established to bring this Traffic Safety Team into existence. In order to be self-sustaining, such a Team would need to be activated, on average, at least 4 times per year. Therefore, the coverage area should be large enough so that this would be achieved. The Team would need to have authority to activate itself. That is, within each organization where a Team member is employed, that Team member should have the capability to cease his/her routine and respond to a Team-declared incident when needed. The Team should be equipped with adequate and sufficient person-to-person communication devices (most likely cellular telephones with 3-way and/or conference calling capability) to contact other Team members as needed. Finally, a rigorous and extensive agency and staff networking outreach capability should be developed for use in this Team. The Team itself may or may not have independently owned and controlled traffic control devices for use in deployments responding to incidents. Each agency's own devices should be accessible if the Traffic Safety Team is created effectively. This Team creation would be a initiated as pilot project for duplication throughout all other areas of the Valley. The use of a contracted facilitator should be employed on this pilot project, with plenty of documentation, lessons learned, and formats to be followed for institutional acceptance of the IMT Team concept. Other areas within the Valley would then be able to model their own Team on the findings and documentation provided in this project.	X	X		**$150**		
2.2ST	**EVP DEPLOYMENTS**	City of Modesto	The project would implement Emergency Vehicle Preemption (EVP) along key arterials throughout the County for use by City and County fire departments. The implementation EVP at a traffic signal modifies normal signal operation to provide a nearly immediate green signal for an approaching emergency vehicle. This type of system is most often deployed on fire trucks because of the nature of the fire truck vehicle performance. The acceleration rate of fire trucks is rather slow due to their relatively low power-to-weight ratio. If fire trucks must slow down (and sometimes stop) when they encounter signalized intersections along their emergency run, the overall delay in responding to their emergency destination can easily exceed 1 to 2 minutes. For fire events, this delay can mean a significant difference in the level of destruction, the level of effort in suppressing the fire, the level of personal danger for firefighters at the scene, and the number and extent of injuries for victims. Depending on the level of congestion and the distance traveled, fire trucks can encounter many traffic signals, and heavy congestion. Driving in oncoming traffic lanes is a "last resort" maneuver, which fire departments rightly avoid. If the fire truck encounters a red signal, it can assert the right of way and go through, but only after gaining assurance that it can safely cross through the intersection. EVP isn't needed in every community. Only when traffic congestion is very significant, or only when long emergency vehicle runs are likely to encounter a large number of signalized intersections, would the provision of EVP be cost effective. Some cities in the Central Valley, including the City of Ceres, already have EVP in place, the 3M Opticom™ system being predominant. Priority request equipment would be installed in each fire truck and matching reception equipment would be installed at each signalized intersection where EVP is to be granted. Some larger agencies that have used EVP for many years have broadened the application to also equip ambulance vehicles and, in some cases, police vehicles with this on-board preemption request equipment. While these vehicles have much better acceleration characteristics, and the added delay at signals while on their emergency runs is much lower, granting EVP to these vehicles may provide another benefit. The crossing of very wide and very busy signalized intersections is very difficult in today's traffic. Each year, many such emergency vehicles are "totaled" after being T-boned when crossing a busy intersection. EVP helps reduce and prevent this occurrence. However, this project assumes only fire department vehicles would be equipped with EVP devices.	X	X		**$2,500**		
2.3ST	**ALTERNATE ROUTE SIGNING**	Stanislaus County City of Modesto City of Merced	This project would include the installation of 70 static alternate route signs within the County for designated detour routes. This project would implement changeable message signs specifically sited, and primarily devoted, to detouring traffic onto alternate routes during incidents, including accidents and weather related road closures. These signs could differ from the large, permanent changeable message signs deployed by Caltrans at key decision points in several respects. First, they would be sited in conjunction with a specific alternate route/detour strategy developed for a particular route and alternate routes. Second, the signs could be smaller than the Caltrans signs. Third, the signs could include features, such as arrows or flashing beacons, that are not included on the traditional CMS. Finally, the alternate routes signs could be deployed as trailblazers along the alternate route, rather than merely in advance of the main route/alternate route decision point. The objective of this project would be to improve compliance with detours and reduce driver uncertainty along detour routes. If successful in reducing the volume of vehicles entering hazardous or congested roadway segments, this project holds the potential to reduce congestion, delay and accidents. In order to be successful, it would be critical that this project include development of an alternate route plan and procedures to support the usage of the signs, and that this plan be effectively linked to an overall multi-agency coordinated incident management strategy. This project would also require a commitment on behalf of the operating agency to devote the time and attention necessary to utilize the signs effectively. Even more so than a single CMS, keeping the dynamic message signs current and accurate would be critical		X	X	**$ 3,000**		
2.4ST	**REMOTE SURVEILLANCE AND INCIDENT SCENE MANAGEMENT PROJECT**	Stanislaus County City of Modesto City of Merced	This new experimental program involves a video system capable of sending images via cellular or microwave technology to a TMC. The images are then put on the internet and key experts who could provide technical advise to the responders at the scene can access the pictures with a password. This process would allow the expert to talk to the scene by telephone, look at the problems on the internet, and help devise solutions for safe and timely resolution. This technology has been purchased for the Washington State DOT and is being installed on their incident response trucks. There is also a handheld unit for getting close up images of truck equipment and other details. Trauma center doctors, hazardous materials specialists, recovery companies, and investigative specialists are some of the resource personnel that will be able to look at problems and give advice. This type of system has significant application for rural interstates. Problems that require special knowledge can now close roads for several hours while the experts respond to the scene. The two-way communication link with video going to the experts can potentially save hours of delay for motorists.			X	**$400**		
2.5ST	**INTEGRATION OF COMMUNICATIONS CHANNELS PROJECT**	StanCOG	There are currently common channels for state agencies to talk to each other. There are channels for county agencies and also for city agencies to talk to others within their own government, but they cannot always communicate with outside government agencies. Technology exists to allow cross communication for major incidents and consideration should be given to establishing a link to be used in case of large multi-agency incidents.		X	X	**$200**		
3.0 Transit Systems									
3.1ST	**MODESTO TRANSIT AVL / SILENT ALARM**	Modesto Area Express	This project would equip transit vehicles in the Modesto area (43 busses) with ITS equipment to both track vehicles and give the bus operator the capability to send a silent alarm for an emergency condition. Automatic Vehicle Location (AVL) equipment generally utilizes satellite technology for pinpointing the exact (to within 20 meters) location of the tracked vehicle. Such tracking is ongoing all the time, and is not limited to the Visalia area. If a bus were removed from the area, it could still be located using the AVL equipment. Providing the bus operator with a silent alarm capability will increase the security level of both bus operators and transit patrons. Bus tracking would be viewed by transit dispatchers in the dispatch office. In many cases, the tracking information can be integrated into the same workstation that the dispatchers use in supervising and managing the transit vehicles.	X			**$ 650**		

ID	Program Area/Project	Involved Agency	Brief Description	Project Initiation* N	Project Initiation* M	Project Initiation* L	Capital Cost Estimates 2001 (Thousands of $)** Total Phase 1	Total Phase 2	Total Phase 3
3.2ST	**TRANSIT MANAGEMENT SYSTEM (TRMS) COMPLETION PROJECT**	Modesto Area Express	Transit agencies emphasized the point that they do not want to "recreate the wheel," and that MAX's transit management system deployment efforts should act as a building block for the rest of the region. This project would look at the most effective options for continuing MAX's TrMS deployment efforts by deploying AVL on uninstrumented rural and urban transit vehicles. Additional TrMS functions should be deployed with a view towards eventual region wide deployment. Options for deploying compatible components across all vehicles should be sought. MAX's system is J1708 compliant. The example provided was that fare equipment in a large bus may not be appropriate to a small rural service vehicle. Different devices may be used, but they should operate across a common software/system with completely compatible standards.			X	**$2,000**		
3.3ST	**DEMAND-RESPONSIVE TRANSIT SYSTEM INTEGRATION STUDY**	StanCOG	This project would fund a study of demand-responsive transit system integration strategies, culminating in a specific set of recommendations to implement strategies within specified transit agencies. The primary objective of integrating multiple demand-responsive transit services is to improve operating efficiency by reducing service redundancies and sharing vehicles, staff and scheduling/dispatch technology among agencies. These improvements result in an overall better quality of service to riders, and riders may benefit directly through enhanced schedule and/or destination options enabled through the integration of services across agencies. Typically, especially in county-based or rural oriented demand respsonsive transit environments, a number of different agencies operate within a given geographic area, providing service to many of the same destinations but often serving a slightly different client base. One of the primary objectives of demand-responsive transit service integration strategies is to reduce these redundancies and associated inefficiencies. Demand-responsive service integration includes a wide range of potential specific activities, ranging from simple coordination to full integration. Examples of specific strategies include consolidation of scheduling and/or dispatch functions (where multiple agencies can share the cost of improvements and share access), agreements to share access to vehicles under specified circumstances, and consolidation of ride reservation systems.		X	X	**$1,200**		
3.4ST	**COMMON ELECTRONIC FARE PAYMENT SYSTEM**	Modesto Area Express (MAX)	This project would create a transit fare payment system that would allow a single prepaid card to be used on all of the transit systems in the San Joaquin County area. Since a large number of County residents commute to the San Francisco Bay Area, it would be ideal to "piggyback" onto the systemwide electronic fare system now being developed for the Bay area (namely, TransLink). TransLink, a regional transit fare payment system using 'smart card' technology, is scheduled to launch as a demonstration project in the San Francisco Bay Area in mid-2001. The nine-county Bay Area will be first in the U.S. to have a single card that can be used on all forms of public transit in the region: buses, trains and ferries. The project began with the award of a contract to Motorola, Inc. in mid-1999. Motorola, Inc. is developing the system under contract to MTC. It is being developed in two phases to ensure that the system meets the needs of the Bay Area riding public and transit Operators. The six-month demonstration project will include approximately 5,000 transit riders using TransLink on six Bay Area transit systems [AC Transit, BART, Caltrain, Golden Gate Transit, SF Muni, and Santa Clara Valley Transportation Authority (VTA)]. The results of this demonstration will be thoroughly evaluated before the system is implemented region wide (in 2002).	X	X		**$4,000**		
3.5ST	**STANISLAUS COUNTY NEXT BUS ARRIVAL SIGNS**	Modesto Area Express (MAX)	This project would deploy dynamic message signs at selected higher-usage bus stops equipped with bus shelters. Currently, only one firm (NextBus) is providing this kind of service. Their equipment is placed on board transit vehicles, and GPS-derived current location and speed information is transmitted to NextBus computers at a remote location where the information is processed, and bus arrival prediction is then published to an Internet IP address. The IP address corresponds to a particular dynamic message sign. NextBus has a patent for this "arrival prediction using GPS coordinate data scheme, and their equipment combination uses a CDPD data modem to transmit the information from the bus to the NextBus servers. The cost for the CDPD "air time" may make this more expensive than in AT&T's coverage area. Also, once an initial installation is completed (using capital funding from some source), then the agency would need to continue the payments for CDPD air time (currently ~$60 per month per bus, and $30 per month per dynamic message sign. Once the service is in place, transit patrons would be able to determine real-time bus locations and expected arrival times at their bus stop. The dynamic message sign at the bus stop would be one source of this information, but NextBus also publishes the information in map form to an internet website, and in WAP form to hand-held PDAs. The information would therefore also be accessible to transit dispatchers as well as agencies that oversee and/or fund transit operations. NextBus can provide a broad cross-section of transit operations data that would be useful to these two management groups as well.		X	X	**$800**		
3.6ST	**COMBINED TRANSIT OPERATIONS/DISPATCH CENTER PROJECT**	Modesto Area Express (MAX)	This project would bring together the various transit dispatching operations into a single and improved transit dispatch center. The application of scarce transit funds to a single center, versus the current system of independent centers, would allow for economies of scale and more effective dispatch through a coordinated single center.			X	**$6,000**		
4.0 Traveler Information Systems									
4.1ST	**MODESTO/CERES TRAVELER INFORMATION SYSTEM**	City of Modesto City of Ceres Sanislaus County	This project would implement a comprehensive Integrated Traveler Information System (ITIS) that includes the following systems: • Closed Circuit Television (CCTV) • System Detection • Changeable Message Signs (CMS) • Highway Advisory Radio (HAR) • Public Information Database (PIDB) • Traveler Advisory Telephones (TAT) • Community Access Television (CATV) information system • HAR/HAT Voice-Response System • Kiosks • Communication Network The goal of the system is to disseminate timely and reliable traffic congestion information along the major arterial streets within the FUA. System detector data would be collected, analyzed and disseminated via the ITIS. In addition, this information can be shared with the regional ATMS including Caltrans and other angencies in the region. This information can be provided to the public through an Internet website, a telephone advisory system, and interactive touch-screen kiosks located at strategic locations.			X	**$ 200**		

ID	Program Area/Project	Involved Agency	Brief Description	Project Initiation* N	M	L	Capital Cost Estimates 2001 (Thousands of $)** Total Phase 1	Phase 2	Phase 3
5.0 Regional ITS Configuration Management/Coordination/Planning									
5.1ST	**DATA EXCHANGE NETWORK (DEN)/** **COMMUNICATIONS INTERTIES**	Valleywide through Regional TMC's City of Modesto City of Ceres Stanislaus County Caltrans District 10	The project would develop logical data exchange network partnerships, initially focus on the urbanized areas of the County. Presumably the County and Caltrans would also be involved in the partnerships. In addition, the logical interties between Caltrans District 6, the County and major cities of the County. In general, local agencies that partner and interconnect more than one agency with Caltrans have been more successful in obtaining state and federal funding than those proposals that intertie only one agency to Caltrans. Data exchange networks are typically set up in areas where several jurisdictions are interested in collectively sharing information from their respective traffic management systems. The most common information shared is from traffic signal systems. While information exchange on the network can be used to more efficiently monitor multiple signal systems, the network usually doesn't allow for field device control or system interoperability. However, those capabilities can be included depending on user needs. Data exchange networks depend on some type of communication infrastructure (dedicated agency owned or leased line) and software to exchange information. Communication intertie projects can establish some of the necessary communication links for a data exchange network. Data exchange networks differ from interties in that data exchange networks typically focus on the network connectivity and "logical" protocols of sharing data among several agencies. Interties typically focus on the "physical" communication link between agencies. Both, interties and data exchange networks can form the basis and initial implementation of the "center to center" portion of a Regional Architecture. Communications intertie projects typically take place between a Caltrans Transportation Management Center (TMC) and a local agency TMC/Traffic Operations Center (TOC). To be most effective, the Caltrans TMC and the local agency would be required to have centralized command and control of traffic management systems and field devices within their respective jurisdictions. In other areas of California, intertie projects allow Caltrans and the local agency to more efficiently share transportation management information, including but not limited to: traffic flow and congestion information, weather information, incident information, video images and in some cases, signal timing plans and modes. In some cases, shared control of a limited number and type of field devices has been arranged between agencies. While full control of one another's assets (field devices, signal systems, etc.) is technically possible it may not be a desired arrangement institutionally. The most important element of an intertie project is a communication link between the intertie agencies. This can either be a dedicated agency owned asset (fiber or copper wire) or some type of telco lease line technology (T1, ISDN or DSL). Another major element of an intertie project is the software, protocols, and interfaces that would allow for the exchange of information between different systems. Interties differ from data exchange networks (see Data Exchange Network fact sheet) in that interties focus on the "physical" communication link between agencies. Data exchange networks typically focus on the network conectivity and "logical" protocols of sharing data among several agencies. Both, interties and data exchange networks can form the basis and initial implementation of the "center to center" portion of a Regional Architecture.			X	**$200**		
			Total Estimated Capital Deployment Costs for All Potential ITS Projects Over 20 Years						**$42,520**

Notes: * Project initiation timeframes - N = Years 1-5, M = Years 6-10, L = Years 11+

**All capital costs are approximate and rounded for purposes of this table.

Table A.8: Timeline of Modesto-Ceres FUA ITS Projects

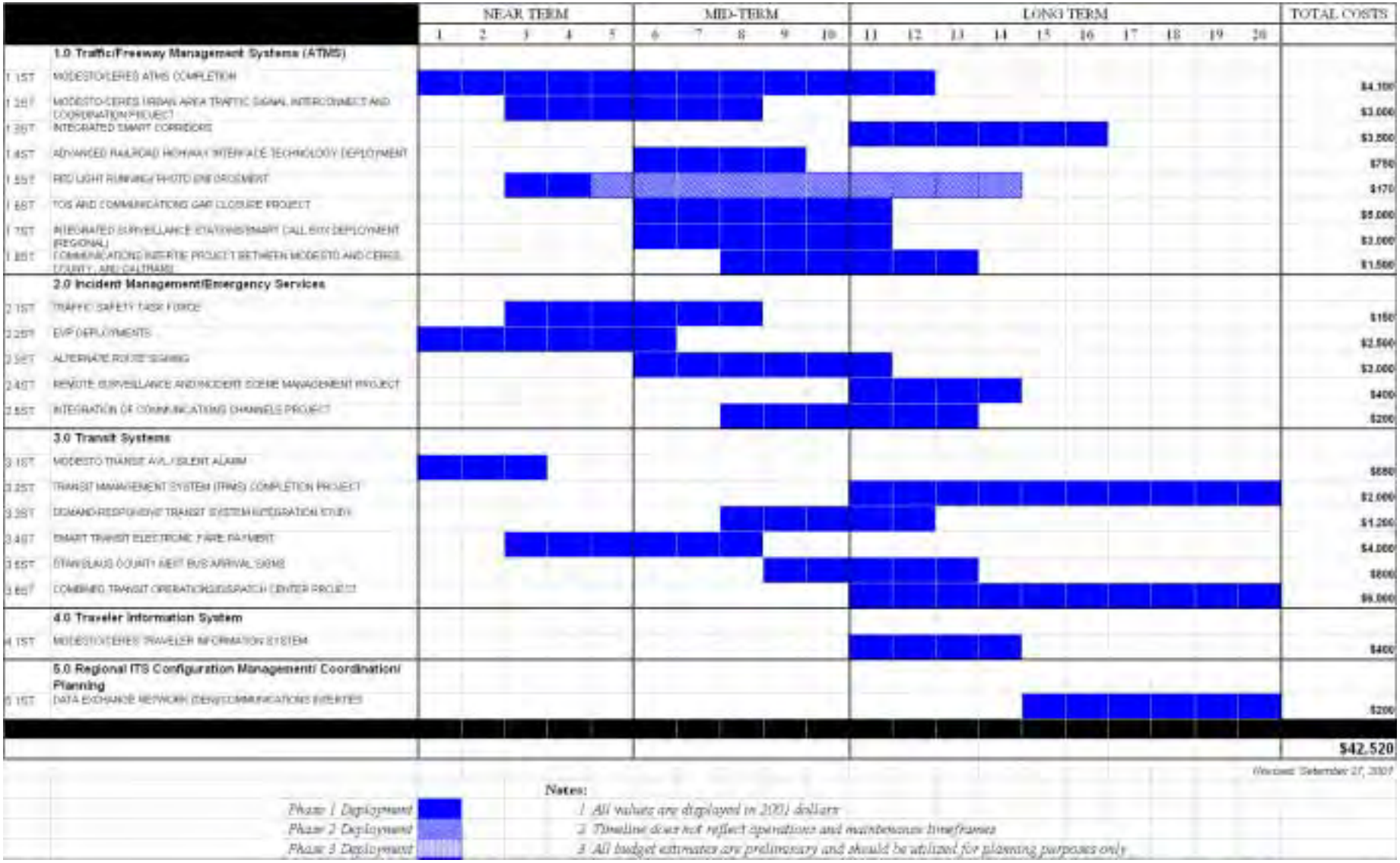


Figure A.7: Sequence of Proposed ITS Implementation Activities for Modesto-Ceres FUA

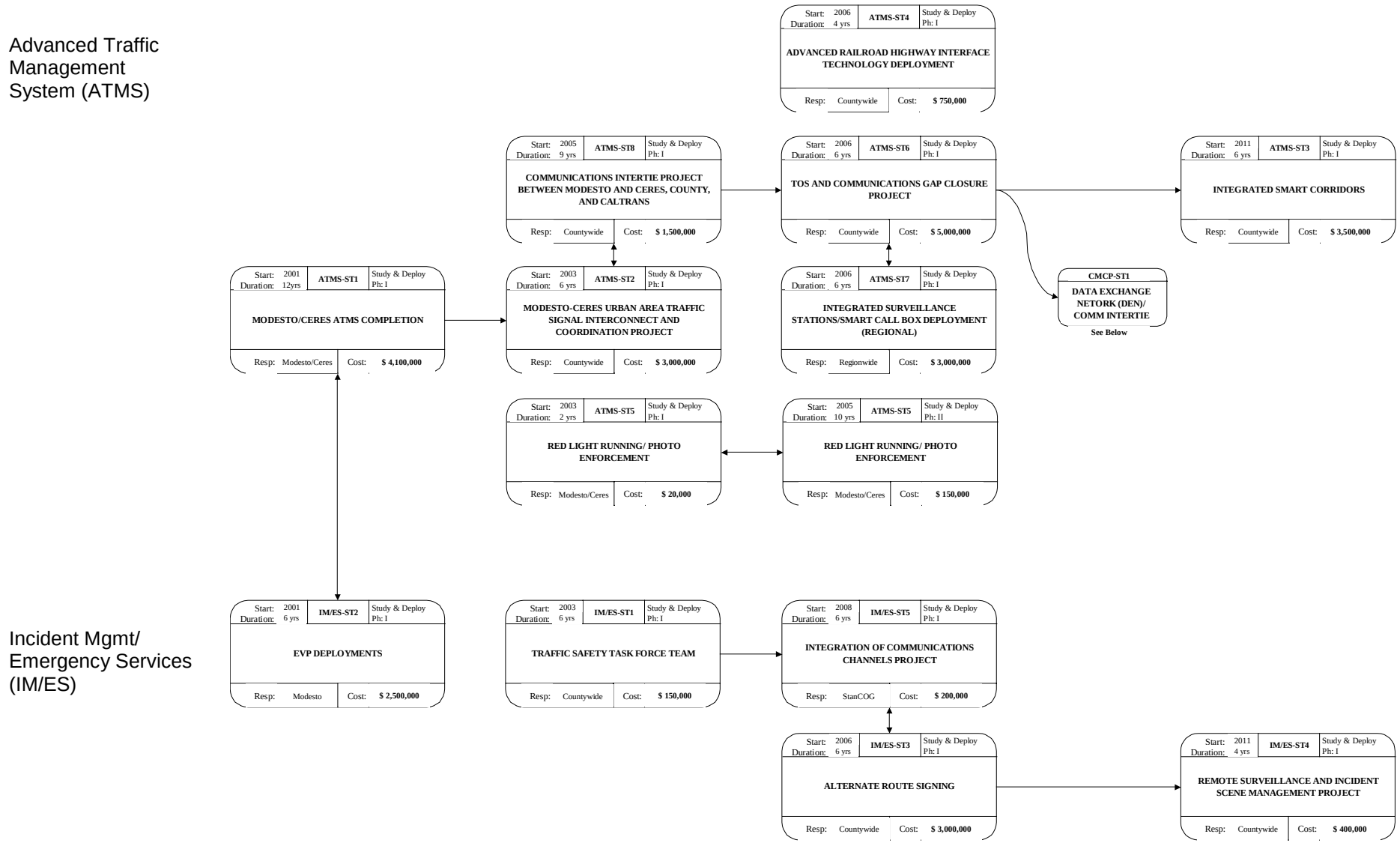


Figure A.7: Sequence of Proposed ITS Implementation Activities for the Modesto-Ceres FUA (cont)

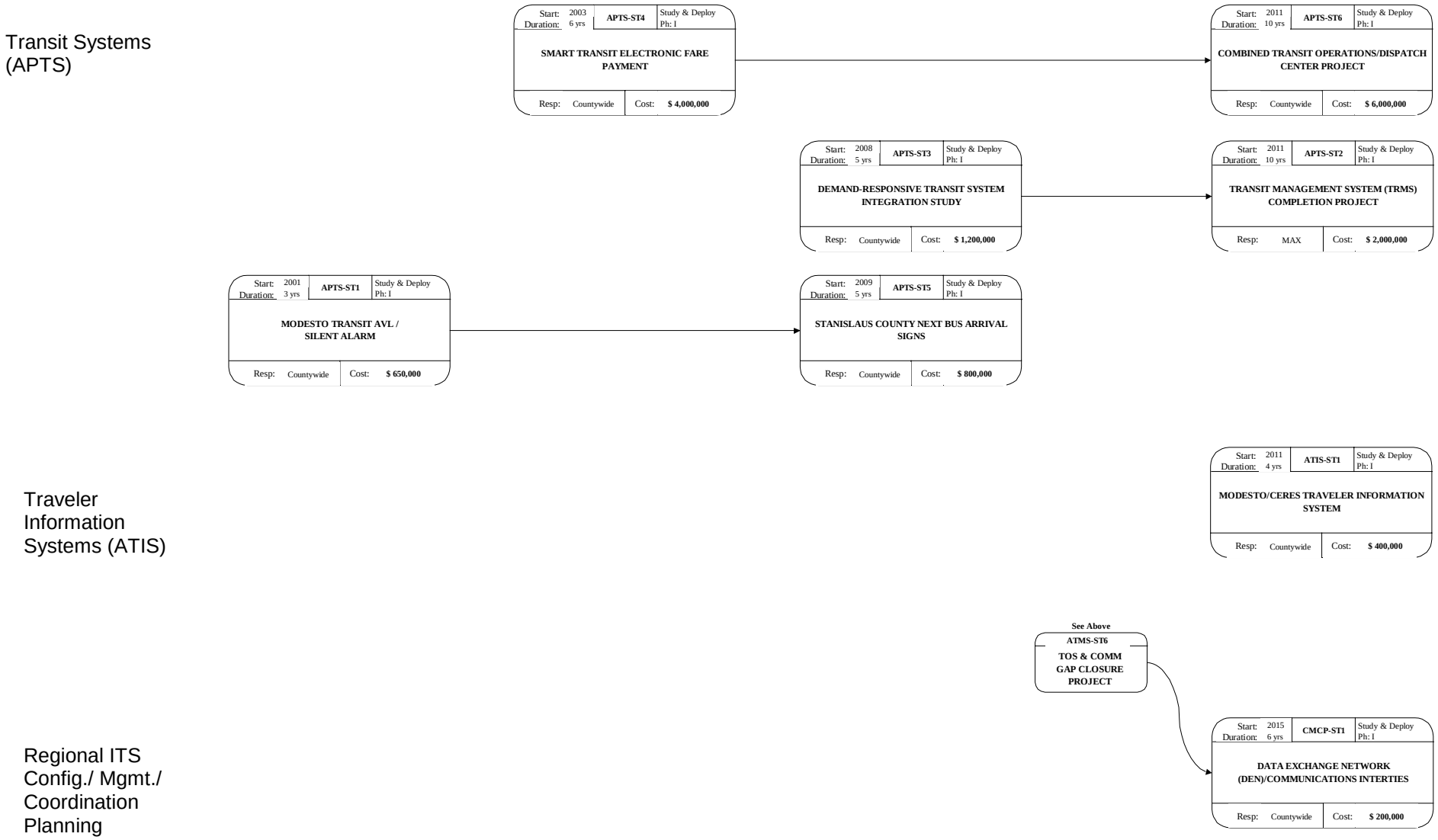
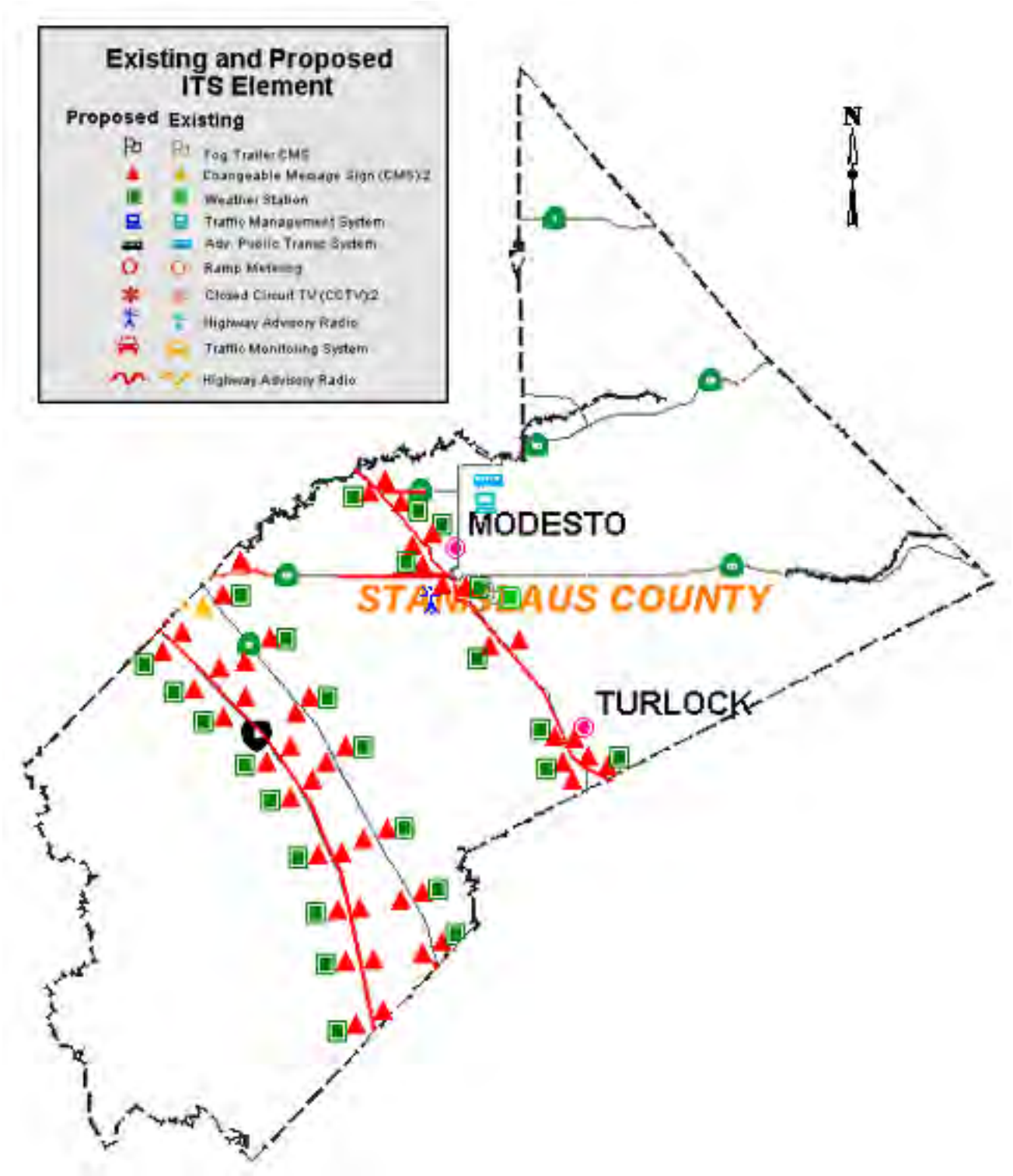


Figure A.8: Existing and Proposed ITS Elements for Stanislaus County



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1.5 San Joaquin County

The total estimated capital deployment costs for all potential ITS projects within the next 20 years is over $33,560,000.

1.5.1 TRAFFIC/FREEWAY MANAGEMENT SYSTEMS (ATMS)

1.5.1.1 City of Stockton ATMS Expansion and Central Control System, Phase II

General Description:

The first phase, or base system, of the Stockton ATMS Master Plan was completed in 1997. The second phase will build upon its current multi-purpose role of providing monitoring and surveillance capabilities to traffic management operators and is intended to conceptually depict the long-term traffic control & surveillance system to be implemented in the City. The major functions of the system are:

- ·Incident Detection·
- Incident Verification & Response·
- Monitoring of traffic signal coordination along major corridors·
- Monitoring high volume intersection operation, queue build-up and high accident locations·
- Evaluate Traffic Management Strategies

The second phase expansion will primarily consist of the elements:

- Expand Central Network·
- Additional CCTV Cameras·
- Interconnect New Traffic Signals
- New Traffic Signal Controllers·
- Integration with Caltrans

The expansion of the system will make use of the existing City fiber optic communication network, which will provide opportunities for a cost-effective communications media for video signals and control signal transmission. The central network will be expanded through a combination of multiplexing the existing fiber network and extending the system to other portions of the City that were not included in the first phase of development.

The CCTV camera site locations will be identified based on established camera site selection criteria. The CCTV cameras are located at strategic locations throughout the City to provide surveillance and monitoring capabilities for the operators at the Traffic Management Center in the City. A total of 10 additional CCTV camera locations were identified throughout the City to provide surveillance and monitoring capabilities.

Project Objectives:

- Design and deploy appropriate communications infrastructure along key arterial in the urbanized area

- Design and deploy a regionally integrated signal system to improve interagency coordination and cooperation.
- Establish regional signal system standards.

Sponsorship: City of Stockton, San Joaquin County, Caltrans District 10, and SMART

Deployment Phasing: This project is a single-phase deployment.

	Phase Components
Phase 1	➢ Local fiber communications. ➢ Deployment of centralized signal software ➢ Deployment of signal workstations to smaller cities. ➢ Upgrade of outdated controllers. ➢ Network equipment & services for communications between signal systems & with remote cities.

Deployment Locations: Countywide

Deployment Timeframes: This project is a near term deployment.

	Phase Timelines
Phase 1	Near Term

Benefits:

General Benefits:

- Communications infrastructure along key arterials will allow for improved signal coordination along those corridors.
- Traffic signals coordination can improve the flow of traffic, even during unexpected traffic conditions.
  - In Los Angeles, traffic signals can adjust for current traffic conditions, even when incidents divert traffic from the freeways. As a result, 41% fewer vehicles are stopped at red lights.
- By using improved communications and control techniques, traffic management can reduce delay in both uncongested and congested situations.
  - The Automated Traffic Surveillance and Control (ATSAC) program in Los Angeles reported an 18% reduction in travel time, a 16% increase in speed, and a 44% decrease in delay.
  - Toronto, Canada evaluated a computerized signal control system on two corridors and the central business district network, totaling about 75 signals. The two-month evaluation period compared the computerized system to a "best effort" fixed timing plan, and showed that the computerized control system resulted in an 8% decrease in travel time, as well as a 17% decrease in delay.
  - The City of Abilene, Texas installed a closed-loop computerized signal system, and reported that the travel times decreased by 14%, the delays decreased by 37%, and the travel speeds increased by 22%.

- Regional system standards will ease the process of coordination among systems in the different agencies, such as cities, counties, and Caltrans by providing a common base for all of the agencies to work from.

Emission Reductions:

- Emissions reductions from signal coordination and centralized signal control have been well established through testing and evaluation. A notable example of background information on the emissions and fuel reduction of signal coordination is California's FETSIM program.
- Emissions reductions from signal coordination and control result from increased travel speeds, fewer stops, and decreased acceleration cycles.
- In order for signal interconnection projects to provide emissions reductions, it is essential that an effective operational plan be put in place to implement improved signal timing.

Budget Estimate:

	Phase Budget Estimates	
	Capital Costs	**Operations and Maintenance Per Year**
Phase 1	$9,700K+	$10K
Totals	$9,700K+	$10K

The capital costs of installing fiber optic communication to within the Stockton urban area was approximately $9,700,000. The additional capital costs for components such as CCTV cameras, and communication hardware and software upgrades related to this project are still to be determined.

Evaluation Criteria:

- *MOE*
  - Intersection delay
  - Arterial travel times
  - Average time to diagnose and resolve a signal problem at a remote location
  - Emissions reduction
  - Data traffic between cities and other signal control agencies
  - Number of interjurisdictional coordinated signals
- *MOP*
  - Time to access information on another agency's signal
- *MOS*
  - Mean-time between failures
  - O&M costs

O&M Considerations: The Traffic Systems Workgroup should develop a set of informal guidelines to assist agencies in interjurisdictional signal coordination. In addition, the Workgroup should draft some example bi-lateral letters of agreement between agencies to share signal information, timing plans, and (in some cases) control.

Architecture Considerations:

Throughout the nation there are significant efforts underway to enhance signal interconnectivity and operations between jurisdictions. Three efforts are of primary importance to the project outlined in this Plan.

- Development of CT-Net – CT-Net is the Caltrans developed version of a centralized signal control system. The main software is free to Caltrans Districts, and it is generally being adopted by Districts throughout most of the State, including District 6. There is some discussion that the CT-Net software will be available for free to local jurisdictions that request it, however the controller firmware (C8 v4) is not. It is not clear at this time whether or not CT-Net will be fully compatible with the Bi-Trans QuicNet 4 software currently being deployed by the area. Interested jurisdictions should contact their District office for further information.
- Development of QuicNet 4+ - QuicNet 4.0 is the central signal control software currently available from Bi-Trans. A more advanced version of QuicNet is about to enter development in the San Diego Region. This development may offer opportunities for the region and should be carefully followed.
- NTCIP – Class E - Many signal software packages are beginning to support the new NTCIP– Class E standard for center to center communications. The continued adoption of this standard by vendors may simplify signal integration efforts in the Region. Compliance with this standard should be an important consideration for any future signal control system.

Reference should be made to market package ATMS 3 in the National Architecture.

1.5.1.2 Caltrans Traffic Operation Systems (TOS) Gap Closure Project (Region)

General Description:

Caltrans considers most field elements that aid in traffic surveillance and management activities to be part of the TOS. The most common field elements deployed as a comprehensive TOS in urbanized areas include, but are not limited to: traffic detection (inductive loops, video, acoustic), closed circuit television (CCTV) cameras, changeable message signs (CMS), highway advisory radio (HAR), communications systems and centralized command and control systems/centers with expert systems to aid in incident detection and response as well as automated ramp metering operations. Additional elements that are typically added to rural settings include, but are not limited to: road weather information systems (RWIS) and other systems that aid in improved emergency response times and dissemination of travel advisory information.

Project Objectives:

- Develop an action plan based on existing Caltrans District 6 and 10 Master Plans to allow for common sense integration of TOS elements into a seamless central operating system, presumably in the Caltrans TMC(s)
- Develop Program of Projects, with potential funding sources, to implement the Action Plan and Master Plan.
- Design and deploy appropriate communications infrastructure along State facilities to eliminate existing gaps and to provide a communications backbone for the Region.
- Design and deploy appropriate field elements that aid in traffic surveillance and management activities.

Sponsorship: Caltrans District 10 and SJCOG

Deployment Phasing: This project is a multi-phase deployment.

Deployment Locations: Countywide. Examination of the District 10 Master Plan identified the following element locations.

Route	Post Mile	Quantity	Location and Need
4	14.5-18.91	4	CMS/CAWS
5	0.35-49.40	35	CMS/CAWS
99	0.25-38.30	25	CMS/CAWS
4/5	Interchange	1	HAR
5/12	Interchange	1	HAR
4/99	Interchange	1	HAR
12/99	Interchange	1	HAR
5	14.90, 25.98, 26.47, 29.98	4	CCTV
99	18.80, 19.00	2	CCTV
5	12.60-32.70	1	FSP
4	15.08-19.40	1	FSP
99	0.00-38.78	1	FSP
99	2.37/Jactone Road	1	Ramp Meter
99	14.61/Arch Road	1	Ramp Meter
4	14.50-18.91	4.91 mi	Fiber
5	0.00-49.819	49.82 mi	Fiber
12	9.00-11.00, 17.90-19.08	3.18 mi	Fiber
99	0.00-38.783	38.79 mi	Fiber

Deployment Timeframes: This project is a near to long term deployment.

	Phase Timelines
Phase 1	Near to Long Term

Benefits:

General Benefits:

- Closing the gaps in the communication systems will improve the flow transportation conditions information from roadway sensors, potentially reduce costs, and allow improved cooperation between various agencies within the Region.
- Improving the communications systems will improve roadway monitoring, as well as lower incident detection frequencies assuming appropriate sensors are in place .

Emission Reductions:

- Communications projects have traditionally been considered as supportive of emissions reductions as long as they provide the capability to install traffic management or signal coordination equipment. Project proponents should work with the regional COG on a case by case basis. To support emissions reduction

goals, it may be appropriate to require that communications projects clearly define what traffic management equipment will be connected and what benefits this equipment provides.

Budget Estimate:

	Phase Budget Estimates	
	Capital Costs	**Operations and Maintenance Per Year**
Phase 1	$2,000K	$100K
Totals	$2,000K	$100K

Fiber-optic deployment costs were based on a unit cost of $25/LF. Design costs were assumed to be 15% of capital costs, and contingencies were 15% of capital costs for traditional project components and 30% for software development.

Evaluation Criteria:

- *MOE*
  - Miles of congested freeway
  - Freeway travel times
  - Amount of transportation conditions information delivered to the public over the proposed fiber network
  - Reduction in freeway accidents near metered interchanges
  - Incident detection/response time (ATMS)
  - Time needed for traffic operations staff to monitor/control field devices (ATMS)
- *MOP*
  - Connection/data transfer times/rates from field devices to the TMC
  - Communications packet loss
  - Time to access data from the database (ATMS)
  - Screen refresh rates (ATMS)
- *MOS*
  - Mean-time between system failures
  - O&M costs

O&M Considerations:

There are no particular O&M considerations for this project. However, if the communications backbone is to be shared by agencies other than Caltrans then some form of cost-sharing agreement may be necessary.

Architecture Considerations:

The infrastructure items in this project are not a concern, however the ATMS deployment and the flexibility of the communications backbone are. Caltrans should discuss its standards with Regional stakeholders to assist in ensuring that some common standards are utilized. Note that communications have many different standards or protocol "layers" that may impact the ability of systems to communicate over any given network. Many of these layers are not necessarily discussed in the

National Architecture, but are commonly used in the computer networking world. For example, the Internet utilizes the TCP-IP standard, which is only one of many of the standards, which make the Internet work. Common fiber network standards include SONET and ATM. Additional discussion of this information can be found in the Technology Options Document (available under separate cover).

Within the National Architecture, it may prove helpful for readers to review market packages ATMS 1, 4, and 6.

1.5.1.3 Communications Intertie Project Between Stockton, County and Caltrans

General Description:

Communications intertie projects typically take place between a Caltrans Transportation Management Center (TMC) and a local agency TMC/Traffic Operations Center (TOC). To be most effective, the Caltrans TMC and the local agency would be required to have centralized command and control of traffic management systems and field devices within their respective jurisdictions. In other areas of California, intertie projects allow Caltrans and the local agency to more efficiently share transportation management information, including but not limited to: traffic flow and congestion information, weather information, incident information, video images and in some cases, signal timing plans and modes. In some cases, shared control of a limited number and type of field devices has been arranged between agencies. While full control of one another's assets (field devices, signal systems, etc.) is technically possible, it may not be a desired arrangement institutionally.

The communication link between the intertie agencies can either be a dedicated agency owned asset (fiber or copper wire) or some type of telecommunication lease line technology (T1, ISDN or DSL). Another major element of an intertie project is the software, protocols, and interfaces that would allow for the exchange of information between different systems.

This project would establish/complete backbone wireline communications between the largest transportation players in the County. The most logical interties in Stockton FUA would be between the Caltrans Districts 10 and the City of Stockton, which would also be linked to ATMS workstations in the County. Communications would likely utilize fiber optic cable, however other opportunities should be reviewed for the various needs. This project should consider the establishment of regional standards for fiber communications deployment, including consideration of modes, capacity needs, communications protocols, and perhaps equipment types.

Project Objectives:

- Design and deploy appropriate communications infrastructure.
- Design and deploy a regionally integrated signal system to improve interagency coordination and cooperation.
- Establish regional signal system standard.
- Provide signal system support for smaller cities with a limited number of signals.

Sponsorship: City of Stockton, San Joaquin County, and Caltrans District 10

Deployment Phasing: This project is a single-phase deployment.

Deployment Locations: Countywide

Deployment Timeframes: This project is a near to Mid term deployment.

	Phase Timelines
Phase 1	Near to Mid Term

Benefits:

- Communication infrastructure will provide links between agencies and will allow for improved signal coordination.
- Traffic signal coordination can improve the flow of traffic, even during unexpected traffic conditions.
- Traffic management, through the use of improved communications and control techniques, can reduce delay in both uncongested and congested situations.
- Regional system standards will ease the process of coordination among systems in the different agencies, such as cities, counties, and Caltrans by providing a common base for all of the agencies to work from.

Budget Estimate:

	Phase Budget Estimates	
	Capital Costs	**Operations and Maintenance Per Year**
Phase 1	$3,000K	$150K
Totals	$3,000K	$150K

Evaluation Criteria:

- *MOE*
  - Intersection delay
  - Arterial travel times
  - Average time to diagnose and resolve a signal problem at a remote location
  - Emissions reduction
  - Data traffic between cities and other signal control agencies
  - Number of interjurisdictional coordinated signals
- *MOP*
  - Time to access information on another agency's signal
- *MOS*
  - Mean-time between failures
  - O&M costs

O&M Considerations: Informal guidelines should be developed to assist agencies in interjurisdictional signal coordination. In addition, example bi-lateral letters of agreement between agencies should be drafted to share signal information, timing plans and, in some cases, signal control.

1.5.1.4 Urban Area Traffic Signal Coordination Project

General Description:

This project would implement a number of local traffic signal coordination projects, spread out at specific urbanized locations along regionally significant arterials in the Stockton FUA, which are identified below. The objective of these projects would primarily be to reduce delays at traffic signals by improving coordination between adjacent signals, with improved safety, and possible secondary benefits depending on the specific improvements made. The specific improvements to be made would vary by location, which could include intra- and inter-jurisdictional efforts. The types of improvements that are possible include upgrading traffic signal controllers and detection, upgrading signal interconnects, and communications systems enabling centralized (i.e., remote) timing plan updating and maintenance and malfunction monitoring. Although providing emergency vehicle preemption, transit vehicle priority or automated enforcement would not be the focus or justification for these improvements, the equipment installed as part of these projects may support these features. Local agency traffic operations staff would lead these projects.

The provision of traffic signal coordination for small communities is most often initiated with use of either time-based coordination (TBC) or a closed-loop system (CLS). Depending on the type of controller equipment now in place, and depending on the level of staffing support that the City (or County) is able to make in the maintenance of signal coordination plans, the initial cost and recurring effort to achieve signal coordination in Hanford would vary from a very low cost, to a moderate cost. A number of communication alternatives are possible to tie the intersection controllers to a supervisory computer at City Hall (in the CLS alternative). With a CLS, the capability is created to remotely monitor intersection operation and the capability to remotely change both basic and coordination timing. A first step in the signal coordination capability would be the design and implementation of TBC timing plans. A feasibility study on possible and appropriate upgrade plans for creation and installation of a traffic signal system could be completed at the same time. Any small community that has more than 10 traffic signals would probably benefit from having signal coordination implemented along its heaviest-traveled street(s) so that vehicles can progress through a series of signalized intersections without stopping. The initial effort to achieve this basic level of coordination is relatively low, especially if it is contracted out. The resulting basic timing plans (perhaps just 2 or 3 plans which run between 7AM and 6 PM) can be left in place with very little subsequent retiming effort required or needed. Traffic signal coordination typically has one of the very highest benefit-to-cost ratios of any public works activity.

Project Objectives:

- Provide improved signal coordination that are upgraded for revised traffic conditions.

Sponsorship: City of Stockton

Deployment Phasing: This project is a single-phase deployment.

	Phase Components
Phase 1	➢ Develop and implement traffic timing plans.

Deployment Locations: Along major arterials in the City of Stockton and San Joaquin County

Deployment Timeframes: This project is a near to mid-term deployment.

	Phase Timelines
Phase 1	Near to Mid Term

Benefits:

- Improved mobility and reduced emissions.

Budget Estimate:

	Phase Budget Estimates	
	Capital Costs	**Operations and Maintenance Per Year**
Phase 1	$1,500K	$75K
Totals	$1,500K	$75K

Evaluation Criteria:

- *MOE*
  - Intersection delay
  - Arterial travel times
  - Emissions reduction
  - Data traffic between cities and other signal control agencies
  - Number of interjurisdictional coordinated signals
- *MOP*
  - Time to access information on another agency's signal
- *MOS*
  - Mean-time between failures
  - O&M costs

1.5.1.5 EVP Deployments

General Description:

Emergency Vehicle Preemption (EVP) is the ITS implementation at a traffic signal which modifies normal signal operation to provide a nearly immediate green signal for an approaching emergency vehicle. This type of ITS project is most often deployed on fire trucks because of the nature of the fire truck vehicle performance. The acceleration rate of fire trucks is rather slow due to their relatively low power-to-weight ratio. If fire trucks must slow down (and sometimes stop) when they encounter signalized intersections along their emergency run, the overall delay in responding to their emergency destination can easily exceed 1 to 2 minutes. For fire events, this delay can mean a significant difference in the level of destruction, the level of effort in suppressing the fire, the level of personal danger for firefighters at the scene, and the number and extent of injuries for victims. Depending on the level of congestion and the distance traveled, fire trucks can encounter many traffic signals, and heavy congestion. Driving in oncoming traffic lanes is a "last resort" maneuver, which fire departments rightly

avoid. If the fire truck encounters a red signal, it can assert the right of way and go through, but only after gaining assurance that it can safely cross through the intersection. Some larger agencies that have used EVP for many years have broadened the application to also equip ambulance vehicles and, in some cases, police vehicles with this on-board preemption request equipment. While these vehicles have much better acceleration characteristics, and the added delay at signals while on their emergency runs is much lower, granting EVP to these vehicles may provide another benefit. The crossing of very wide and very busy signalized intersections is very difficult in today's traffic. Each year, many such emergency vehicles are "totaled" after being T-boned when crossing a busy intersection. EVP helps reduce and prevent this occurrence.

Project Objectives:

- Design and deploy EVP devices at strategic locations throughout the City to reduce delay occurred at traffic signals during emergency response.
- Improve emergency response to major incidents.
- Reduce potential for accidents between motorists and emergency vehicles.

Sponsorship: City of Stockton

Deployment Phasing: This project is a single-phase deployment.

	Phase Components
Phase 1	➢ Evaluate and deploy EVP at strategic locations and corridors. ➢ Deploy EVP sensors at appropriate traffic signals and emergency vehicles.

Deployment Locations: City of Stockton - Potential corridors for EVP deployments include Hammer Lane, Pacific Avenue, Pershing Avenue, West Lane, March Lane, Harding Way, and 8th Street.

Deployment Timeframes: This project is a mid term deployment.

	Phase Timelines
Phase 1	Mid Term

Benefits:

- Improved response time for emergency vehicles.
- Reduction in accidents between motorists and emergency vehicles.

Budget Estimate:

	Phase Budget Estimates	
	Capital Costs	**Operations and Maintenance Per Year**
Phase 1	$3,500K	$350K
Totals	$3,500K	$350K

Evaluation Criteria:

- *MOE*
  - Reduction in accidents between motorists and emergency vehicles
  - Emissions reduction
  - Survey of public perceptions
  - Emergency vehicle response time
  - Delay at traffic signals
- *MOS*
  - O&M costs

1.5.1.6 Port of Stockton ITS Project

General Description:

This project would enhance the existing staging areas utilized by the Port of Stockton for trucks waiting to enter the Port. The project would provide a monitoring system at both the Port and the two staging areas that would direct trucks, through a series of CMS, coming to the Port into the staging areas when the Port is backed up. The effort would establish a monitoring system using technologies such as CMS (5), CCTV (3), video detection system, and a workstation.

Project Objectives:

- Develop an action plan to integrate the TOS elements into the Port operating system.
- Design and deploy appropriate communications infrastructure.
- Design and deploy appropriate field elements that aid in traffic surveillance and management activities.

Sponsorship: City of Stockton, San Joaquin County

Deployment Phasing: This project is a single-phase deployment.

	Phase Components
Phase 1	➢ Design and deploy the field elements and monitoring system

Deployment Locations: Port of Stockton

Deployment Timeframes: This project is a long-term deployment.

	Phase Timelines
Phase 1	Long Term

Benefits:

- Emissions reduction.
- Improving the communications systems will improve monitoring of staging areas.

Budget Estimate:

	Phase Budget Estimates	
	Capital Costs	**Operations and Maintenance Per Year**
Phase 1	$300K	$30K
Totals	$300K	$30K

Evaluation Criteria:

- *MOE*
  - Miles of congested freeway
  - Freeway travel times
  - Time needed for operations staff to monitor/control field devices
- *MOP*
  - Connection/data transfer times/rates from field devices to the monitoring system
- *MOS*
  - Mean-time between system failures
  - O&M costs

O&M Considerations: There are no particular O&M considerations for this project. However, if the communications backbone is to be shared by agencies other than the Port, then some form of coordination and cost-sharing agreement may be necessary.

1.5.1.7 Integrated Smart Corridors

General Description:

This project would implement a package of ITS applications in a highway corridor consisting of at least one main route and one parallel route. The focus of the project would be to improve the level of coordination of traffic management activities on the main route and parallel route(s); in effect to conduct corridor-level rather than facility-specific ITS traffic management. The range of ITS applications that could be included in a smart corridor application include essentially the full range of freeway management, arterial street management (e.g., traffic signalization) and traveler information strategies, including surveillance and detection; incident management, including coordinated and dynamic traffic detouring strategies utilizing both the main and parallel route(s); changeable message signs; dynamic trailblazer signs; highway advisory radio; and integrated traffic signal operations, including coordination between ramp meters and adjacent traffic signals. The smart corridor project would feature

implementation of a combination of ITS applications, with the emphasis being on linking operations across multiple facilities serving a defined travel corridor. Given the multi-facility nature of this project, the multi-jurisdictional coordination aspects of the project will be critical, including developing consensus on the specific objectives of the project and on the individual coordination procedures and techniques. The first step in the development of this project would be to identify a candidate project corridor, based on accidents and congestion, travel patterns, availability of alternate routes and interest among the potential project participants.

Project Objectives:

- Design and deploy appropriate ITS infrastructure along the proposed smart corridors.
- Develop common standards for ATMS functions.
- Consider the integration of freeway and major arterial operations (managing the overall transportation network).
- Design and develop integrated corridor system tools that can be deployed throughout the Region.

Sponsorship: City of Stockton, San Joaquin County, and Caltrans District 10

Deployment Phasing: This project is a single-phase deployment.

	Phase Components
Phase 1	➢ Fiber communications ➢ Smart corridor including appropriate (CMS, CCTV, HAR, and freeway/arterial integration)

Deployment Locations: Stockton FUA:

Deployment Timeframes: This project is a near to long term deployment.

	Phase Timelines
Phase 1	Long Term

Benefits:

General Benefits:

- The Smart Corridor Project for the City of Los Angeles involving I-10 and adjacent arterials is an example of an "integrated" ITS system. A preliminary evaluation of this system was performed to evaluate its impacts. It was estimated that total travel time along the Smart Corridor would be reduced by 11 to 15%. Intersection delay is expected to be reduced by nearly 20%. Vehicle emission will generally decrease as follows: CO (15%), HC (8%). Freeway speeds during peak hours will increase by nearly 70 to 80 %. Stop-and-go freeway conditions will decrease substantially. Average surface street speeds during peak periods will increase by nearly 11%. These same benefits are anticipated for the Fresno County project. A conservative 8% reduction in travel time is assumed for benefit-cost analysis.
- The Information for Motorist (INFORM) program in Long Island, New York, is an integrated program using changeable message signs, ramp meters, in-road traffic detectors, and signal coordination on parallel

streets. INFORM has increased rush hour speeds on Long Island from 34 mph to 46 mph. Drivers will divert to an alternate route 5% to 10% of the time when passive messages are displayed on electronic signs, and will divert even more frequently when the message recommends an alternate route.

- Integrated systems have the ability to lower costs by sharing infrastructure, staff, and equipment cost among a number of services and agencies. An analysis performed for the US DOT ITS Joint Program Office indicated that incorporation of the full metropolitan ITS infrastructure into a regional transportation improvement plan could reduce the cost of infrastructure expansion by approximately one-half. The analysis was based on published data regarding VMT growth, infrastructure component benefits, and FHWA cost estimates.
- In Detroit, Michigan, an expansion of the freeway management system is expected to reduce delays from incidents by about 40%. This could lead to an annual reduction of 41.3 million gallons of fuel used, a reduction of 122,000 tons of carbon monoxide, 1,400 tons hydrocarbons, and 1,200 tons of nitrogen oxides.

Emissions Reductions:

- See above.
- Smart Corridor projects reduce emissions by decreasing delay and traffic flow breakdown along congested facilities. The extent of emissions reduction is largely a function of the extent of congestion, volume of traffic, type of traffic management devices/operations, and the number of incidents along the facility in question. Generally, it should be possible to estimate emissions reduction by determining the likely reduction in either the number of incidents or the duration of these incidents and applying this to the affected vehicles.
- As with signal coordination, Smart Corridors are implementations of devices and the operation of those devices. It is essential that a sound operational plan be in place to take full advantage of Smart Corridor operations.

Budget Estimate:

	Phase Budget Estimates	
	Capital Costs	**Operations and Maintenance Per Year**
Phase 1	$4,000K	$270K
Totals	$4,000K	$270K

Fiber-optic deployment costs based on a unit cost of $25/LF. Design costs were assumed to be 15% of capital costs, and contingencies were 15% of capital costs for traditional project components and 30% for software development.

Evaluation Criteria:

- *MOE*
  - Traffic delays (arterial/freeway)
  - Number of primary and secondary incidents
  - Emissions reduction
  - Diverted traffic volumes

- Survey of public perceptions

O&M Considerations: Smart Corridors are very dependent on interagency cooperation and coordination. Generally, specific response plans must be developed for each portion of the corridor to prescribe how agencies will react in certain situations. Continued coordination and the setting and following of common standards throughout ITS deployment will greatly assist the development of the Smart Corridor concept.

Architecture Considerations: Prerequisite efforts include software integration/systems elements of county projects. It may also prove helpful to review market packages ATMS 1, 3, 4, 6, and 7, as well as ATMS 8.

1.5.1.8 Advanced Railroad Highway Interface Technology Deployment

General Description:

This project would deploy railroad-highway grade crossing technology at needed grade crossings with safety (high accident) and/or high volume and delay concerns. The objective of the project would use field validated strategies for improving safety, reducing delay and/or providing travelers with improved real-time information on grade crossing status developed by the Kings County Advanced HRI Technology Deployment Demonstration project. The project could feature any combination of detection (both for trains and approaching vehicles), warning/traveler information, and control devices. Many different strategies are possible. Possible strategies include sensors coupled with message signs, in-vehicle devices and/or highway advisory radio that would provide approaching travelers with information on the expected duration of a crossing blockage. Another possible application would tie sensors to emergency vehicle dispatching systems to provide dispatchers and drivers with real time crossing status information.

This project would use the blueprint for applying technology to enhance grade crossing safety developed by the demonstration project. One major cause of crashes at railroad grade crossings is the persistent presence of the heavy Tulle fog in the Valley, and the inability for drivers to see grade crossings which are occupied with a train, usually in motion, until they are too close to stop. If some kind of train presence detection could be devised, and tied to an advance-warning beacon, approaching drivers would be forewarned about the dangerous situation. Such an active presence could be detected by an advanced detector, and need not involve the cooperation / joint solution with the railroad. Because of liability, railroads are not eager to create new and unproven detection or safety mechanisms; they have a well-defined program for active warning devices at the crossing which are very involved “systems” tied in with the railroad’s own advance detection systems. The possibility of deploying an advanced technology solution, especially at locations where no active warning devices now exist, would be the basis for this project.

Highway traffic at highway-rail intersections (HRIs) could be managed, where operational requirements demand advanced features (e.g., where rail operational speeds are greater than 80 miles per hour). This would include all capabilities from the Standard Railroad Grade Crossing and augments these with additional safety features to mitigate the risks associated with higher rail speeds. The active warning systems would include positive barrier systems, which preclude entrance into the intersection when the barriers are activated. Like the Standard Package, the HRI equipment is activated on notification by wayside interface equipment, which detects, or communicates with, the approaching train.

The wayside interface equipment would provide additional information about the arriving train so that the train's direction of travel, estimated time of arrival, and the estimated duration of closure may be derived. This enhanced information may be conveyed to the driver prior to, or in context with, warning system activation. This would also include additional detection capabilities, enabling it to detect an entrapped or otherwise immobilized vehicle within the HRI and provide an immediate notification to highway and railroad officials.

Project Objectives:

- Design and deploy either a single or a series of systems, which enhance safety at high activity railroad crossings.
- Develop traveler information systems, which display accurate, timely, and useful information on expected train crossings and anticipated delays.
- Consider inexpensive options to enhance RR crossing safety

Sponsorship: City of Stockton and San Joaquin County

Deployment Phasing: This project is a single-phase deployment.

	Phase Components
Phase 1	➢ Analyze locations of Smart crossing sites within project area ➢ Deploy Smart Crossing Sites

Deployment Locations: Countywide with potential locations in the FUA include March Lane, Hammer Lane, and Eight Mile Road.

Deployment Timeframes: This project is a mid term deployment.

	Phase Timelines
Phase 1	Mid Term

Benefits:

General Benefits:

- Enhanced safety at grade crossings through improved warning of approaching trains.
- Decreased travel delays to travelers through enhanced information.

Emissions Reductions:

- Emissions reductions may result from these types of projects through the diversion of some traffic to alternative routes not delayed by train traffic. Based on the site being deployed, the volume of traffic, and availability of alternative routes to reach the same destination it should be possible to estimate the emissions reductions resulting from anticipated traffic diversions.
- Deployment of this type of equipment along high volume routes with viable alternative paths of travel should improve the emissions reduction potential of these projects.

Budget Estimate:

	Phase Budget Estimates	
	Capital Costs	**Operations and Maintenance Per Year**
Phase 1	$750K	$75K
Totals	$750K	$75K

Evaluation Criteria:

- *MOE*
  - Traffic delays at RR-xings
  - Number of incidents at crossings
  - Number of illegal crossings
  - Emissions reduction
  - Diverted traffic volumes
  - Survey of public perceptions

O&M Considerations: Concurrence of the California Public Utilities Commission (CPUC) and property owners will be required to place devices within the railroad right-of-way.

Architecture Considerations: Readers may want to review market packages ATMS 14 and 15 of the National Architecture.

1.5.1.9 Vanpool Vehicle Traffic Probes

General Description:

Several attempts to utilize transit vehicles as traffic probes have been undertaken around the United States and the world over the past several years. These efforts have met with mixed results for a few different reasons. The inherent, and unpredictable, stop and start nature of most transit vehicle trips does not lend itself well to judging the general flow of traffic. Algorithms, which have not always proven reliable, needed top be developed to account for passenger drop-off and pick-up activity. These implementations typically worked best on vehicles that made fewer and more predictable stops. Before the advent of geographic positioning systems (GPS), these systems employed roadside beacons, or similar technologies, to track vehicle location and progress over a pre-defined route. This was an infrastructure intensive solution that was relatively expensive to implement, especially compared to today's GPS based vehicle tracking systems. A GPS based system allows greater coverage to determine vehicle location, heading and velocity without the roadside infrastructure investment.

Given the above information, the general assertion is that vehicle probes are most reliable and less expensive to implement on vehicles that travel longer distances, make fewer stops and utilize GPS technology. Long distance express transit buses and vanpools typically fit these criteria.

Project Objectives:

- Utilize express transit buses and vanpools as traffic probes to collect information.

Sponsorship: San Joaquin County

Deployment Phasing: This project is a single-phase deployment.

	Phase Components
Phase 1	➢ Evaluate and deploy vehicle probe equipment in express transit buses and vanpools.

Deployment Locations: Countywide

Deployment Timeframes: This project is a near to mid-term deployment.

	Phase Timelines
Phase 1	Near to Mid-Term

Benefits:

- Improved data information relating to traffic flow conditions.

Budget Estimate:

	Phase Budget Estimates	
	Capital Costs	**Operations and Maintenance Per Year**
Phase 1	$500K	$50K
Totals	$500K	$50K

1.5.2 INCIDENT MANAGEMENT/EMERGENCY SERVICES

1.5.2.1 Alternate Route Plans Database/Web Site

General Description:

This project would aid in the dissemination and utilization of alternate route plans by providing access to the plans via the Internet. During the needs identification process, it was noted that in many cases alternate routes plans to facilitate traffic diversions during incidents, including accidents, construction and weather-related closures, do exist, but are not utilized to the extent they should be because some agencies are not aware of the plans and/or do not have convenient access to them. If successful, this project would make traffic diversions more coordinated and effective, including reducing the adverse impacts that detoured traffic imposes on alternate routes, and reducing the volume of traffic on roadway segments with hazardous conditions or heavy congestion. This project would focus on collecting and providing access to existing alternate route plans, although it would likely include some development of new plans to fill gaps, etc. In addition to the collection of plans and development of dissemination tools, this project should include agency discussions to stimulate understanding and use of the alternate route plans.

Project Objectives:

- To provide improved availability of information related to alternate routes.

Sponsorship: County of San Joaquin

Deployment Phasing: This project is a single-phase deployment.

	Phase Components
Phase 1	➢ Evaluate and deploy vehicle probe equipment in express transit buses and vanpools.

Deployment Locations: Countywide

Deployment Timeframes: This project is a mid- term deployment.

	Phase Timelines
Phase 1	Mid Term

Benefits:

- Improved incident management with better information.

Budget Estimate:

	Phase Budget Estimates	
	Capital Costs	**Operations and Maintenance Per Year**
Phase 1	$20K	$4K
Totals	$20K	$4K

- *MOE*
  - Improved incident management
  - Improved jurisdictional coordination
- *MOP*
  - Time to access information on another agency's site
- *MOS*
  - Mean-time between failures
  - O&M costs

1.5.2.2 Traffic Safety Task Force / Team

General Description:

This project would develop, for the Stockton FUA, an interjurisdictional and cross-agency teaming arrangement that would be mobilized to respond to any major traffic-snarling incident in the team's coverage area. Once a specific geographic area has been selected for this project (due in large part to the presence of a project champion), an ad-hoc working group would be established to bring this Traffic

Safety Team into existence. In order to be self-sustaining, such a Team will need to be activated, on average, at least 4 times per year. Therefore, the coverage area should be large enough so that this will be achieved. The Team will need to have authority to activate itself. That is, within each organization where a Team member is employed, that Team member shall have the capability to cease his/her routine and respond to a Team-declared incident when needed. The Team shall be equipped with adequate and sufficient person-to-person communication devices (most likely cellular telephones with 3-way and/or conference calling capability) to contact other Team members as needed. Finally, a rigorous and extensive agency and staff networking outreach capability shall be developed for use in this Team. The Team itself may or may not have independently owned and controlled traffic control devices for use in deployments responding to incidents. Each agency's own devices should be accessible if the Traffic Safety Team is created effectively.

This Team creation would be a pilot project for duplication throughout all other areas of the Valley. The use of a contracted facilitator should be employed on this pilot project, with plenty of documentation, lessons learned, and formats to be followed for institutional acceptance of the IR Team concept. Other areas within the Valley would then be able to model their own Team on the findings and documentation provided in this project.

Project Objectives:

- Provide a forum for emergency service agencies to propose needed projects, operational agreements, and cooperative efforts.
- Provide for inter-agency training.
- Fund some site visits to other regions implementing desirable incident management systems, policies, and/or procedures.

Sponsorship: SJCOG, CHP, and Caltrans, with heavy involvement from all other emergency service agencies

Deployment Phasing: This project is a single-phase deployment.

	Phase Components
Phase 1	➢ Development of a Regional Traffic Safety Plan for large-scale interagency incidents. ➢ Funding of appropriate site visits to regions with desirable IM/ES deployments. ➢ Inter-agency training support – the importance of this element should not be underestimated. ➢ IM/ES program management by agency/other staff.

Deployment Locations: Within the urbanized area highway system.

Deployment Timeframes: This project is a mid term deployment.

	Phase Timelines
Phase 1	Mid Term

Benefits:

General Benefits:

- Enhanced interagency coordination and communications
- Provides an interagency structure upon which deployment efforts can be constituted
- Provides institutional structure necessary to support interagency incident management coordination.

Emissions Reduction:

- None directly associated with this project.

Budget Estimate:

	Phase Budget Estimates	
	Capital Costs	**Operations and Maintenance Per Year**
Phase 1	$150K	$70K
Totals	$150K	$70K

Evaluation Criteria:

- MOE
  - Participation of emergency service agencies.

O&M Considerations: Long-term programming and support should be provided to support the basic functions of the Task Force.

Architecture Considerations: The Task Force should follow and report to the ITS Deployment Steering and Review group on emerging important standards, as regional and State issues, relating to the area of incident management.

1.5.2.3 Portable Changeable Message Sign Pool

General Description:

This project will establish a pool of portable changeable message signs that would be made available to various public agencies for use in construction work zones, special event traffic control and other appropriate incident management applications. Currently, many agencies that could benefit from the signs cannot afford, or justify, purchase of the signs. Caltrans is the most likely candidate to purchase the signs and administer the lending program. For costing purposes, it has been assumed that 20 signs would be purchased. The signs could be made available at no cost or for a fee that would be less than that charged by commercial equipment rental companies. Agencies borrowing the signs may or may not financially contribute toward maintenance of the signs, depending on the funding source.

Project Objectives:

- Reduce congestion on highways due to incidents and expected congestion location in the Valley by providing timely and accurate incident and route choice information (advisory, warning and diversion messages).

- Provide accurate and timely information about construction, maintenance, event activities, weather/road conditions, roadway closure information, etc.

Sponsorship: SJCOG

Deployment Phasing: This project is considered a near term project to be completed within the next 5 years.

	Phase Components
Phase 1	➢ Development of a Regional Traffic Safety Plan for large-scale interagency incidents. ➢ Funding of appropriate site visits to regions with desirable IM/ES deployments. ➢ Inter-agency training support – the importance of this element should not be underestimated. ➢ IM/ES program management by agency/other staff.

Deployment Locations: Countywide

Deployment Timeframes: This project is a near term deployment.

	Phase Timelines
Phase 1	Near Term

Benefits:

General Benefits:

- Provide improved motorist information
- Improved safety

Budget Estimate:

	Phase Budget Estimates	
	Capital Costs	**Operations and Maintenance Per Year**
Phase 1	$150K	$15K
Totals	$150K	$15K

Evaluation Criteria:

- MOE
  - Reduction in delay
  - Reduction in accidents

O&M Considerations: Operational and maintenance costs were estimated at 10 percent of the capital cost per CMS location, annually.

1.5.2.4 Dynamic Alternate Route Signing

General Description:

This project would implement dynamic variable message signs (VMS) specifically sited, and primarily devoted, to detouring traffic onto alternate routes during incidents, including accidents and weather related road closures. These signs could differ from the large, permanent changeable message signs deployed by Caltrans at key decision points in several respects. First, they would be sited in conjunction with a specific alternate route/detour strategy developed for a particular route and alternate routes. Second, the signs could be smaller than the Caltrans signs. Third, the signs could include features, such as arrows or flashing beacons that are not included on the traditional CMS. Finally, the alternate routes signs could be deployed as trailblazers along the alternate route, rather than merely in advance of the main route/alternate route decision point. The objective of this project would be to improve compliance with detours and reduce driver uncertainty along detour routes. If successful in reducing the volume of vehicles entering hazardous or congested roadway segments, this project holds the potential to reduce congestion, delay and accidents. In order to be successful, it would be critical that this project include development of an alternate route plan and procedures to support the usage of the signs, and that this plan be effectively linked to an overall multi-agency coordinated incident management strategy. This project would also require a commitment on behalf of the operating agency to devote the time and attention necessary to utilize the signs effectively. Even more so than a single CMS, keeping the dynamic message signs current and accurate would be critical. This project assumes the installation of 6 dynamic alternate route signs for all the urban traffic corridors.

Project Objectives:

- Provide efficient routing around major incidents on the highway system.
- Design and deploy alternate route signs.

Sponsorship: City of Stockton and San Joaquin County

Deployment Phasing: This project is a single-phase deployment.

	Phase Components
Phase 1	➢ Identify potential sign locations. ➢ Design and deploy CMS at strategic locations.

Deployment Locations: Stockton FUA

Deployment Timeframes: This project is a near to mid term deployment.

	Phase Timelines
Phase 1	Near to Mid-Term

Benefits:

- Improved mobility
- Reduced congestion related to highway incidents

- Improved traffic management
- Reduced delay time to major incidents
- Reduced impact on adjacent communities

Budget Estimate:

	Phase Budget Estimates	
	Capital Costs	**Operations and Maintenance Per Year**
Phase 1	$1,740K	$116K
Totals	$1,740K	$116K

Evaluation Criteria:

- *MOE*
  - Travel Time
  - Delay
  - Incident work zone safety

O&M Considerations: Operational and maintenance costs were estimated at $2,000 per location.

1.5.3 TRANSIT SYSTEMS

1.5.3.1 Transit Management System (TrMS) Upgrades

General Description:

This project would provide funding to implement a transit management system. A transit management system typically includes automatic vehicle location (AVL), computer-aided scheduling and dispatch software, mobile data terminals, automated schedule adherence monitoring, computer report generation and data management, and maintenance management software. Transit management systems may also include traveler information elements such as automated itinerary planning systems, station signs showing real-time vehicle arrival information, and Internet web sites. The project shall be consistent with other regional systems including Fresno Area Express, Golden Empire Transit and San Joaquin Regional Transit. In addition, the Transit Management System shall take into consideration other potential projects with overlapping components such as AVL.

This project will build upon the SMARTtrac system implemented by the San Joaquin Regional Transit District, which is an advanced public transportation system that uses a Global Positioning System to track its buses and provide passengers with real-time bus arrival information. The SMARTtrac system is the first of its kind in the nation, integrating real-time vehicle location with an interactive voice response system (IVRS) providing bus stop arrival information. All bus stops in the Stockton Metropolitan Area and on intercity routes connecting Lodi, Tracy, Lathrop and Manteca have been assigned a four-digit identification number. This number is located on the bus stop sign. A potential rider can call SMARTtrac and find out when the bus will reach the stop based on the location of the bus at the time of the call, which allows time to reach the stop just a few minutes before the bus arrives.

Project Objectives:

- Develop/Expand regional TrMS deployment by using regional TrMS as a building block.
- Establish regional standards for the deployment of transit AVL equipment.
- Enhance the efficiency of transit services throughout the Region by deployment of a common TrMS.
- Allow transit agencies to remotely operate the core TrMS system with appropriate security features.
- Establish/Enhance the TrMS to effectively support demand based transit operations.

Sponsorship: San Joaquin Regional Transit District

Deployment Phasing: This project is a single-phase deployment.

	Phase Components
Phase 1	➢ Perform a focused transit communications study to determine the specific communications needs of TrMS development or expansion. ➢ Deploy transit vehicles (including fixed route & paratransit) with standard AVL/GPS equipment. ➢ Deploy transit vehicles with enhanced equipment (passenger counting, etc.) ➢ Develop/procure software/upgrades for TrMS to support regional needs and paratransit services. ➢ Install radio/communications system upgrades. ➢ Procure new or additional workstations.

Deployment Locations: Countywide

Deployment Timeframes: This project is a mid to long term deployment.

	Phase Timelines
Phase 1	Mid to Long Term

Benefits:

General Benefits:

- Enhanced information for transit managers.
- Provides enhanced potential for real-time transit operations integration.
- Improved coordination between various transit agencies.
- Expands core for the TrMS deployment to support other ITS transit deployment efforts.

Emissions Reductions:

- Transit management systems generally have a significant potential for positive impacts on emissions reductions resulting from more effective use of the transit fleet.

- Enhanced management and dispatching could reduce out-of-direction travel and increased service effectiveness.

Budget Estimate:

	Phase Budget Estimates	
	Capital Costs	**Operations and Maintenance Per Year**
Phase 1	$2,000K	$200K
Totals	$2,000K	$200K

Based on deployments in other regions, the basic costs were conservatively assumed to be $7,500 for a standard vehicle deployment and $20,000 for an advanced vehicle deployment.

Evaluation Criteria:

- MOE
  - Transit O&M
  - Ridership
  - On-time performance
- MOS
  - Mean-time between failures
  - O&M costs

O&M Considerations: None

Architecture Considerations: The Transit Systems Workgroup should establish regional standards for TrMS deployment based on existing/emerging regional and national. Reference should be made to APTS 1 of the National Architecture.

1.5.3.2 Transit Information System

General Description:

This project would implement a system for collecting, processing and disseminating transit information, including "static" information such as routes and schedules, and in the cases of those operators with vehicle tracking systems, real-time information such as estimated vehicle arrival times at specific locations. The objective of the project would be to improve the availability and accessibility of transit information, thereby making transit more convenient and increasing transit utilization. Transit users often site uncertainty in transit schedules, stops, fares and the timing of arrivals at specific stops as impediments.

This project would establish a centralized transit information database, residing in a computer that would probably be housed at one of the San Joaquin Valley transit operations, or perhaps at a location, such as a Caltrans traffic management facility, where other traveler information is compiled. The project would include procedures and supporting communications infrastructure that would allow participating transit operators to submit information to the system. For static information, the communications system could be very minimal, such as via e-mail or Internet file transfer. The

communications necessary to support real-time information would be more costly and elaborate and could include a dial-up or dedicated phone connection. The project would also include dissemination tools to make the information available to travelers. These tools could include an Internet web site, telephone information system, and kiosks.

Project Objectives:

- Provide real-time transit status information to transit patrons including delays, arrival times, and schedules.
- Promote transit ridership through enhanced information to the public.

Sponsorship: San Joaquin Regional Transit District

Deployment Phasing: This project is a single-phase deployment.

	Phase Components
Phase 1	➢ Deploy real-time transit information displays at ten locations (2 displays each/secure casings). ➢ Procure or develop software to upgrade the TrMS to support the transit information displays. ➢ Provide communications for each of the locations. ➢ Provide monitoring/management workstations for the system.

Deployment Locations: Countywide

Deployment Timeframes: This project is a mid term deployment.

	Phase Timelines
Phase 1	Mid Term

Benefits:

General Benefits:

- Provides simple, accurate, and timely transit information to transit patrons on the status of the next bus, delays, schedules, etc.
- Promotes transit ridership by improving the perception of the service.

Emissions Reduction:

- Improved information for transit patrons should help to enhance ridership. Short- and Long-Range transit plans should include this project, and the anticipated impacts on ridership. These estimates could be used to determine emissions reduction potential.

Budget Estimate:

	Phase Budget Estimates	
	Capital Costs	**Operations and Maintenance Per Year**
Phase 1	$600K	$60K
Totals	$600K	$60K

Evaluation Criteria:

- MOE
  - Survey of transit patrons
- MOS
  - O&M costs
  - Mean time between failures

O&M Considerations: None

Architecture Considerations: Reference should be made to market packages APTS 4 and 8 of the National Architecture.

1.5.3.3 SMART NextBus Arrival Signs

General Description:

This project would deploy dynamic message signs at selected higher-usage bus stops equipped with bus shelters. Currently, only one firm (NextBus) is providing this kind of service. Their equipment is placed on board transit vehicles, and GPS-derived current location and speed information is transmitted to NextBus computers at a remote location where the information is processed, and bus arrival prediction is then published to an Internet IP address. The IP address corresponds to a particular dynamic message sign. NextBus has a patent for this "arrival prediction using GPS coordinate data scheme, and their equipment combination uses a CDPD data modem to transmit the information from the bus to the NextBus servers. The cost for the CDPD "air time" may make this more expensive than in AT&T's coverage area. Also, once an initial installation is completed (using capital funding from some source), then the agency would need to continue the payments for CDPD air time (currently ~$60 per month per bus, and $30 per month per dynamic message sign.

Once the service is in place, transit patrons would be able to determine real-time bus locations and expected arrival times at their bus stop. The dynamic message sign at the bus stop would be one source of this information, but NextBus also publishes the information in map form to an Internet website, and in WAP form to hand-held PDAs. The information would therefore also be accessible to transit dispatchers as well as agencies that oversee and/or fund transit operations. NextBus can provide a broad cross-section of transit operations data that would be useful to these 2 management groups as well.

Project Objectives:

- Improve traveler information and increase ridership.
- Improve transit efficiency
- Increase ridership

Sponsorship: San Joaquin Regional Transit District

Deployment Phasing: This project is a single-phase deployment.

	Phase Components
Phase 1	➢ Siting study for system. ➢ Deployment of up to 30 sign locations

Deployment Locations: Within the urbanized area.

Deployment Timeframes: This project is a near term deployment.

	Phase Timelines
Phase 1	Near Term

Benefits:

- Provide real-time transit information to users

Budget Estimate:

	Phase Budget Estimates	
	Capital Costs	**Operations and Maintenance Per Year**
Phase 1	$800K	$80K
Totals	$800K	$80K

1.5.3.4 San Joaquin Transit Electronic Fare Payment

General Description:

This project would coordinate the fare payment systems of one or more transit systems, allowing riders to use the same fare media, such as a magnetic strip swipe card, interchangeably on any of the participating systems. The objective of this project would be to increase the convenience of fare payment for riders and promote transfers between systems. The introduction of electronic fare collection systems can also reduce fare handling costs for transit operators. Since a large number of County residents commute to the San Francisco Bay Area, it would be ideal to “piggyback” onto the systemwide electronic fare system now being developed for the Bay area (namely, TransLink). TransLink, a regional transit fare payment system using 'smart card' technology, is scheduled to launch as a demonstration project in the San Francisco Bay Area in mid-2001. The nine-county Bay Area will be first in the U.S. to have a single card that can be used on all forms of public transit in the region: buses, trains and ferries. The project began with the award of a contract to Motorola, Inc. in mid-1999. Motorola, Inc. is developing the system under contract to MTC. It is being developed in two phases to ensure that the system meets the needs of the Bay Area riding public and transit Operators. The six-month demonstration project will include approximately 5,000 transit riders using TransLink on six Bay Area transit systems (AC Transit, BART, Caltrain, Golden Gate Transit, SF Muni, and Santa Clara Valley Transportation Authority). The results of this demonstration will be thoroughly evaluated before

the system is implemented regionwide (in 2002). In addition to on-board fare collection equipment, this project would also include the computing and communications resources necessary to coordinate fare accounting among the participating agencies. This project could involve two or more agencies that do not have electronic fare payment systems (e.g., implement new equipment at all participating agencies), or expand upon a system already implemented by one or more agencies by equipping additional agencies.

Project Objectives:
- Improve transit efficiency
- Increase ridership

Sponsorship: SJCOG, San Joaquin Regional Transit District

Deployment Phasing: This project is a single-phase deployment.

	Phase Components
Phase 1	➢ Develop the implementation plan based on lessons learned from the Bay Area and other such systems in California. ➢ Deploy limited amount of system for interregional transit users.

Deployment Locations: Countywide

Deployment Timeframes: This project is a near to long term deployment.

	Phase Timelines
Phase 1	Long Term

Benefits:

- More efficient transit service

Budget Estimate:

	Phase Budget Estimates	
	Capital Costs	**Operations and Maintenance Per Year**
Phase 1	$2,000K	$200K
Totals	$2,000K	$200K

1.5.3.5 Demand-Responsive Transit System Integration Study

General Description:

This project would fund a study of demand-responsive transit system integration strategies, culminating in a specific set of recommendations to implement strategies within specified transit agencies. The primary objective of integrating multiple demand-responsive transit services is to improve operating efficiency by reducing service redundancies and sharing vehicles, staff and scheduling/dispatch

technology among agencies. These improvements result in an overall better quality of service to riders, and riders may benefit directly through enhanced schedule and/or destination options enabled through the integration of services across agencies. Typically, especially in county-based or rural oriented demand responsive transit environments, a number of different agencies operate within a given geographic area, providing service to many of the same destinations but often serving a slightly different client base. One of the primary objectives of demand-responsive transit service integration strategies is to reduce these redundancies and associated inefficiencies. Demand-responsive service integration includes a wide range of potential specific activities, ranging from simple coordination to full integration. Examples of specific strategies include consolidation of scheduling and/or dispatch functions (where multiple agencies can share the cost of improvements and share access), agreements to share access to vehicles under specified circumstances, and consolidation of ride reservation systems.

Project Objectives:

- Improve paratransit efficiency by providing coordinated operations and improved system purchasing power.

Sponsorship: San Joaquin County, San Joaquin Regional Transit District with partnership from local paratransit operators.

Deployment Phasing: This project is a single-phase deployment.

	Phase Components
Phase 1	➢ Prepare a study of the feasibility of integrated services.

Deployment Locations: Countywide

Deployment Timeframes: This project is a mid term deployment.

	Phase Timelines
Phase 1	Mid Term

Benefits:

- Improved paratransit service Countywide

Budget Estimate:

	Phase Budget Estimates	
	Capital Costs	**Operations and Maintenance Per Year**
Phase 1	$150K	$0K
Totals	$150K	$0K

1.5.4 TRAVELER INFORMATION SYSTEMS

1.5.4.1 Metropolitan Traveler Information System

General Description:

This project would implement a comprehensive Integrated Traveler Information System (ITIS) that includes the following systems:

- ·Closed Circuit Television (CCTV)·
- System Detection·
- Changeable Message Signs (CMS)·
- Highway Advisory Radio (HAR)·
- Public Information Database (PIDB)·
- Traveler Advisory Telephones (TAT)·
- Community Access Television (CATV) information system·
- HAR/HAT Voice-Response System·
- Kiosks·
- Communication Network

The goal of the system is to disseminate timely and reliable traffic congestion information along the major arterial streets within the Stockton FUA. System detector data would be collected, analyzed and disseminated via the ITIS. In addition, this information can be shared with the regional ATMS including Caltrans and the County. This information can be provided to the public through an Internet website, a telephone advisory system, and interactive touch-screen kiosks located at strategic locations. To complement the system, links should be made with TravInfo.

TravInfo is an open access traveler information system in the San Francisco Bay Area. The Field Operational Test took place over a two-year period from September 1996 to September 1998 with funding from the Federal Highway Administration and the California Department of Transportation (Caltrans). TravInfo provides a free public service of real-time traffic information through a phone line, FM data broadcast, and the Internet with the goal to broadly disseminate accurate, comprehensive, timely, and reliable information on traffic conditions and multi-modal travel options to the public in the Bay Area.

Project Objectives:

- Improve mobility and make more efficient use of the arterial street system.

Sponsorship: San Joaquin County

Deployment Phasing: This project is a single-phase deployment.

Deployment Locations: Urbanized area of the County.

Deployment Timeframes: This project is a near to long term deployment.

	Phase Timelines
Phase 1	Long Term

Benefits:

- Reduce congestion
- Improve air quality

Budget Estimate:

	Phase Budget Estimates	
	Capital Costs	**Operations and Maintenance Per Year**
Phase 1	$400K	$20K
Totals	$400K	$20K

1.5.5 REGIONAL ITS CONFIGURATION MANAGEMENT/COORDINATION/PLANNING

1.5.5.1 Data Exchange Network (DEN)/Communications Interties

General Description:

The project would develop logical data exchange network partnerships, initially focusing on the urbanized areas of the County. Presumably the County and Caltrans would also be involved in the partnerships. In addition, the logical interties between Caltrans District 6, the County and major cities of the County. In general, local agencies that partner and interconnect more than one agency with Caltrans have been more successful in obtaining state and federal funding than those proposals that intertie only one agency to Caltrans.

Data exchange networks are typically set up in areas where several jurisdictions are interested in collectively sharing information from their respective traffic management systems. The most common information shared is from traffic signal systems. While information exchange on the network can be used to more efficiently monitor multiple signal systems, the network usually doesn't allow for field device control or system interoperability. However, those capabilities can be included depending on user needs.

Data exchange networks depend on some type of communication infrastructure (dedicated agency owned or leased line) and software to exchange information. Communication intertie projects can establish some of the necessary communication links for a data exchange network. Data exchange networks differ from interties in that data exchange networks typically focus on the network connectivity and "logical" protocols of sharing data among several agencies. Interties typically focus on the "physical" communication link between agencies. Both, interties and data exchange networks can form the basis and initial implementation of the "center to center" portion of a Regional Architecture.

Communications intertie projects typically take place between a Caltrans Transportation Management Center (TMC) and a local agency TMC/Traffic Operations Center (TOC). To be most effective, the Caltrans TMC and the local agency would be required to have centralized command and control of traffic management systems and field devices within their respective jurisdictions. In other areas of California, intertie projects allow Caltrans and the local agency to more efficiently share transportation management information, including but not limited to: traffic flow and congestion information, weather information, incident information, video images and in some cases, signal timing plans and modes. In some cases, shared control of a limited number and type of field devices has been arranged between agencies. While full control of one another's assets (field devices, signal systems, etc.) is technically possible it may not be a desired arrangement institutionally. The most important element of an intertie project is a communication link between the intertie agencies. This can either be a dedicated agency owned asset (fiber or copper wire) or some type of telco lease line technology (T1, ISDN or DSL). Another major element of an intertie project is the software, protocols, and interfaces that would allow for the exchange of information between different systems. Interties differ from data exchange networks (see Data Exchange Network fact sheet) in that interties focus on the "physical" communication link between agencies. Data exchange networks typically focus on the network connectivity and "logical" protocols of sharing data among several agencies. Both, interties and data exchange networks can form the basis and initial implementation of the "center to center" portion of a Regional Architecture.

Project Objectives:

- Improve coordination and data sharing among agencies within the County.

Sponsorship: City of Stockton, San Joaquin County, and Caltrans District 10

Deployment Phasing: This project is a single-phase deployment.

	Phase Components
Phase 1	➢ System engineering design of the DEN ➢ Develop and deploy DEN within the County

Deployment Locations: Countywide through Regional TMC's

Deployment Timeframes: This project is a long term deployment.

	Phase Timelines
Phase 1	Long Term

Benefits:

- Improve incident management and traffic management in the urbanized area.

Budget Estimate:

	Phase Budget Estimates	
	Capital Costs	**Operations and Maintenance Per Year**
Phase 1	$300K	$30K
Totals	$300K	$30K

Table A.9: Summary of Stockton FUA ITS Projects

ID	Program Area/Project	Involved Agency	Brief Description	Project Initiation*			Capital Cost Estimates 2001 (Thousands of $)**		
				N	M	L	Total		
							Phase 1	Phase 2	Phase 3
SAN JOAQUIN COUNTY									
1.0 Traffic/Freeway Management Systems (ATMS)									
1.1SJ	**City of Stockton Expansion of ATMS and Central Control System, Phase 2**	City of Stockton San Joaquin County Caltrans District 10 SMART	The first phase, or base system, of the Stockton ATMS Master Plan was completed in 1997. The second phase will build upon its current multi-purpose role of providing monitoring and surveillance capabilities to traffic management operators and is intended to conceptually depict the long term traffic control & surveillance system to be implemented in the City. The major functions of the system are: • Incident Detection • Incident Verification & Response • Monitoring of traffic signal coordination along major corridors • Monitoring high volume intersection operation, queue build-up and high accident locations • Evaluate Traffic Management Strategies The second phase expansion will primarily consist of the elements: • Expand Central Network • Additional CCTV Cameras • Interconnect New Traffic Signals • New Traffic Signal Controllers • Integration with Caltrans The expansion of the system will make use of the existing City fiber optic communication network, which will provide opportunities for a cost-effective communications media for video signals and control signal transmission. The central network will be expanded through a combination of multiplexing the existing fiber network and extending the system to other portions of the City that were not included in the first phase of development. The CCTV camera site locations will be identified based on established camera site selection criteria. The CCTV cameras are located at strategic locations throughout the City to provide surveillance and monitoring capabilities for the operators at the Traffic Management Center in the City. A total of 10 additional CCTV camera locations were identified throughout the City to provide surveillance and monitoring capabilities.	X			**$9,700+**		
1.2SJ	**Caltrans Traffic Operation Systems (TOS) Gap Closure Project (Region)**	Caltrans District 10 SJCOG	Caltrans considers most field elements that aid in traffic surveillance and management activities to be part of the TOS. The most common field elements deployed as a comprehensive TOS in urbanized areas include, but are not limited to: traffic detection (inductive loops, video, acoustic), closed circuit television (CCTV) cameras, changeable message signs (CMS), highway advisory radio (HAR), communications systems and centralized command and control systems/centers with expert systems to aid in incident detection and response as well as automated ramp metering operations. Additional elements that are typically added to rural settings include, but are not limited to: road weather information systems (RWIS) and other systems that aid in improved emergency response times and dissemination of travel advisory information.	X	X	X	**$2,000**		
1.3SJ	**Communications Intertie Project Between Stockton, County and Caltrans**	City of Stockton San Joaquin County Caltrans District 10	Communications intertie projects typically take place between a Caltrans Transportation Management Center (TMC) and a local agency TMC/Traffic Operations Center (TOC). To be most effective, the Caltrans TMC and the local agency would be required to have centralized command and control of traffic management systems and field devices within their respective jurisdictions. In other areas of California, intertie projects allow Caltrans and the local agency to more efficiently share transportation management information, including but not limited to: traffic flow and congestion information, weather information, incident information, video images and in some cases, signal timing plans and modes. In some cases, shared control of a limited number and type of field devices has been arranged between agencies. While full control of one another's assets (field devices, signal systems, etc.) is technically possible, it may not be a desired arrangement institutionally. The communication link between the intertie agencies can either be a dedicated agency owned asset (fiber or copper wire) or some type of telecommunication lease line technology (T1, ISDN or DSL). Another major element of an intertie project is the software, protocols, and interfaces that would allow for the exchange of information between different systems. This project would establish/complete backbone wireline communications between the largest transportation players in the County. The most logical interties in Stockton FUA would be between the Caltrans Districts 10 and the City of Stockton, which would also be linked to ATMS workstations in the County. Communications would likely utilize fiber optic cable, however other opportunities should be reviewed for the various needs. This project should consider the establishment of regional standards for fiber communications deployment, including consideration of modes, capacity needs, communications protocols, and perhaps equipment types.	X	X		**$3,000**		
1.4SJ	**URBAN AREA TRAFFIC SIGNAL COORDINATION PROJECT**	City of Stockton	This project would implement a number of local traffic signal coordination projects, spread out at specific urbanized locations along regionally significant arterials in the Stockton FUA, which are identified below. The objective of these projects would primarily be to reduce delays at traffic signals by improving coordination between adjacent signals, with improved safety, and possible secondary benefits depending on the specific improvements made. The specific improvements to be made would vary by location, which could include intra- and inter-jurisdictional efforts. The types of improvements that are possible include upgrading traffic signal controllers and detection, upgrading signal interconnects, and communications systems enabling centralized (i.e., remote) timing plan updating and maintenance and malfunction monitoring. Although providing emergency vehicle preemption, transit vehicle priority or automated enforcement would not be the focus or justification for these improvements, the equipment installed as part of these projects may support these features. Local agency traffic operations staff would lead these projects. The provision of traffic signal coordination for small communities is most often initiated with use of either time-based coordination (TBC) or a closed-loop system (CLS). Depending on the type of controller equipment now in place, and depending on the level of staffing support that the City (or County) is able to make in the maintenance of signal coordination plans, the initial cost and recurring effort to achieve signal coordination in Hanford would vary from a very low cost, to a moderate cost. A number of communication alternatives are possible to tie the intersection controllers to a supervisory computer at City Hall (in the CLS alternative). With a CLS, the capability is created to remotely monitor intersection operation and the capability to remotely change both basic and coordination timing. A first step in the signal coordination capability would be the design and implementation of TBC timing plans. A feasibility study on possible and appropriate upgrade plans for creation and installation of a traffic signal system could be completed at the same time. Any small community that has more than 10 traffic signals would probably benefit from having signal coordination implemented along its heaviest-traveled street(s) so that vehicles can progress through a series of signalized intersections without stopping. The initial effort to achieve this basic level of coordination is relatively low, especially if it is contracted out. The resulting basic timing plans (perhaps just 2 or 3 plans which run between 7AM and 6 PM) can be left in place with very little subsequent retiming effort required or needed. Traffic signal coordination typically has one of the very highest benefit-to-cost ratios of	X	X		**$1,500**		

ID	Program Area/Project	Involved Agency	Brief Description	Project Initiation* N	Project Initiation* M	Project Initiation* L	Capital Cost Estimates 2001 (Thousands of $)** Total Phase 1	Phase 2	Phase 3
			any public works activity.						
1.5SJ	EVP DEPLOYMENTS	City of Stockton	Emergency Vehicle Preemption (EVP) is the ITS implementation at a traffic signal which modifies normal signal operation to provide a nearly immediate green signal for an approaching emergency vehicle. This type of ITS project is most often deployed on fire trucks because of the nature of the fire truck vehicle performance. The acceleration rate of fire trucks is rather slow due to their relatively low power-to-weight ratio. If fire trucks must slow down (and sometimes stop) when they encounter signalized intersections along their emergency run, the overall delay in responding to their emergency destination can easily exceed 1 to 2 minutes. For fire events, this delay can mean a significant difference in the level of destruction, the level of effort in suppressing the fire, the level of personal danger for firefighters at the scene, and the number and extent of injuries for victims. Depending on the level of congestion and the distance traveled, fire trucks can encounter many traffic signals, and heavy congestion. Driving in oncoming traffic lanes is a "last resort" maneuver, which fire departments rightly avoid. If the fire truck encounters a red signal, it can assert the right of way and go through, but only after gaining assurance that it can safely cross through the intersection. Some larger agencies that have used EVP for many years have broadened the application to also equip ambulance vehicles and, in some cases, police vehicles with this on-board preemption request equipment. While these vehicles have much better acceleration characteristics, and the added delay at signals while on their emergency runs is much lower, granting EVP to these vehicles may provide another benefit. The crossing of very wide and very busy signalized intersections is very difficult in today's traffic. Each year, many such emergency vehicles are "totaled" after being T-boned when crossing a busy intersection. EVP helps reduce and prevent this occurrence. Potential corridors for EVP deployments include Hammer Lane, Pacific Avenue, Pershing Avenue, West Lane, March Lane, Harding Way, and 8th Street.		X		$3,500		
1.6SJ	PORT OF STOCKTON ITS PROJECT	City of Stockton San Joaquin County	This project would enhance the existing staging areas utilized by the Port of Stockton for trucks waiting to enter the Port. The project would provide a monitoring system at both the Port and the two staging areas that would direct trucks, through a series of CMS, coming to the Port into the staging areas when the Port is backed up. The effort would establish a monitoring system using technologies such as CMS (5), CCTV (3), video detection system, and a workstation.			X	$ 300		
1.7SJ	INTEGRATED SMART CORRIDORS	Stockton FUA: City of Stockton San Joaquin County Caltrans District 10	This project would implement a package of ITS applications in a highway corridor consisting of at least one main route and one parallel route. The focus of the project would be to improve the level of coordination of traffic management activities on the main route and parallel route(s); in effect to conduct corridor-level rather than facility-specific ITS traffic management. The range of ITS applications that could be included in a smart corridor application include essentially the full range of freeway management, arterial street management (e.g., traffic signalization) and traveler information strategies, including surveillance and detection; incident management, including coordinated and dynamic traffic detouring strategies utilizing both the main and parallel route(s); changeable message signs; dynamic trailblazer signs; highway advisory radio; and integrated traffic signal operations, including coordination between ramp meters and adjacent traffic signals. The smart corridor project would feature implementation of a combination of ITS applications, with the emphasis being on linking operations across multiple facilities serving a defined travel corridor. Given the multi-facility nature of this project, the multi-jurisdictional coordination aspects of the project will be critical, including developing consensus on the specific objectives of the project and on the individual coordination procedures and technques. The first step in the development of this project would be to identify a candidate project corridor, based on accidents and congestion, travel patterns, availability of alternate routes and interest among the potential project partcipants.			X	$4,000		
1.8SJ	ADVANCED RAILROAD HIGHWAY INTERFACE TECHNOLOGY DEPLOYMENT	City of Stockton San Joaquin County	This project would deploy railroad-highway grade crossing technology at needed grade crossings with safety (high accident) and/or high volume and delay concerns. The objective of the project would use field validated strategies for improving safety, reducing delay and/or providing travelers with improved real-time information on grade crossing statu developed by the Kings County Advanced HRI Technology Deployment Demonstration project. The project could feature any combination of detection (both for trains and approaching vehicles), warning/traveler information, and control devices. Many different strategies are possible. Possible strategies include sensors coupled with message signs, in-vehicle devices and/or highway advisory radio that would provide approaching travelers with information on the expected duration of a crossing blockage. Another possible application would tie sensors to emergency vehicle dispatching systems to provide dispatchers and drivers with real time crossing status information. This project would use the blueprint for applying technology to enhance grade crossing safety developed by the demonstration project. One major cause of crashes at railroad grade crossings is the persistent presence of the heavy Tule fog in the Valley, and the inability for drivers to see grade crossings which are occupied with a train, usually in motion, until they are too close to stop. If some kind of train presence detection could be devised, and tied to an advance-warning beacon, approaching drivers would be forewarned about the dangerous situation. Such an active presence could be detected by an advanced detector, and need not involve the cooperation / joint solution with the railroad. Because of liability, railroads are not eager to create new and unproven detection or safety mechanisms; they have a well-defined program for active warning devices at the crossing which are very involved "systems" tied in with the railroad's own advance detection systems. The possibility of deploying an advanced technology solution, especially at locations where no active warning devices now exist, would be the basis for this project. Highway traffic at highway-rail intersections (HRIs) could be managed, where operational requirements demand advanced features (e.g., where rail operational speeds are greater than 80 miles per hour). This would include all capabilities from the Standard Railroad Grade Crossing and augments these with additional safety features to mitigate the risks associated with higher rail speeds. The active warning systems would include positive barrier systems, which preclude entrance into the intersection when the barriers are activated. Like the Standard Package, the HRI equipment is activated on notification by wayside interface equipment, which detects, or communicates with, the approaching train. The wayside interface equipment would provide additional information about the arriving train so that the train's direction of travel, estimated time of arrival, and the estimated duration of closure may be derived. This enhanced information may be conveyed to the driver prior to, or in context with, warning system activation. This would also include additional detection capabilities, enabling it to detect an entrapped or otherwise immobilized vehicle within the HRI and provide an immediate notification to highway and railroad officials.		X		$750		
1.9SJ	VANPOOL VEHICLE TRAFFIC PROBES	San Joaquin County	Several attempts to utilize transit vehicles as traffic probes have been undertaken around the United States and the world over the past several years. These efforts have met with mixed results for a few different reasons. The inherent, and unpredictable, stop and start nature of most transit vehicle trips does not lend itself well to judging the general flow of traffic. Algorithms, which have not always proven reliable, needed top be developed to account for passenger drop-off and pick-up activity. These implementations typically worked best on vehicles that made fewer and more predictable stops. Before the advent of geographic positioning systems (GPS), these systems employed roadside beacons, or similar technologies, to track vehicle location and progress over a pre-defined route. This was an infrastructure intensive solution that was relatively expensive to implement, especially compared to today's GPS based vehicle tracking systems. A GPS based system allows greater coverage to determine vehicle location, heading and velocity without the roadside infrastructure investment. Given the above information, the general assertion is that vehicle probes are most reliable and less expensive to implement on vehicles that travel longer distances, make fewer stops and utilize GPS technology. Long distance express transit buses and vanpools typically fit these criteria.	X			$ 500		
2.0 Incident Management/Emergency Services									
2.1SJ	ALTERNATE ROUTE DATABASE/ WEBSITE	San Joaquin County	This project would aid in the dissemination and utilization of alternate route plans by providing access to the plans via the Internet. During the needs identification process, it was noted that in many cases alternate routes plans to facilitiate traffic diversions during incidents, including accidents, construction and weather-related closures, do exist, but are not utilized to the extent they should be because some agencies are not aware of the plans and/or do not have convenient access to them. If successful, this project would make traffic diversions more coordinated and effective, including reducing the adverse impacts that detoured traffic imposes on alternate routes, and reducing the volume of traffic on roadway segments with hazardous conditions or heavy congestion. This project would focus on collecting and providing access to existing alternate route plans, although it would likely include some		X		$ 20		

ID	Program Area/Project	Involved Agency	Brief Description	Project Initiation* N	Project Initiation* M	Project Initiation* L	Capital Cost Estimates 2001 (Thousands of $)** Total Phase 1	Phase 2	Phase 3
			development of new plans to fill gaps, etc. In addition to the collection of plans and development of dissemination tools, this project should include agency discussions to stimulate understanding and use of the alternate route plans.						
2.2SJ	TRAFFIC SAFETY TASK FORCE	SJCOG, CHP, Caltrans, with heavy involvement from all other emergency service agencies.	This project would integrate radio communications among agenices that respond to incidents, such as local police, state patrol, fire departments, Caltrans, and local traffic agencies. The objective of the project would be to improve communications and thereby improve the effectiveness of incident management, resulting in reduced response times, reduced incident duration and associated traffic delays. Currently, most agencies that must, or should, work together during incidents cannot easily communicate with one another over their respective radio systems. This project would identify a specific study area and set of agencies, then identify and implement a solution to provide integrated communications. Depending on the existing equipment and approaches, the potential strategies to provide for integrated communications include both heavily capital intensive solutions, such as those involving major changes in communications infrastructure, and less intensive solutions, such as those that could involve changes in procedures, reprogramming of existing equipment, etc.		X		$150		
2.3SJ	PORTABLE CMS POOL	SJCOG, Caltrans, CHP, San Joaquin County, Stockton	This project will establish a pool of portable changeable message signs that would be made available to various public agencies for use in construction work zones, special event traffic control and other appropriate incident management applications. Currently, many agencies that could benefit from the signs cannot afford, or justify, purchase of the signs. Caltrans is the most likely candidate to purchase the signs and administer the lending program. For costing purposes, it has been assumed that 20 signs would be purchased. The signs could be made available at no cost or for a fee that would be less than that charged by commercial equipment rental companies. Agencies borrowing the signs may or may not financially contribute toward maintenance of the signs, depending on the funding source.	X			$150		
2.4SJ	ALTERNATE ROUTE SIGNING	Stockton FUA: City of Stockton San Joaquin County	This project would include the installation of 58 static alternate route signs within the County for designated detour routes. This project would implement changeable message signs specifically sited, and primarily devoted, to detouring traffic onto alternate routes during incidents, including accidents and weather related road closures. These signs could differ from the large, permanent changeable message signs deployed by Caltrans at key decision points in several respects. First, they would be sited in conjunction with a specific alternate route/detour strategy developed for a particular route and alternate routes. Second, the signs could be smaller than the Caltrans signs. Third, the signs could include features, such as arrows or flashing beacons that are not included on the traditional CMS. Finally, the alternate routes signs could be deployed as trailblazers along the alternate route, rather than merely in advance of the main route/alternate route decision point. The objective of this project would be to improve compliance with detours and reduce driver uncertainty along detour routes. If successful in reducing the volume of vehicles entering hazardous or congested roadway segments, this project holds the potential to reduce congestion, delay and accidents. In order to be successful, it would be critical that this project include development of an alternate route plan and procedures to support the usage of the signs, and that this plan be effectively linked to an overall multi-agency coordinated incident management strategy. This project would also require a commitment on behalf of the operating agency to devote the time and attention necessary to utilize the signs effectively. Even more so than a single CMS, keeping the dynamic message signs current and accurate would be critical	X	X		$ 1,740		
3.0 Transit Systems									
3.1SJ	TRANSIT MANAGEMENT SYSTEM (TrMS) UPGRADES	San Joaquin Regional Transit District	This project would provide funding to implement a transit management system. A transit management system typically includes automatic vehicle location (AVL), computer-aided scheduling and dispatch software, mobile data terminals, automated schedule adherence monitoring, computer report generation and data management, and maintenance management software. Transit management systems may also include traveler information elements such as automated itinerary planning systems, station signs showing real-time vehicle arrival information, and Internet web sites. The project shall be consistent with other regional systems including Fresno Area Express, Golden Empire Transit and San Joaquin Regional Transit. In addition, the Transit Management System shall take into consideration other potential projects with overlapping components such as AVL. This project will build upon the *SMARTtrac* system implemented by the San Joaquin Regional Transit District, which is an advanced public transportation system that uses a Global Positioning System to track its buses and provide passengers with real-time bus arrival information. The *SMARTtrac* system is the first of its kind in the nation, integrating real-time vehicle location with an interactive voice response system (IVRS) providing bus stop arrival information. All bus stops in the Stockton Metropolitan Area and on Intercity routes connecting Lodi, Tracy, Lathrop and Manteca have been assigned a four-digit identification number. This number is located on the bus stop sign. A potential rider can call *SMARTtrac* and find out when the bus will reach the stop based on the location of the bus at the time of the call, which allows time to reach the stop just a few minutes before the bus arrives.		X	X	$2,000		
3.2SJ	TRANSIT INFORMATION SYSTEM	San Joaquin Regional Transit District	This project would implement a system for collecting, processing and disseminating transit information, including "static" information such as routes and schedules, and in the cases of those operators with vehicle tracking systems, real-time information such as estimated vehicle arrival times at specific locations. The objective of the project would be to improve the availability and accessibility of transit information, thereby making transit more convenient and increasing transit utilization. Transit users often site uncertainty in transit schedules, stops, fares and the timing of arrivals at specific stops as impediments. This project would establish a centralized transit information database, residing in a computer that would probably be housed at one of the San Joaquin Valley transit operations, or perhaps at a location, such as a Caltrans traffic management facility, where other traveler information is compiled. The project would include procedures and supporting communications infrastructure that would allow participating transit operators to submit information to the system. For static information, the communications system could be very minimal, such as via e-mail or Internet file transfer. The communications necessary to support real-time information would be more costly and elaborate and could include a dial-up or dedicated phone connection. The project would also include dissemination tools to make the information available to travelers. These tools could include an Internet web site, telephone information system, and kiosks.		X		$600		
3.3SJ	SMART NextBus Arrival Signs	San Joaquin Regional Transit District	This project would deploy dynamic message signs at selected higher-usage bus stops equipped with bus shelters. Currently, only one firm (NextBus) is providing this kind of service. Their equipment is placed on board transit vehicles, and GPS-derived current location and speed information is transmitted to NextBus computers at a remote location where the information is processed, and bus arrival prediction is then published to an Internet IP address. The IP address corresponds to a particular dynamic message sign. NextBus has a patent for this "arrival prediction using GPS coordinate data scheme, and their equipment combination uses a CDPD data modem to transmit the information from the bus to the NextBus servers. The cost for the CDPD "air time" may make this more expensive than in AT&T's coverage area. Also, once an initial installation is completed (using capital funding from some source), then the agency would need to continue the payments for CDPD air time (currently ~$60 per month per bus, and $30 per month per dynamic message sign. Once the service is in place, transit patrons would be able to determine real-time bus locations and expected arrival times at their bus stop. The dynamic message sign at the bus stop would be one source of this information, but NextBus also publishes the information in map form to an Internet website, and in WAP form to hand-held PDAs. The information would therefore also be accessible to transit dispatchers as well as agencies that oversee and/or fund transit operations. NextBus can provide a broad cross-section of transit operations data that would be useful to these 2 management groups as well.	X	X		$800		
3.4SJ	SAN JOAQUIN TRANSIT ELECTRONIC FARE PAYMENT	AC Transit, BART, Caltrain, Golden Gate Transit, SF Muni, Santa Clara Valley Transportation Authority (VTA).	This project would coordinate the fare payment systems of one or more transit systems, allowing riders to use the same fare media, such as a magnetic strip swipe card, interchangeably on any of the participating systems. The objective of this project would be to increase the convenience of fare payment for riders and promote transfers between systems. The introduction of electronic fare collection systems can also reduce fare handling costs for transit operators. Since a large number of County residents commute to the San Francisco Bay Area, it would be ideal to "piggyback" onto the systemwide electronic fare system now being developed for the Bay area (namely, TransLink). TransLink, a regional transit fare payment system using 'smart card' technology, is scheduled to launch as a demonstration project in the San Francisco Bay Area in mid-2001. The nine-county Bay Area will be first in the U.S. to have a single card that can be used on all forms of public transit in the region: buses, trains and ferries. The project began with the award of a contract to Motorola, Inc. in mid-1999. Motorola, Inc. is developing the system under contract to MTC. It is being developed in two phases to ensure that the system meets the needs of the Bay Area riding public and transit Operators. The six-month demonstration project will include approximately 5,000 transit riders using TransLink on six Bay Area transit systems (AC Transit, BART, Caltrain, Golden Gate Transit, SF Muni, and Santa Clara Valley Transportation Authority). The results of this demonstration will be thoroughly evaluated before the system is implemented regionwide (in 2002).			X	$2,000		

ID	Program Area/Project	Involved Agency	Brief Description	Project Initiation*			Capital Cost Estimates 2001 (Thousands of $)**		
				N	M	L	Total		
							Phase 1	Phase 2	Phase 3
			In addition to on-board fare collection equipment, this project would also include the computing and communications resources necessary to coordinate fare accounting among the participating agencies. This project could involve two or more agencies that do not have electronic fare payment systems (e.g., implement new equipment at all participating agencies), or expand upon a system already implemented by one or more agencies by equipping additional agencies.						
3.5SJ	**DEMAND-RESPONSIVE TRANSIT SYSTEM INTEGRATION STUDY**	San Joaquin County San Joaquin Regional Transit District	This project would fund a study of demand-responsive transit system integration strategies, culminating in a specific set of recommendations to implement strategies within specified transit agencies. The primary objective of integrating multiple demand-responsive transit services is to improve operating efficiency by reducing service redundancies and sharing vehicles, staff and scheduling/dispatch technology among agencies. These improvements result in an overall better quality of service to riders, and riders may benefit directly through enhanced schedule and/or destination options enabled through the integration of services across agencies. Typically, especially in county-based or rural oriented demand respsonsive transit environments, a number of different agencies operate within a given geographic area, providing service to many of the same destinations but often serving a slightly different client base. One of the primary objectives of demand-responsive transit service integration strategies is to reduce these redundancies and associated inefficiencies. Demand-responsive service integration includes a wide range of potential specific activities, ranging from simple coordination to full integration. Examples of specific strategies include consolidation of scheduling and/or dispatch functions (where multiple agencies can share the cost of improvements and share access), agreements to share access to vehicles under specified circumstances, and consolidation of ride reservation systems.		X		**$150**		
4.0 Traveler Information Systems									
4.1SJ	**METROPOLITAN TRAVELER INFORMATION SYSTEM**	San Joaquin County	This project would implement a comprehensive Integrated Traveler Information System (ITIS) that includes the following systems: • Closed Circuit Television (CCTV) • System Detection • Changeable Message Signs (CMS) • Highway Advisory Radio (HAR) • Public Information Database (PIDB) • Traveler Advisory Telephones (TAT) • Community Access Television (CATV) information system • HAR/HAT Voice-Response System • Kiosks • Communication Network The goal of the system is to disseminate timely and reliable traffic congestion information along the major arterial streets within the Stockton FUA. System detector data would be collected, analyzed and disseminated via the ITIS. In addition, this information can be shared with the regional ATMS including Caltrans and the County. This information can be provided to the public through an Internet website, a telephone advisory system, and interactive touch-screen kiosks located at strategic locations. To complement the system, links should be made with TravInfo. TravInfo is an open access traveler information system in the San Francisco Bay Area. The Field Operational Test took place over a two-year period from September 1996 to September 1998 with funding from the Federal Highway Administration and the California Department of Transportation (Caltrans). TravInfo provides a free public service of real-time traffic information through a phone line, FM data broadcast, and the Internet with the goal to broadly disseminate accurate, comprehensive, timely, and reliable information on traffic conditions and multi-modal travel options to the public in the Bay Area.		X	X	**$400**		
5.0 Regional ITS Configuration Management/Coordination/Planning									
5.1SJ	**DATA EXCHANGE NETWORK (DEN)/** **COMMUNICATIONS INTERTIES**	Valleywide through Regional TMC's City of Stockton San Joaquin County Caltrans District 10	The project would develop logical data exchange network partnerships, initially focus on the urbanized areas of the County. Presumably the County and Caltrans would also be involved in the partnerships. In addition, the logical interties between Caltrans District 6, the County and major cities of the County. In general, local agencies that partner and interconnect more than one agency with Caltrans have been more successful in obtaining state and federal funding than those proposals that intertie only one agency to Caltrans. Data exchange networks are typically set up in areas where several jurisdictions are interested in collectively sharing information from their respective traffic management systems. The most common information shared is from traffic signal systems. While information exchange on the network can be used to more efficiently monitor multiple signal systems, the network usually doesn't allow for field device control or system interoperability. However, those capabilities can be included depending on user needs. Data exchange networks depend on some type of communication infrastructure (dedicated agency owned or leased line) and software to exchange information. Communication intertie projects can establish some of the necessary communication links for a data exchange network. Data exchange networks differ from interties in that data exchange networks typically focus on the network connectivity and "logical" protocols of sharing data among several agencies. Interties typically focus on the "physical" communication link between agencies. Both, interties and data exchange networks can form the basis and initial implementation of the "center to center" portion of a Regional Architecture. Communications intertie projects typically take place between a Caltrans Transportation Management Center (TMC) and a local agency TMC/Traffic Operations Center (TOC). To be most effective, the Caltrans TMC and the local agency would be required to have centralized command and control of traffic management systems and field devices within their respective jurisdictions. In other areas of California, intertie projects allow Caltrans and the local agency to more efficiently share transportation management information, including but not limited to: traffic flow and congestion information, weather information, incident information, video images and in some cases, signal timing plans and modes. In some cases, shared control of a limited number and type of field devices has been arranged between agencies. While full control of one another's assets (field devices, signal systems, etc.) is technically possible it may not be a desired arrangement institutionally. The most important element of an intertie project is a communication link between the intertie agencies. This can either be a dedicated agency owned asset (fiber or copper wire) or some type of telco lease line technology (T1, ISDN or DSL). Another major element of an intertie project is the software, protocols, and interfaces that would allow for the exchange of information between different systems. Interties differ from data exchange networks (see Data Exchange Network fact sheet) in that interties focus on the "physical" communication link between agencies. Data exchange networks typically focus on the network conectivity and "logical" protocols of sharing data among several agencies. Both, interties and data exchange networks can form the basis and initial implementation of the "center to center" portion of a Regional Architecture.			X	**$300**		
			Total Estimated Capital Deployment Costs for All Potential ITS Projects Over 20 Years						**$33,560+**

Notes:

* Project initiation timeframes - N = Years 1-5, M = Years 6-10, L = Years 11+

**All capital costs are approximate and rounded for purposes of this table.

Table A.10: Timeline of Stockton FUA ITS Projects

	NEAR TERM					MID-TERM					LONG TERM										TOTAL COSTS
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
1.0 Traffic/Freeway Management Systems (ATMS)																					
1.1(L) CITY OF STOCKTON EXPANSION OF ATMS AND CENTRAL CONTROL SYSTEM, PHASE 2																					$9,700
1.2(L) CALTRANS TRAFFIC OPERATION SYSTEMS (TOS) GAP CLOSURE PROJECT (REGION)																					$2,000
1.3(L) COMMUNICATIONS INTERTIE PROJECT BETWEEN STOCKTON, COUNTY AND CALTRANS																					$3,000
1.4(L) URBAN AREA TRAFFIC SIGNAL COORDINATION PROJECT																					$1,500
1.5(L) DVP DEPLOYMENTS																					$3,500
1.6(L) PORT OF STOCKTON ITS PROJECT																					$300
1.7(L) INTEGRATED SMART CORRIDORS																					$4,000
1.8(L) ADVANCED RAILROAD HIGHWAY INTERFACE TECHNOLOGY DEPLOYMENT																					$750
1.9(L) VANPOOL VEHICLE TRAFFIC PROBES																					$500
2.0 Incident Management/Emergency Services																					
2.1(L) ALTERNATE ROUTE DATABASE/WEBSITE																					$20
2.2(L) TRAFFIC SAFETY TASK FORCE																					$100
2.3(L) PORTABLE CMS POOL																					$150
2.4(L) ALTERNATE ROUTE SIGNING																					$1,740
3.0 Transit Systems																					
3.1(L) TRANSIT MANAGEMENT SYSTEM (TRMS) UPGRADES																					$2,000
3.2(L) TRANSIT INFORMATION SYSTEM																					$600
3.3(L) SMART NEXTBUS ARRIVAL SIGNS																					$800
3.4(L) SAN JOAQUIN TRANSIT ELECTRONIC FARE PAYMENT																					$2,000
3.5(L) DEMAND RESPONSIVE TRANSIT SYSTEM INTEGRATION STUDY																					$150
4.0 Traveler Information System																					
4.1(L) METROPOLITAN TRAVELER INFORMATION SYSTEM																					$400
5.0 Regional ITS Configuration Management/ Coordination/ Planning																					
5.1(L) DATA EXCHANGE NETWORK (DEN)/COMMUNICATIONS INTERFACE																					$300
																					$33,560

Revised September 28, 2001

Phase 1 Deployment
Phase 2 Deployment
Phase 3 Deployment

Notes:

1. *All values are displayed in 2001 dollars*
2. *Timeline does not reflect operations and maintenance timeframes*
3. *All budget estimates are preliminary and should be utilized for planning purposes only*

Figure A.9: Sequence of Proposed ITS Implementation Activities for Stockton FUA

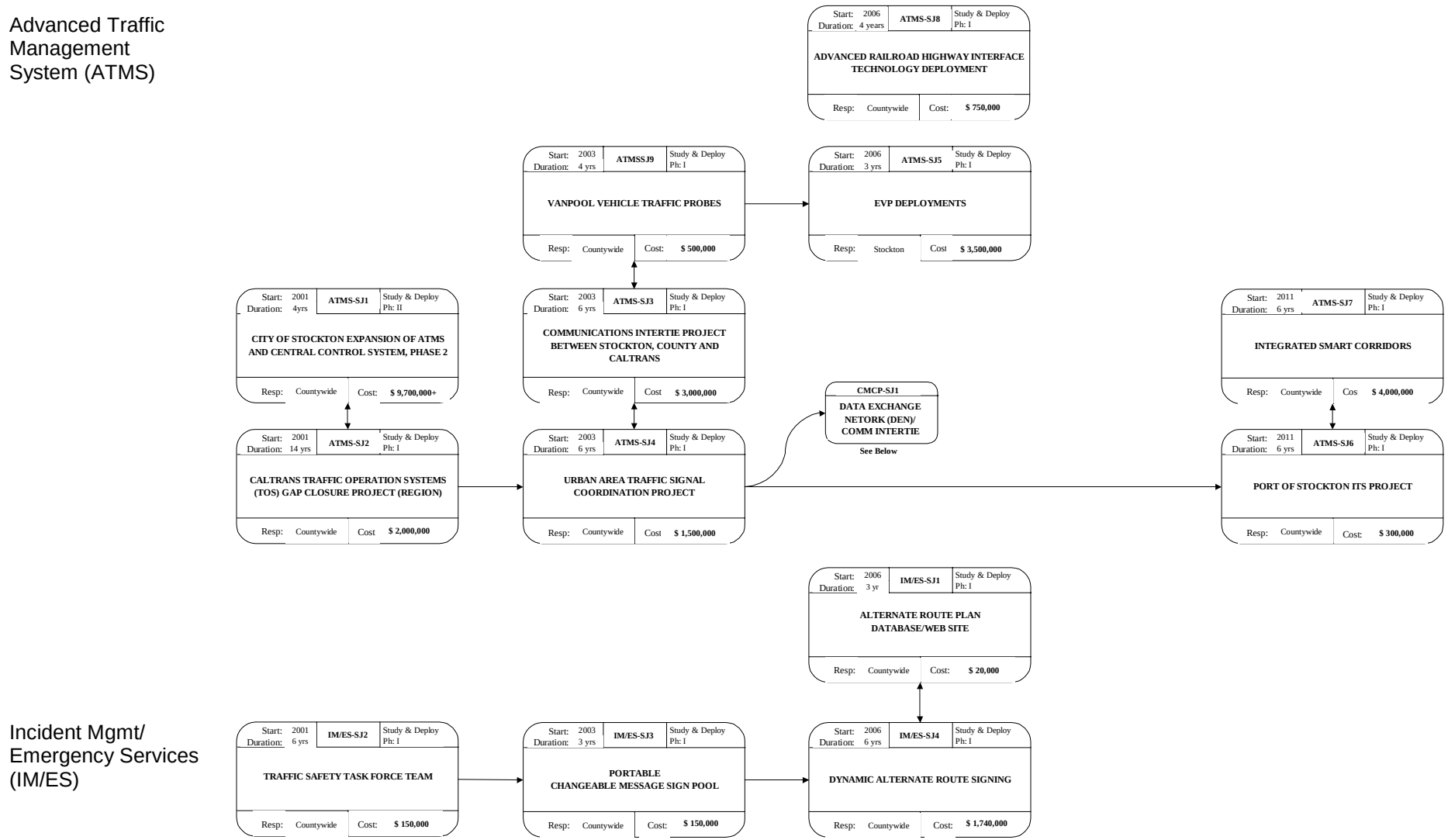

Figure A.9: Sequence of Proposed ITS Implementation Activities for the Stockton FUA (cont)

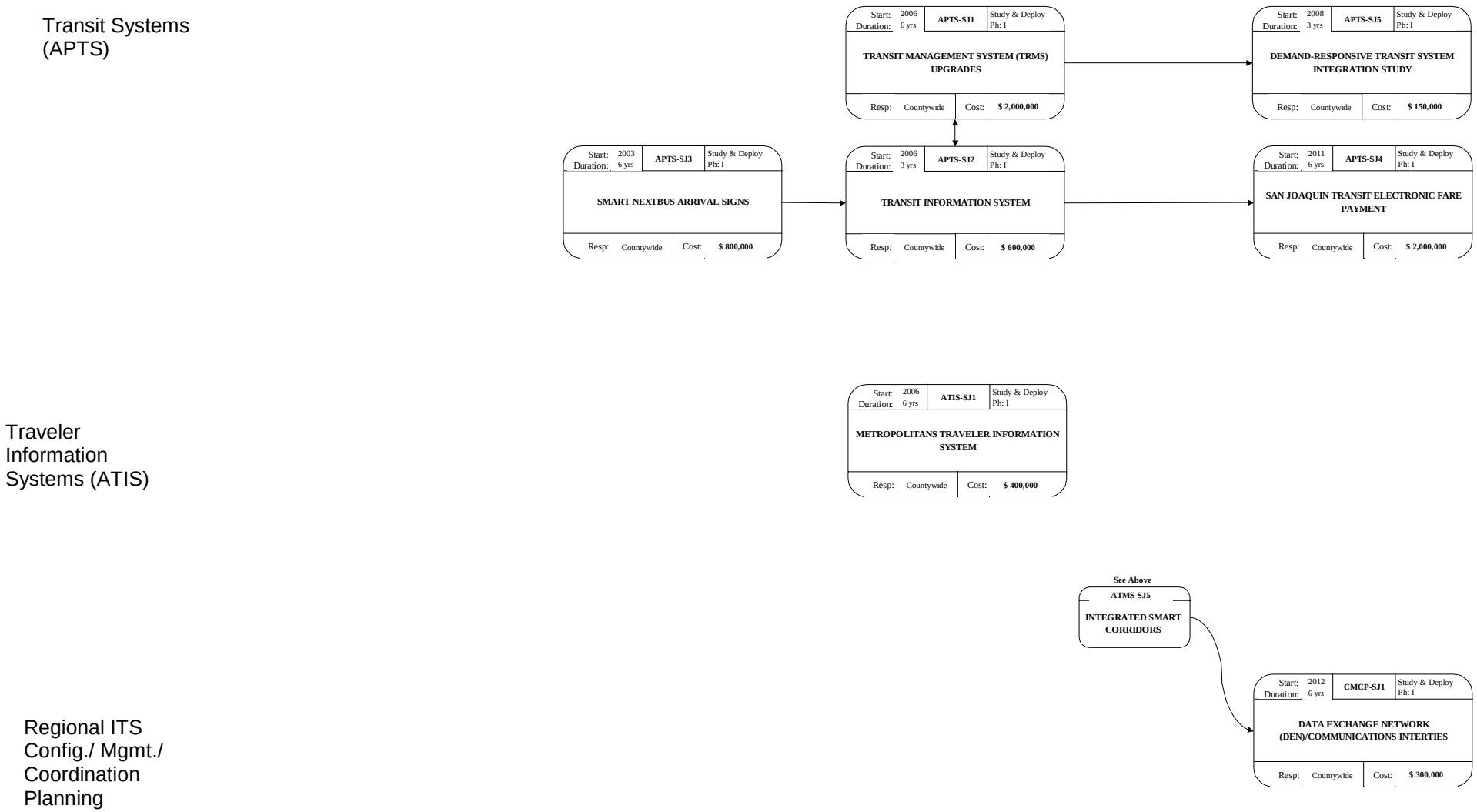

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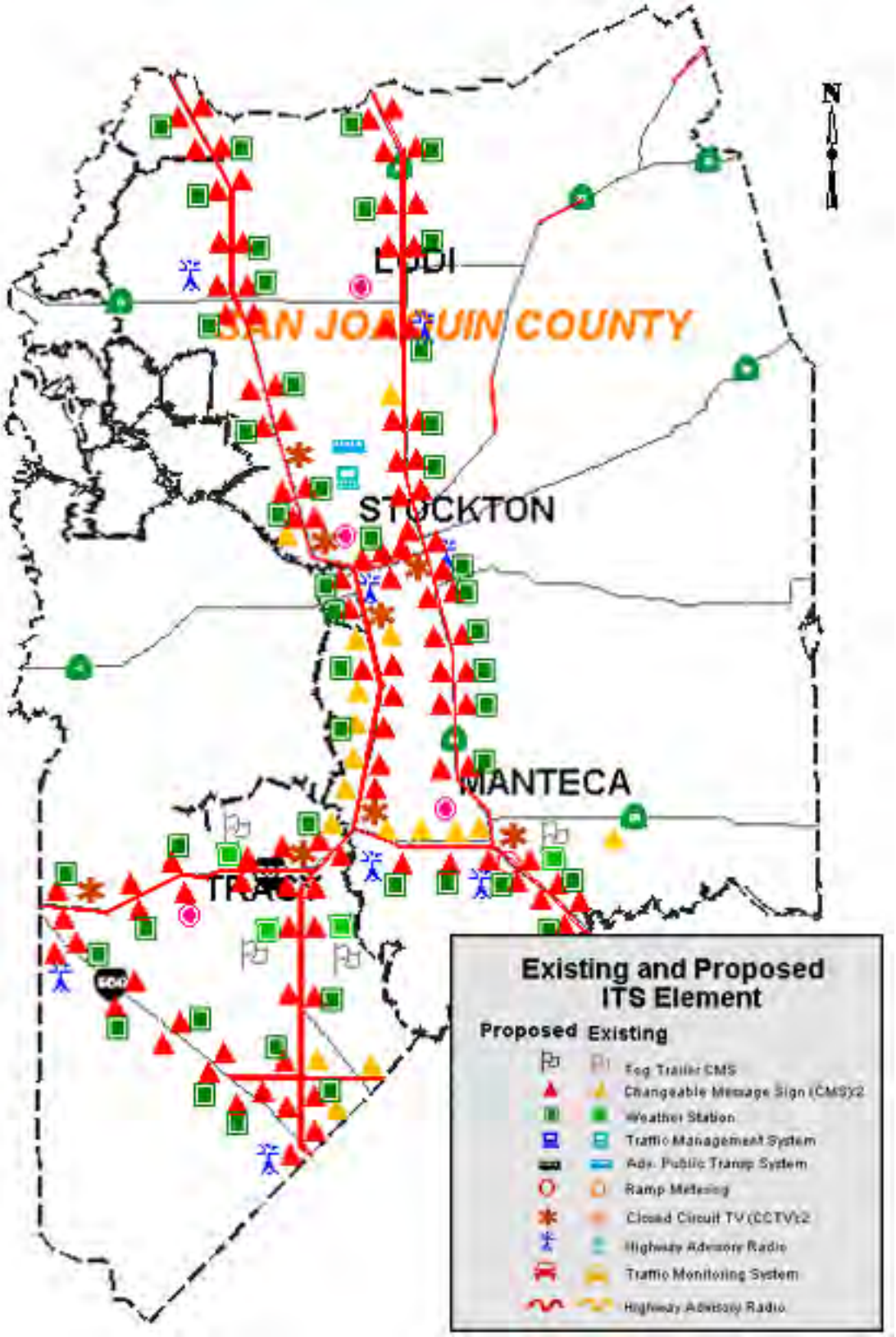
Figure A.10: Existing and Proposed ITS Elements for Stanislaus County



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1.6 Kern County

The total estimated capital deployment costs for all potential ITS projects over 20 years is $19,122,000.

1.6.1 TRAFFIC/FREEWAY MANAGEMENT SYSTEMS (ATMS)

1.6.1.1 EVP Deployments

General Description:

The project would implement Emergency Vehicle Preemption (EVP) along key arterials throughout the County for use by City and County fire departments. The implementation EVP at a traffic signal modifies normal signal operation to provide a nearly immediate green signal for an approaching emergency vehicle. This type of system is most often deployed on fire trucks because of the nature of the fire truck vehicle performance. The acceleration rate of fire trucks is rather slow due to their relatively low power-to-weight ratio. If fire trucks must slow down (and sometimes stop) when they encounter signalized intersections along their emergency run, the overall delay in responding to their emergency destination can easily exceed 1 to 2 minutes. For fire events, this delay can mean a significant difference in the level of destruction, the level of effort in suppressing the fire, the level of personal danger for firefighters at the scene, and the number and extent of injuries for victims. Depending on the level of congestion and the distance traveled, fire trucks can encounter many traffic signals, and heavy congestion. Driving in oncoming traffic lanes is a "last resort" maneuver, which fire departments rightly avoid. If the fire truck encounters a red signal, it can assert the right of way and go through, but only after gaining assurance that it can safely cross through the intersection. EVP isn't needed in every community. Only when traffic congestion is very significant, or only when long emergency vehicle runs are likely to encounter a large number of signalized intersections, would the provision of EVP be cost effective. Some cities in the Central Valley already have EVP in place, the 3M Opticom™ system being predominant. Priority request equipment would be installed in each fire truck and matching reception equipment would be installed at each signalized intersection where EVP is to be granted.

Some larger agencies that have used EVP for many years have broadened the application to also equip ambulance vehicles and, in some cases, police vehicles with this on-board preemption request equipment. While these vehicles have much better acceleration characteristics, and the added delay at signals while on their emergency runs is much lower, granting EVP to these vehicles may provide another benefit. The crossing of very wide and very busy signalized intersections is very difficult in today's traffic. Each year, many such emergency vehicles are "totaled" after being T-boned when crossing a busy intersection. EVP helps reduce and prevent this occurrence. However, this project assumes only fire department vehicles would be equipped with EVP devices

Project Objectives:

- Design and deploy EVP devices at strategic locations throughout the City to reduce delay occurred at traffic signals during emergency response.
- Improve emergency response to major incidents.
- Reduce potential for accidents between motorists and emergency vehicles.

Sponsorship: Kern County and City of Bakersfield

Deployment Phasing: This project is a single-phase deployment.

	Phase Components
Phase 1	➢ Evaluate and deploy EVP at strategic locations and corridors. ➢ Deploy EVP sensors at appropriate traffic signals and emergency vehicles.

Deployment Locations: Bakersfield Urban Area

Deployment Timeframes: This project is a near term deployment.

	Phase Timelines
Phase 1	Near Term

Benefits:

- Improved response time for emergency vehicles.
- Reduction in accidents between motorists and emergency vehicles.

Budget Estimate:

	Phase Budget Estimates	
	Capital Costs	**Operations and Maintenance Per Year**
Phase 1	$1,500K	$150K
Totals	$1,500K	$150K

Evaluation Criteria:

- *MOE*
  - Reduction in accidents between motorists and emergency vehicles
  - Emissions reduction
  - Survey of public perceptions
  - Emergency vehicle response time
  - Delay at traffic signals
- *MOS*
  - O&M costs

1.6.1.2 Bakersfield TOC Expansion, Phase II

General Description:

In order to accommodate Kern ITS with the City of Bakersfield TOC acting as the regional TOC for Kern (particularly for traveler information) certain aspects and elements will require improvements. Spatial requirements will include additional racks for the traveler information system server; a

workstation for the traveler information system operator, including furniture; and all additional associated hardware, such as additional monitors. Live video feeds to the media will involve upgrades to the traveler information system, and, potentially, upgrades to the TOC. This component may include a monitor for each media feed, in order to verify the view being received by the news stations. Future expansion plans of the TOC should consider region-wide ITS needs, especially the traveler information system, in addition to City of Bakersfield needs.

The upgrade can be achieved through one of the following alternatives:· Expanding the existing TOC if space is available· Moving the TOC to Control 5· Moving the TOC to the Superintendent of Schools building in downtown Bakersfield· Moving the TOC to a new, dedicated building at a site to be determined at a later date.

The following are changes identified in the City of Bakersfield Traffic Operations Center report to expand the opening day TOC should it need to function as a temporary regional TMC. These changes can also be used to temporarily convert the TOC to accommodate a traveler information system. ·

- The TOC room can be enlarged to allow for console expansion·
- CCTV monitors can be added to the video wall·
- The console can be shifted and two additional workstations added·
- The "offline" desk can be re-oriented for partial video wall viewing·
- File cabinet space can be added for storage of TOC related files·
- The workspace south of the conference room can be replaced by storage area.

The Equipment Room and racks should be able to contain the additional equipment associated with the expanded console and CCTV monitors. The racks, when purchased for opening day, should be, at a minimum, 6 feet in height and secured to the back wall to prevent movement. All equipment in the rack should be mounted on drawer slides that pull completely out of the rack for access to the back panel. Cable management will be important to this design. The City could also alter the location of each equipment rack, so that both the front and back of the rack are accessible.

The phasing will involve the upgrades described above, to accommodate the region-wide ATIS in the short term. Eventually, permanent changes will be required to accommodate the long-term enhancements and upgrades. Live video feed(s) to the media should be planned for the short-term as well. Additional phases should be determined as new region-wide projects are introduced into the Kern ITS. Regional systems and technologies should be co-located with the City of Bakersfield TOC and the traveler information system as much as is reasonable. For example, rural ITS may eventually expand enough to warrant a rural TOC in the future. Until this time, the City of Bakersfield TOC should be considered the regional TOC, with all future systems planned for integration with the systems in the TOC.

Project Objectives:

- Accommodate traveler information system and future countywide ITS functions

Sponsorship: City of Bakersfield

Deployment Phasing: This project is a single-phase deployment.

	Phase Components
Phase 1	➢ Design and deploy the field elements and monitoring system

Deployment Locations: City of Bakersfield

Deployment Timeframes: This project is a near to midterm deployment.

	Phase Timelines
Phase 1	Near to Mid Term

Benefits:

- Emissions reduction.
- Improving the communications systems will improve monitoring of staging areas.

Budget Estimate:

	Phase Budget Estimates	
	Capital Costs	**Operations and Maintenance Per Year**
Phase 1	$500K	$50K
Totals	$500K	$50K

Evaluation Criteria:

- *MOE*
  - Miles of congested freeway
  - Freeway travel times
  - Time needed for operations staff to monitor/control field devices
- *MOP*
  - Connection/data transfer times/rates from field devices to the monitoring system
- *MOS*
  - Mean-time between system failures
  - O&M costs

O&M Considerations: There are no particular O&M considerations for this project. However, if the communications backbone is to be shared by agencies other than the Port, then some form of coordination and cost-sharing agreement may be necessary.

1.6.1.3 Communications Links with Bakersfield SONET Network, Phase II

General Description:

The Bakersfield Communication Master Plan defined a fiber optic, SONET backbone for the City of Bakersfield, dedicated to ITS and other transportation needs. This backbone will need to be enhanced to be used as the network for Kern ITS. It is imperative that this backbone be constructed in a manner that will provide the central communications necessary for Kern ITS. Since the SONET is currently sized only for the City of Bakersfield needs, upgrades will be necessary and included as a part of this Communications Network Development Plan. This means that any additional fibers, which are needed for Kern ITS over and above the current SONET design (which accommodates only the City of Bakersfield's projected future needs), will need to be funded as part of this Kern Communication Network Development Plan.

Links to the SONET network will allow any connected agency to communicate with any other agency. Physical communication links will be fiber, hardwire, or wireless. The microwave network owned and operated by the Office of the Superintendent of Schools in Kern should be analyzed and strongly considered to be used as the communication medium wherever possible. The cost effective use of the Internet (specifically the world wide web) should be considered as well. An extranet, or private Internet (as opposed to intranets) could be easily utilized to provide the links between the different jurisdictions and agencies. Communication will allow operators to share information and to discuss strategies, the exchange of weather and traffic information through the advanced traveler information system (to be described later), and, potentially, the sharing of field elements. Cooperative agreements will be necessary among all agencies in order to address control issues. Cooperative agreements are discussed further as a part of the Traffic and Incident Mangement Program.

The overall objective of the Communication Link component of this program is to provide a means of communicating among all agencies involved in Kern transportation (and ITS) in order to allow for interagency coordination and cooperation, information sharing, and shared field element control.
There is currently a link from Kern County's Control 5 Communication System to the City of Bakersfield via two-way radio. Since the City of Bakersfield will be an actual node on the SONET network, this is technically an existing link. This link should be replaced, however, with fiber, as is recommended in the Bakersfield Communication Master Plan. This will allow for communication with the traveler information system. No other links exist.

Through CMAQ federal funds, approximately 85% of the conduit (not the fiber) for the SONET network is programmed for installation.

Caltrans District 6 should be the first link made. (Bakersfield is not listed as a location because it is an actual node on the network and, therefore, is not considered a link). Since the Smart Call Boxes (the second component of the Communication Network Development Program) will communicate with the system through Caltrans (by way of CHP), this link will be important in retrieving critical weather and traffic information, especially from the rural areas of Kern. This link should be obtained through leased services. If District 6 lays fiber down one of the major north-south freeways (I-5 or SR 99) in the future, the fiber should be considered for the connection to the SONET network.

Kern County should be linked next, because of the number of traffic signals in the urban area. Multi-jurisdictional signal coordination will be facilitated by this link.

The rural workstations and Kern COG should be linked next. (Rural traveler information workstations are described as a part of the Kern Informed Traveler Program later.) These links, each of which may be

funded by different sources, will enhance the system by connecting the urban and rural portions of the region. The links will provide the urban-rural combination central to Kern's ITS vision. Incident management, traveler information, and traffic management will all be facilitated and enhanced by these links. Links will probably be achieved through leased services.

Emergency services located at the County Communication Center should be linked through Control 5. Providing emergency response programs with real-time congestion and weather information will enable emergency response teams to better route vehicles for faster response times. The link can also be used for incident management coordination, for direct lines from the TMCs to the emergency sercvices, which need to be dispatched. The City of Bakersfield Communication Master plan specifically allocates four of twenty-four fibers on the SONET network for Control 5. This leg of the network should be constructed as shown in the plan.

The final links should be the Kern Regional Transit and GET connections. The transit agencies will benefit more from the traveler information system after the other links are in place, and the system is built and integrated. By providing each one of these systems a link to the network the two transit systems will also be connected. This, aside from providing traveler information, will enable coordination between the two transit systems for route scheduling and transfers.

Project Objectives:

- Provide for coordination with Bakersfield SONET Network.
- Provide minor communications upgrades for the Region to communicate with the State network.

Sponsorship: Kern County and City of Bakersfield

Deployment Phasing: This project is a single-phase deployment.

	Phase Components
Phase 1	➢ Staff time to coordinate with Statewide communications efforts. ➢ Additional communications equipment for connecting the Bakersfield SONET Network to the Statewide network.

Deployment Locations: Countywide

Deployment Timeframes: This project is a near mid term deployment.

	Phase Timelines
Phase 1	Near to Mid Term

Benefits:

- N/A – requirement for communication outside of the Region.

Budget Estimate:

	Phase Budget Estimates	
	Capital Costs	Operations and Maintenance Per Year
Phase 1	$6,500K	$650K
Totals	$6,500K	$650K

Evaluation Criteria:

- N/A

O&M Considerations: N/A

Architecture Considerations: Compliance with Caltrans Statewide communications standards will be required. Coordination between agencies to establish and maintain common standards would be critical.

1.6.1.4 Integrated Smart Corridors

General Description:

This project would implement a package of ITS applications in a highway corridor consisting of at least one main route and one parallel route. The focus of the project would be to improve the level of coordination of traffic management activities on the main route and parallel route(s); in effect to conduct corridor-level rather than facility-specific ITS traffic management. The range of ITS applications that could be included in a smart corridor application include essentially the full range of freeway management, arterial street management (e.g., traffic signalization) and traveler information strategies, including surveillance and detection; incident management, including coordinated and dynamic traffic detouring strategies utilizing both the main and parallel route(s); changeable message signs; dynamic trailblazer signs; highway advisory radio; and integrated traffic signal operations, including coordination between ramp meters and adjacent traffic signals. The smart corridor project would feature implementation of a combination of ITS applications, with the emphasis being on linking operations across multiple facilities serving a defined travel corridor. Given the multi-facility nature of this project, the multi-jurisdictional coordination aspects of the project will be critical, including developing consensus on the specific objectives of the project and on the individual coordination procedures and techniques. The first step in the development of this project would be to identify a candidate project corridor, based on accidents and congestion, travel patterns, availability of alternate routes and interest among the potential project participants.

Project Objectives:

- Design and deploy appropriate ITS infrastructure along the proposed smart corridors.
- Develop common standards for ATMS functions.
- Consider the integration of freeway and major arterial operations (managing the overall transportation network).
- Design and develop integrated corridor system tools that can be deployed throughout the Region.

Sponsorship: Kern County, City of Bakersfield, and Caltrans District 6

Deployment Phasing: This project is a single-phase deployment.

	Phase Components
Phase 1	➢ Fiber communications ➢ Smart corridor including appropriate (CMS, CCTV, HAR, and freeway/arterial integration)

Deployment Locations: Bakersfield urban area

Deployment Timeframes: This project is a mid term deployment.

	Phase Timelines
Phase 1	Mid Term

Benefits:

General Benefits:

- The Smart Corridor Project for the City of Los Angeles involving I-10 and adjacent arterials is an example of an "integrated" ITS system. A preliminary evaluation of this system was performed to evaluate its impacts. It was estimated that total travel time along the Smart Corridor would be reduced by 11 to 15%. Intersection delay is expected to be reduced by nearly 20%. Vehicle emission will generally decrease as follows: CO (15%), HC (8%). Freeway speeds during peak hours will increase by nearly 70 to 80 %. Stop-and-go freeway conditions will decrease substantially. Average surface street speeds during peak periods will increase by nearly 11%. These same benefits are anticipated for the Fresno County project. A conservative 8% reduction in travel time is assumed for benefit-cost analysis.
- The Information for Motorist (INFORM) program in Long Island, New York, is an integrated program using changeable message signs, ramp meters, in-road traffic detectors, and signal coordination on parallel streets. INFORM has increased rush hour speeds on Long Island from 34 mph to 46 mph. Drivers will divert to an alternate route 5% to 10% of the time when passive messages are displayed on electronic signs, and will divert even more frequently when the message recommends an alternate route.
- Integrated systems have the ability to lower costs by sharing infrastructure, staff, and equipment cost among a number of services and agencies. An analysis performed for the US DOT ITS Joint Program Office indicated that incorporation of the full metropolitan ITS infrastructure into a regional transportation improvement plan could reduce the cost of infrastructure expansion by approximately one-half. The analysis was based on published data regarding VMT growth, infrastructure component benefits, and FHWA cost estimates.
- In Detroit, Michigan, an expansion of the freeway management system is expected to reduce delays from incidents by about 40%. This could lead to an annual reduction of 41.3 million gallons of fuel used, a reduction of 122,000 tons of carbon monoxide, 1,400 tons hydrocarbons, and 1,200 tons of nitrogen oxides.

Emissions Reductions:

- See above.

- Smart Corridor projects reduce emissions by decreasing delay and traffic flow breakdown along congested facilities. The extent of emissions reduction is largely a function of the extent of congestion, volume of traffic, type of traffic management devices/operations, and the number of incidents along the facility in question. Generally, it should be possible to estimate emissions reduction by determining the likely reduction in either the number of incidents or the duration of these incidents and applying this to the affected vehicles.
- As with signal coordination, Smart Corridors are implementations of devices and the operation of those devices. It is essential that a sound operational plan be in place to take full advantage of Smart Corridor operations.

Budget Estimate:

	Phase Budget Estimates	
	Capital Costs	**Operations and Maintenance Per Year**
Phase 1	$1917K	$130K
Totals	$1917K	$130K

Fiber-optic deployment costs based on a unit cost of $25/LF. Design costs were assumed to be 15% of capital costs, and contingencies were 15% of capital costs for traditional project components and 30% for software development.

Evaluation Criteria:

- MOE
  - Traffic delays (arterial/freeway)
  - Number of primary and secondary incidents
  - Emissions reduction
  - Diverted traffic volumes
  - Survey of public perceptions

O&M Considerations: Smart Corridors are very dependent on interagency cooperation and coordination. Generally, specific response plans must be developed for each portion of the corridor to prescribe how agencies will react in certain situations. Continued coordination and the setting and following of common standards throughout ITS deployment will greatly assist the development of the Smart Corridor concept.

Architecture Considerations: Prerequisite efforts include software integration/systems elements of county projects. It may also prove helpful to review market packages ATMS 1, 3, 4, 6, and 7, as well as ATMS 8.

1.6.1.5 Kern County Smart Studs Demonstration Project

General Description:

Smart Studs are an upgrade of the traditional reflective road studs used on most roads for delineating lanes. The Studs are solar powered and use a microprocessor for hazard sensing and processing. The Smart Studs can sense fog, blowing dust, surface water, ice, or any number of obstacles. The Studs can be used to provide weather warnings, lane guidance, and proximity warnings through colored, flashing lights within the reflectors. They can be mounted on the pavement (lane delineation) or on hazard posts (on shoulders). The objective of the Smart Studs is to reduce the number and severity of incidents due to poor weather and visibility on highways.

In the San Joaquin Valley, the primary hazards are fog and blowing dust during the late fall and winter months. During wet years, fog will dominate during periods of non-frontal activity, decreasing visibilities over large areas for extended periods of time. Blowing dust occurs in all three regions. In the valley blowing dust usually occurs during dry winter months when farmland is not under production.

Project Objectives:

- Improve driver recognition of the conditions surrounding them.
- Reduce the potential for large-scale incidents through the use of advisory speeds and improved roadway delineation.
- Reduce the number of incidents in poor weather conditions.

Sponsorship: Kern County, City of Bakersfield, and Caltrans District 6

Deployment Phasing: This project is a single-phase deployment.

	Phase Components
Phase 1	➢ Study of the locations of VSS and IRS deployments. ➢ Deployment of VSS along key facilities (1/4 mile increments). ➢ Deployment of IRS along facilities. ➢ Procurement of VSS misc. support equipment and software.

Deployment Locations: Countywide

Deployment Timeframes: This project is a near term deployment.

	Phase Timelines
Phase 1	Near Term

Benefits:

General Benefits:

- Improved notification to the driver of roadway/travel conditions will improve driver safety.

- Improved information to the travelers on the nature of the weather conditions confronting them both at their current location and down the road.
- Enhanced motorist safety.
- Reduction in the number and severity of incidents.
- Reduced number of accidents at deployed locations, and reduced number of major incidents during poor weather conditions.

Emissions Reductions:

- Emissions reductions may result from this project by a reduction in the number and severity of major incidents in poor weather conditions. Reduction estimates can be made by comparing the number of major incidents, hours of delay, and number of vehicles involved in poor weather conditions. The actual estimated emissions reduced by limiting such major incidents are usually quite significant, but apply to only a few days out of any one-year. This means that the overall reduction potential of this project type may be somewhat limited as relatively few large scale incidents occur each year, and then only under special weather conditions such as blowing dust or fog.
- Reduction in number of major incidents would lead to emissions reductions.

Budget Estimate:

	Phase Budget Estimates	
	Capital Costs	**Operations and Maintenance Per Year**
Phase 1	$2,500K	$170K
Totals	$2,500K	$170K

Unit costs were assumed to be $50,000 per VSS and $15,000 per IRS increment (1/4 mile deployment). Any communications necessary would be available through other projects.

Evaluation Criteria:

- MOE
  - Number of incidents
  - Number of VSS activations/speed adjustments
  - Public perceptions of the accuracy of VSS data/IRS effectiveness
  - Number of single vehicle incidents
  - Number of “reckless driving” citations
- MOS
  - Mean-time between failures
  - O&M costs

O&M Considerations: None.

Architecture Considerations: The Region should continue to follow the testing efforts by Caltrans in the use of IRS. The ITS SDP for Kern County also indicates the potential deployment of IRS, and the potential for a joint procurement should be considered.

1.6.1.6 Alternate Route Signing

General Description:

This project would include the installation of 70 static alternate route signs within the County for designated detour routes by implementing changeable message signs specifically sited, and primarily devoted, to detouring traffic onto alternate routes during incidents, including accidents and weather related road closures. These signs could differ from the large, permanent changeable message signs deployed by Caltrans at key decision points in several respects. First, they would be sited in conjunction with a specific alternate route/detour strategy developed for a particular route and alternate routes. Second, the signs could be smaller than the Caltrans signs. Third, the signs could include features, such as arrows or flashing beacons that are not included on the traditional CMS. Finally, the alternate routes signs could be deployed as trailblazers along the alternate route, rather than merely in advance of the main route/alternate route decision point. The objective of this project would be to improve compliance with detours and reduce driver uncertainty along detour routes. If successful in reducing the volume of vehicles entering hazardous or congested roadway segments, this project holds the potential to reduce congestion, delay and accidents. In order to be successful, it would be critical that this project include development of an alternate route plan and procedures to support the usage of the signs, and that this plan be effectively linked to an overall multi-agency coordinated incident management strategy. This project would also require a commitment on behalf of the operating agency to devote the time and attention necessary to utilize the signs effectively. Even more so than a single CMS, keeping the dynamic message signs current and accurate would be critical

Project Objectives:

- Provide efficient routing around major incidents on the highway system.
- Design and deploy alternate route signs.

Sponsorship: Kern County and City of Bakersfield

Deployment Phasing: This project is a single-phase deployment.

	Phase Components
Phase 1	➢ Identify potential sign locations. ➢ Design and deploy CMS at strategic locations

Deployment Locations: Bakersfield Urban Area

Deployment Timeframes: This project is a mid to long term deployment.

	Phase Timelines
Phase 1	Mid to Long Term

Benefits:

- Improved mobility
- Reduced congestion related to highway incidents
- Improved traffic management
- Reduced delay time to major incidents
- Reduced impact on adjacent communities

Budget Estimate:

	Phase Budget Estimates	
	Capital Costs	**Operations and Maintenance Per Year**
Phase 1	$3,000K	$300K
Totals	$3,000K	$300K

Evaluation Criteria:

- *MOE*
  - Travel Time
  - Delay
  - Incident work zone safety

O&M Considerations: Operational and maintenance costs were estimated at $2,000 per location.

1.6.1.7 Roadside Weather Information Stations (RWIS) with CCTV

General Description:

This project would extend coverage of weather stations for the entire Kern region. The objectives of the weather stations and CCTV cameras are to obtain and verify adverse weather conditions in the rural areas of Kern. In the San Joaquin Valley, the primary hazards are fog and blowing dust during the late fall and winter months. During wet years, fog will dominate during periods of non-frontal activity, decreasing visibilities over large areas for extended periods of time. Blowing dust occurs in all three regions. In the valley it usually occurs during dry winter months when farmland is not under production. Associated with blowing dust is the hazard of high winds, which can occur in all three regions, but is most prevalent in the desert and mountain areas. Rain, snow and ice are precipitation hazards which exist in the mountain region during the winter months, affecting the two main interstate routes, I-5 and SR 58.Existing weather stations which are not within sight of the monitoring agency, should be outfitted with CCTV cameras for verification of weather conditions.

Weather stations which combine a variety of technologies, coupled with CCTV cameras for verification (especially in rural areas), can provide an accurate picture of weather conditions region-wide in real-time. Available technologies include visibility sensors, precipitation intensity and type sensors, wind speed/direction sensors, and pressure transducer sensors. Visibility sensors use infrared technology to measure visibility constraints as the result of various sources such as precipitation, fog, haze, dust, and

smoke. Precipitation intensity and type sensors use infrared technology to measure and classify precipitation. Humidity/Air Temperature sensors measure relative humidity and temperature. Wind Speed/Direction sensors monitor wind speed (mph) and direction (bearing). Pressure transducer sensors detect water levels in flood channels. Caltrans operates five weather stations in Kern: two on I-5 and three in Tehachapi on SR 58. These stations are linked via cellular phone service to the TMCs in Fresno and Bishop. Caltrans currently has no plans for additional weather stations in Kern. Kern County operates a system of twenty-five rain gauge stations located throughout the County. Some of these stations have additional capabilities for measuring wind, temperature and humidity. In addition, the County gathers data from remote weather stations owned and maintained by private corporations.

These remote weather stations automatically transmit information to a dedicated weather data computer located at the County communication center. Daily weather data is also collected manually at each County fire station and called in to the County communication center, where it is placed in the weather computer database. The database of weather information is accessed by the national weather service and various water and other agencies. The national weather service disseminates this information, along with weather forecasts, to the CHP and Caltrans. This project assumes the installation of 5 RWIS in Kern County, in addition to the 30 RWIS being installed as part of the Valleywide ITS project.

Project Objectives:

- Design and deploy roadside weather information station field elements, including CCTV equipment.

Sponsorship: Kern County, City of Bakersfield, and Caltrans District 6

Deployment Phasing: This project is a single-phase deployment.

	Phase Components
Phase 1	➢ Install roadside weather information stations with CCTV

Deployment Locations: Countywide

Deployment Timeframes: This project is a near term deployment.

	Phase Timelines
Phase 1	Near Term

Benefits:

- Improve highway safety
- Aid in traffic surveillance and management activities

Budget Estimate:

	Phase Budget Estimates	
	Capital Costs	Operations and Maintenance Per Year
Phase 1	$375K	$40K
Totals	$375K	$40K

1.6.2 INCIDENT MANAGEMENT/EMERGENCY SERVICES

1.6.2.1 Kern County Coordinated Incident Management Procedures

General Description:

Whether the incident management within Kern is done manually or automatically (with the assistance of a DSS) coordinated incident management procedures will be necessary. Since there will be several agencies involved in the incident management in Kern (County of Kern, City of Bakersfield, Caltrans, CHP, and rural cities), it will be most efficient and beneficial to all if strategies are coordinated among the agencies. All agencies will agree upon the strategies to be used. Strategies will include signal and ramp meter timing plans (when applicable), text for display on CMS's and Trailblazers, messages to be recorded on HAR's, and other responses to incidents. Emergency response teams and, potentially, commuter services (similar to the Freeway Service Patrol in other areas) for different geographic areas of the region should be established as a part of this component.

Policies will also be developed which outline the responsibilities and limits of each agency under different scenarios. If field devices are to be shared as a part of traffic and incident management, details of the control agreements (standard operating procedures) will be logged along with the cooperative agreements. These operating procedures outline details such as: which field elements may be controlled by which agencies, and under what circumstances. Standard operating procedures also define after-hours operations of entire systems by other agencies (e.g. Caltrans District 6 operating the County of Kern's system after hours to enable monitoring on a 24-hour basis).

The objective of establishing coordinated incident management procedures is to ensure that incident management in Kern is coordinated among and agreed upon by all agencies. Caltrans District 6 TMC has incident management procedures established. Since these procedures cover various jurisdictions, including surrounding counties (Fresno, Kings, Tulare, and Madera) they should be used as a starting point for the establishment of region-wide, multi-jurisdictional agreements.

Project Objectives:

- Develop common procedures/ standards incident management procedures.

Sponsorship: KernCOG

Deployment Phasing: This project is a single-phase deployment.

	Phase Components
Phase 1	➢ Development of a Regional Traffic Safety Plan for large-scale interagency incidents.

Deployment Locations: Countywide

Deployment Timeframes: This project is a long term deployment.

	Phase Timelines
Phase 1	Long Term

Benefits:

- Enhanced interagency coordination and communications
- Provides an interagency structure upon which deployment efforts can be constituted
- Provides institutional structure necessary to support interagency incident management coordination.

Budget Estimate:

	Phase Budget Estimates	
	Capital Costs	**Operations and Maintenance Per Year**
Phase 1	$30K	$0K
Totals	$30K	$0K

1.6.3 TRANSIT SYSTEMS

1.6.3.1 Demand Responsive Transit System Integration Study

General Description:

This project would fund a study of demand-responsive transit system integration strategies, culminating in a specific set of recommendations to implement strategies within specified transit agencies. The primary objective of integrating multiple demand-responsive transit services is to improve operating efficiency by reducing service redundancies and sharing vehicles, staff and scheduling/dispatch technology among agencies. These improvements result in an overall better quality of service to riders, and riders may benefit directly through enhanced schedule and/or destination options enabled through the integration of services across agencies. Typically, especially in county-based or rural oriented demand responsive transit environments, a number of different agencies operate within a given geographic area, providing service to many of the same destinations but often serving a slightly different client base. One of the primary objectives of demand-responsive transit service integration strategies is to reduce these redundancies and associated inefficiencies. Demand-responsive service integration includes a wide range of potential specific activities, ranging from simple coordination to full integration. Examples of specific strategies include consolidation of scheduling and/or dispatch functions (where multiple agencies can share the cost of improvements and share access), agreements to share access to vehicles under specified circumstances, and consolidation of ride reservation systems.

Project Objectives:

- Improve paratransit efficiency by providing coordinated operations and improved system purchasing power.

Sponsorship: KernCOG and Golden Empire Transit (GET)

Deployment Phasing: This project is a single-phase deployment.

	Phase Components
Phase 1	➢ Prepare a study of the feasibility of integrated services.

Deployment Locations: Countywide

Deployment Timeframes: This project is a mid term deployment.

	Phase Timelines
Phase 1	Mid Term

Benefits:

- Improved paratransit service Countywide

Budget Estimate:

	Phase Budget Estimates	
	Capital Costs	**Operations and Maintenance Per Year**
Phase 1	$750K	$75K
Totals	$750K	$75K

1.6.3.2 Common Fare Equipment Deployment

General Description:

This project would coordinate the fare payment systems of one or more transit systems, allowing riders to use the same fare media, such as a magnetic strip swipe card, interchangeably on any of the participating systems. The objective of this project would be to increase the convenience of fare payment for riders and promote transfers between systems. The introduction of electronic fare collection systems can also reduce fare-handling costs for transit operators.

In addition to on-board fare collection equipment, this project would also include the computing and communications resources necessary to coordinate fare accounting among the participating agencies. This project could involve two or more agencies that do not have electronic fare payment systems (e.g., implement new equipment at all participating agencies), or expand upon a system already implemented by one or more agencies by equipping additional agencies.

Project Objectives:

- Establish a common regional transit fare system.
- Simplify fares for transit patrons.

Sponsorship: Golden Empire Transit (GET)

Deployment Phasing: This project is a single-phase deployment.

	Phase Components
Phase 1	➢ Perform a needs definition and installation plan. ➢ Procurement of fare management software, workstations, and interface equipment. ➢ Deployment of new fare system on transit vehicles

Deployment Locations: Countywide

Deployment Timeframes: This project is a near to mid term deployment.

	Phase Timelines
Phase 1	Near to Mid Term

Benefits:

General Benefits:

- Improve regional integration of the transit fare system.
- Benefits patrons making transfers.
- Improves extent and quality of information available to transit managers.
- Allows for integration with the TrMS.

Emissions Reductions:

- No specific emissions reductions can be associated with this project.

Budget Estimate:

	Phase Budget Estimates	
	Capital Costs	**Operations and Maintenance Per Year**
Phase 1	$2,000K	$120K
Totals	$2,000K	$120K

Evaluation Criteria:

- Number of units deployed and mean time between failures.

O&M Considerations: None

Architecture Considerations: The Transit Systems Workgroup should establish regional standards for fare systems deployment based on existing/emerging national standards. Reference market package APTS 4 of the National Architecture.

1.6.4 TRAVELER INFORMATION SYSTEMS

Currently, there are no Traveler Information System projects proposed for the County.

1.6.5 REGIONAL ITS CONFIGURATION MANAGEMENT/COORDINATION/PLANNING

1.6.5.1 Kern County Regional communication Links

General Description:

Communication links to other regions in California and surrounding areas, will enable coordination among agencies and will optimize information gathering and dissemination for incident and traffic management purposes. These links are all estimated for future deployment (ten to twenty years), but are listed here to emphasize the importance of establishing these links as soon as is feasible and cost-effective. Ultimately these links will become part of a statewide system.

The objective of the statewide/regional communications links is to enable travelers to receive information from areas outside of the immediate region and to facilitate incident management and traffic control activities by sharing information among agencies. SR 58, which runs east west through the Kern region, links with I-40 to the east of Kern. An Early Deployment Plan has recently been completed for this I-40 Corridor as it traverses northern Arizona. Traveler information systems will be implemented and enhanced for all segments of the route, including the segment through Kern County (SR 58) as a result of these EDPs. The high percentages of tourist and truck traffic on this route makes the integration of the various traveler information systems highly desirable to advise travelers of safety and road closure issues on this route.

Project Objectives:

- Provide for coordination with Caltrans Statewide communications activities.
- Provide minor communications upgrades for the Region to communicate on the State network.

Sponsorship: Kern County and City of Bakersfield

Deployment Phasing: This project is a single-phase deployment.

	Phase Components
Phase 1	➢ Staff time to coordinate with Regional communications efforts. ➢ Additional communications equipment for connecting the RIW network to the Regional network.

Deployment Locations: Countywide

Deployment Timeframes: This project is a near to mid term deployment.

	Phase Timelines
Phase 1	Near to Mid Term

Benefits:

- N/A – requirement for communication outside of the Region.

Budget Estimate:

	Phase Budget Estimates	
	Capital Costs	**Operations and Maintenance Per Year**
Phase 1	$50K	$10K
Totals	$50K	$10K

Evaluation Criteria:

- N/A

O&M Considerations: N/A

Architecture Considerations: Compliance with Caltrans Statewide communications standards will be required. Coordination between agencies to establish and maintain common standards will be critical.

Table A.11: Summary of Kern County ITS Projects

ID	Program Area/Project	Involved Agency	Brief Description	Project Initiation*			Capital Cost Estimates 2001 (Thousands of $)**		
				N	M	L	Total		
							Phase 1	Phase 2	Phase 3
KERN COUNTY									
1.0 Traffic/Freeway Management Systems (ATMS)									
1.1KE	**EVP DEPLOYMENTS**	Bakersfield Urban Area Kern County City of Bakersfield	The project would implement Emergency Vehicle Preemption (EVP) along key arterials throughout the County for use by City and County fire departments. The implementation EVP at a traffic signal modifies normal signal operation to provide a nearly immediate green signal for an approaching emergency vehicle. This type of system is most often deployed on fire trucks because of the nature of the fire truck vehicle performance. The acceleration rate of fire trucks is rather slow due to their relatively low power-to-weight ratio. If fire trucks must slow down (and sometimes stop) when they encounter signalized intersections along their emergency run, the overall delay in responding to their emergency destination can easily exceed 1 to 2 minutes. For fire events, this delay can mean a significant difference in the level of destruction, the level of effort in suppressing the fire, the level of personal danger for firefighters at the scene, and the number and extent of injuries for victims. Depending on the level of congestion and the distance traveled, fire trucks can encounter many traffic signals, and heavy congestion. Driving in oncoming traffic lanes is a "last resort" maneuver, which fire departments rightly avoid. If the fire truck encounters a red signal, it can assert the right of way and go through, but only after gaining assurance that it can safely cross through the intersection. EVP isn't needed in every community. Only when traffic congestion is very significant, or only when long emergency vehicle runs are likely to encounter a large number of signalized intersections, would the provision of EVP be cost effective. Some cities in the Central Valley already have EVP in place, the 3M Opticom™ system being predominant. Priority request equipment would be installed in each fire truck and matching reception equipment would be installed at each signalized intersection where EVP is to be granted. Some larger agencies that have used EVP for many years have broadened the application to also equip ambulance vehicles and, in some cases, police vehicles with this on-board preemption request equipment. While these vehicles have much better acceleration characteristics, and the added delay at signals while on their emergency runs is much lower, granting EVP to these vehicles may provide another benefit. The crossing of very wide and very busy signalized intersections is very difficult in today's traffic. Each year, many such emergency vehicles are "totaled" after being T-boned when crossing a busy intersection. EVP helps reduce and prevent this occurrence. However, this project assumes only fire department vehicles would be equipped with EVP devices.	X			**$1,500**		
1.2KE	**BAKERSFIELD TOC EXPANSION, PHASE II**	City of Bakersfield	In order to accommodate Kern ITS with the City of Bakersfield TOC acting as the regional TOC for Kern (particularly for traveler information) certain aspects and elements will require improvements. Spatial requirements will include additional racks for the traveler information system server; a workstation for the traveler information system operator, including furniture; and all additional associated hardware, such as additional monitors. Live video feeds to the media will involve upgrades to the traveler information system, and, potentially, upgrades to the TOC. This component may include a monitor for each media feed, in order to verify the view being received by the news stations. Future expansion plans of the TOC should consider region-wide ITS needs, especially the traveler information system, in addition to City of Bakersfield needs. The upgrade can be achieved through one of the following alternatives: • Expanding the existing TOC if space is available • Moving the TOC to Control 5 • Moving the TOC to the Superintendent of Schools building in downtown Bakersfield • Moving the TOC to a new, dedicated building at a site to be determined at a later date The objective of the Bakersfield TOC upgrade component is to accommodate the traveler information system and future county-wide ITS functions. The following are changes identified in the City of Bakersfield Traffic Operations Center report to expand the opening day TOC should it need to function as a temporary regional TMC. These changes can also be used to temporarily convert the TOC to accommodate a traveler information system. • The TOC room can be enlarged to allow for console expansion • CCTV monitors can be added to the video wall • The console can be shifted and two additional workstations added • The "offline" desk can be re-oriented for partial video wall viewing • File cabinet space can be added for storage of TOC related files • The work space south of the conference room can be replaced by storage area The Equipment Room and racks should be able to contain the additional equipment associated with the expanded console and CCTV monitors. The racks, when purchased for opening day, should be, at a minimum, 6 feet in height and secured to the back wall to prevent movement. All equipment in the rack should be mounted on drawer slides that pull completely out of the rack for access to the back panel. Cable management will be important to this design. The City could also alter the location of each equipment rack, so that both the front and back of the rack are accessible. The phasing will involve the upgrades described above, to accommodate the region-wide ATIS in the short term. Eventually, permanent changes will be required to accommodate the long-term enhancements and upgrades. Live video feed(s) to the media should be planned for the short-term as well. Additional phases should be determined as new region-wide projects are introduced into the Kern ITS. Regional systems and technologies should be co-located with the City of Bakersfield TOC and the traveler information system as much as is reasonable. For example, rural ITS may eventually expand enough to warrant a rural TOC in the future. Until this time, the City of Bakersfield TOC should be considered the regional TOC, with all future systems planned for integration with the systems in the TOC.	X	X		**$500**		

ID	Program Area/Project	Involved Agency	Brief Description	Project Initiation*			Capital Cost Estimates 2001 (Thousands of $)**		
				N	M	L	Total		
							Phase 1	Phase 2	Phase 3
1.3KE	**COMMUNICATION LINKS WITH BAKERSFIELD SONET NETWORK, PHASE II**	Kern County City of Bakersfield	The Bakersfield Communication Master Plan defined a fiber optic, SONET backbone for the City of Bakersfield, dedicated to ITS and other transportation needs. This backbone will need to be enhanced to be used as the network for Kern ITS. It is imperative that this backbone be constructed in a manner that will provide the central communications necessary for Kern ITS. Since the SONET is currently sized only for the City of Bakersfield needs, upgrades will be necessary and included as a part of this Communications Network Development Plan. This means that any additional fibers which are needed for Kern ITS over and above the current SONET design (which accommodates only the City of Bakersfield's projected future needs), will need to be funded as part of this Kern Communication Network Development Plan. Links to the SONET network will allow any connected agency to communicate with any other agency. Physical communication links will be either fiber, hardwire, or wireless. The microwave network owned and operated by the Office of the Superintendent of Schools in Kern should be analyzed and strongly considered to be used as the communication medium wherever possible. The cost effctive use of the Internet (specifically the world wide web) should be considered as well. An extranet, or private internet (as opposed to intranets) could be easily utilized to provide the links between the different jurisdictions and agencies. Communication will allow operators to share information and to discuss strategies, the exchange of weather and traffic information through the advanced traveler information system (to be described later), and, potentially, the sharing of field elements. Cooperative agreements will be necessary among all agencies in order to address control issues. Cooperative agreements are discussed further as a part of the Traffic and Incident Mangement Program. The overall objective of the Communication Link component of this program is to provide a means of communicating among all agencies involved in Kern transportation (and ITS) in order to allow for interagency coordination and cooperation, information sharing, and shared field element control. There is currently a link from Kern County's Control 5 Communication System to the City of Bakersfield via two-way radio. Since the City of Bakersfield will be an actual node on the SONET network, this is technically an existing link. This link should be replaced, however, with fiber, as is recommended in the Bakersfield Communication Master Plan. This will allow for communication with the traveler information system. No other links are existing. Through CMAQ federal funds, approximately 85% of the conduit (not the fiber) for the SONET network is programmed for installation. Caltrans District 6 should be the first link made. (Bakersfield is not listed as a location because it is an actual node on the network and, therefore, is not considered a link). Since the Smart Call Boxes (the second component of the Communication Network Development Program) will communicate with the system through Caltrans (by way of CHP), this link will be important in retrieving critical weather and traffic information, especially from the rural areas of Kern. This link should be obtained through leased services. If District 6 lays fiber down one of the major north-south freeways (I-5 or SR 99) in the future, the fiber should be considered for the connection to the SONET network. Kern County should be linked next, because of the number of traffic signals in the urban area. Multi-jurisdictional signal coordination will be facilitated by this link. The rural workstations and Kern COG should be linked next. (Rural traveler information workstations are described as a part of the Kern Informed Traveler Program later.) These links, each of which may be funded by different sources, will enhance the system by connecting the urban and rural portions of the region. The links will provide the urban-rural combination central to Kern's ITS vision. Incident management, traveler information, and traffic management will all be facilitated and enhanced by these links. Links will probably be achieved through leased services. Emergency services located at the County Communication Center should be linked through Control 5. Providing emergency response programs with real-time congestion and weather information will enable emergency response teams to better route vehicles for faster response times. The link can also be used for incident management coordination, for direct lines from the TMCs to the emergency sercvices which need to be dispatched. The City of Bakersfield Communication Master plan specifically allocates four of twenty-four fibers on the SONET network for Control 5. This leg of the network should be constructed as shown in the plan. The final links should be the Kern Regional Transit and GET connections. The transit agencies will benefit more from the traveler information system after the other links are in place, and the system is built and integrated. By providing each one of these systems a link to the network the two transit systems will also be connected. This, aside from providing traveler information, will enable coordination between the two transit systems for route scheduling and transfers.	X	X		**$6,500**		
1.4KE	**INTEGRATED SMART CORRIDORS**	Bakersfield urban area with Caltrans Kern County City of Bakersfield Caltrans District 6	This project would implement a package of ITS applications in a highway corridor consisting of at least one main route and one parallel route. The focus of the project would be to improve the level of coordination of traffic management activities on the main route and parallel route(s); in effect to conduct corridor-level rather than facility-specific ITS traffic management. The range of ITS applications that could be included in a smart corridor application include essentially the full range of freeway management, arterial street management (e.g., traffic signalization) and traveler information strategies, including surveillance and detection; incident management, including coordinated and dynamic traffic detouring strategies utilizing both the main and parallel route(s); changeable message signs; dynamic trailblazer signs; highway advisory radio; and integrated traffic signal operations, including coordination between ramp meters and adjacent traffic signals. The smart corridor project would feature implementation of a combination of ITS applications, with the emphasis being on linking operations across multiple facilities serving a defined travel corridor. Given the multi-facility nature of this project, the multi-jurisdictional coordination aspects of the project will be critical, including developing consensus on the specific objectives of the project and on the individual coordination procedures and technques. The first step in the development of this project would be to identify a candidate project corridor, based on accidents and congestion, travel patterns, availability of alternate routes and interest among the potential project partcipants.		X	X	**$1,917**		
1.5KE	**KERN COUNTY SMART STUDS DEMONSTRATION PROJECT**	Kern County City of Bakersfield Caltrans District 6	Smart Studs are an upgrade of the traditional reflective road studs used on most roads for delineating lanes. The Studs are solar powered and use a microprocessor for hazard sensing and processing. The Smart Studs can sense fog, blowing dust, surface water, ice, or any number of obstacles. The Studs can be used to provide weather warnings, lane guidance, and proximity warnings through colored, flashing lights within the reflectors. They can be mounted on the pavement (lane delineation) or on hazard posts (on shoulders). The objective of the Smart Studs is to reduce the number and severity of incidents due to poor weather and visibility on highways. In the San Joaquin Valley, the primary hazards are fog and blowing dust during the late fall and winter months. During wet years, fog will dominate during periods of non-frontal activity, decreasing visibilities over large areas for extended periods of time. Blowing dust occurs in all three regions. In the valley blowing dust usualy occurs during dry winter months when farm land is not under production.	X			**$ 2,500**		

ID	Program Area/Project	Involved Agency	Brief Description	Project Initiation*			Capital Cost Estimates 2001 (Thousands of $)**		
				N	M	L	Total		
							Phase 1	Phase 2	Phase 3
1.6KE	**ALTERNATE ROUTE SIGNING**	Bakersfield Urban Area Kern County City of Bakersfield	This project would include the installation of 70 static alternate route signs within the County for designated detour routes. This project would implement changeable message signs specifically sited, and primarily devoted, to detouring traffic onto alternate routes during incidents, including accidents and weather related road closures. These signs could differ from the large, permanent changeable message signs deployed by Caltrans at key decision points in several respects. First, they would be sited in conjunction with a specific alternate route/detour strategy developed for a particular route and alternate routes. Second, the signs could be smaller than the Caltrans signs. Third, the signs could include features, such as arrows or flashing beacons, that are not included on the traditional CMS. Finally, the alternate routes signs could be deployed as trailblazers along the alternate route, rather than merely in advance of the main route/alternate route decision point. The objective of this project would be to improve compliance with detours and reduce driver uncertainty along detour routes. If successful in reducing the volume of vehicles entering hazardous or congested roadway segments, this project holds the potential to reduce congestion, delay and accidents. In order to be successful, it would be critical that this project include development of an alternate route plan and procedures to support the usage of the signs, and that this plan be effectively linked to an overall multi-agency coordinated incident management strategy. This project would also require a commitment on behalf of the operating agency to devote the time and attention necessary to utilize the signs effectively. Even more so than a single CMS, keeping the dynamic message signs current and accurate would be critical		X	X	**$ 3,000**		
1.7KE	**ROADSIDE WEATHER INFORMATION STATIONS (RWIS) WITH CCTV**	Kern County City of Bakersfield Caltrans District 6	This project would extend coverage of weather stations for the entire Kern region. The objectives of the weather stations and CCTV cameras are to obtain and verify adverse weather conditions in the rural areas of Kern. In the San Joaquin Valley, the primary hazards are fog and blowing dust during the late fall and winter months. During wet years, fog will dominate during periods of non-frontal activity, decreasing visibilities over large areas for extended periods of time. Blowing dust occurs in all three regions. In the valley it usually occurs during dry winter months when farm land is not under production. Associated with blowing dust is the hazard of high winds, which can occur in all three regions, but is most prevalent in the desert and mountain areas. Rain, snow and ice are precipitation hazards which exist in the mountain region during the winter months, affecting the two main interstate routes, I-5 and SR 58. Existing weather stations which are not within sight of the monitoring agency, should be outfitted with CCTV cameras for verification of weather conditions.Weather stations which combine a variety of technologies, coupled with CCTV cameras for verification (especially in rural areas), can provide an accurate picture of weather conditions region-wide in real-time. Available technologies include visability sensors, precipitation intensity and type sensors, wind speed/direction sensors, and pressure transducer sensors. Visibility sensors use infrared technology to measure visibility constraints as the result of various sources such as preciptation, fog, haze, dust, and smoke. Precipitation intensity and type sensors use infrared technology to measure and classify precipitation. Humidity/Air Temperature sensors measure relative humidity and temperature. Wind Speed/Direction sensors monitor wind speed (mph) and direction (bearing). Pressure transducer sensors detect water levels in flood channels. Caltrans operates five weather stations in Kern: two on I-5 and three in Tehachapi on SR 58. These stations are linked via cellular phone service to the TMCs in Fresno and Bishop. Caltrans currently has no plans for additional weather stations in Kern. Kern County operates a system of twenty-five rain gauge stations located throughout the County. Some of these stations have additional capabilities for measuring wind, temperature and humidity. In addition, the County gathers data from remote weather stations owned and maintained by private corporations. These remote weather stations automatically transmit information to a dedicated weather data computer located at the County communication center. Daily weather data is also collected manually at each County fire station and called in to the County communication center, where it is placed in the weather computer database. The database of weather information is accessed by the national weather service and various water and other agencies. The national weather service disseminates this information, along with weather forecasts, to the CHP and Caltrans. This project assumes the installation of 5 RWIS in Kern County, in addition to the 30 RWIS being installed as part of the Valleywide ITS project.	X	X		**$ 375**		
2.0 Incident Management/Emergency Services									
2.1KE	**KERN COUNTY COORDINATED INCIDENT MANAGEMENT PROCEDURES**	KernCOG	Whether the incident management within Kern is done manually or automatically (with the assistance of a DSS) coordinated incident management procedures will be necessary. Since there will be several agencies involved in the incident management in Kern (County of Kern, City of Bakersfield, Caltrans, CHP, and rural cities), it will be most efficient and beneficial to all if strategies are coordinated among the agencies. All agencies will agree upon the strategies to be used. Strategies will include signal and ramp meter timing plans (when applicable), text for display on CMSs and Trailblazers, messages to be recorded on HARs, and other responses to incidents. Emergency response teams and, potentially, commuter services (similar to the Freeway Service Patrol in other areas) for different geographic areas of the region should be established as a part of this component. Policies will also be developed which outline the responsibilities and limits of each agency under differnet scenarios. If field devices are to be shared as a part of traffic and incident management, details of the control agreements (standard operating procedures) will be logged along with the cooperative agreements. These operating procedures outline details such as: which field elements may be controlled by which agencies, and under what circumstances. Standard operating proceures also define after-hours operations of entire systems by other agencies (e.g. Caltrans District 6 operating the County of Kern's system after hours to enable monitoring on a 24-hour basis). The objective of establishing coordinated incident management procedures is to ensure that incident management in Kern is coordinated among and agreed upon by all agencies. Caltrans District 6 TMC has incident management procedures established. Since these procedures cover various jurisdictions, including surrounding counties (Fresno, Kings, Tulare, and Madera) they should be used as a starting point for the establishment of region-wide, multi-jurisdictional agreements.			X	**$30**		
3.0 Transit Systems									
3.1KE	**DEMAND-RESPONSIVE TRANSIT SYSTEM INTEGRATION STUDY**	KernCOG Golden Empire Transit (GET)	This project would fund a study of demand-responsive transit system integration strategies, culminating in a specific set of recommendations to implement strategies within specified transit agencies. The primary objective of integrating multiple demand-responsive transit services is to improve operating efficiency by reducing service redundancies and sharing vehicles, staff and scheduling/dispatch technology among agencies. These improvements result in an overall better quality of service to riders, and riders may benefit directly through enhanced schedule and/or destination options enabled through the integration of services across agencies. Typically, especially in county-based or rural oriented demand respsonsive transit environments, a number of different agencies operate within a given geographic area, providing service to many of the same destinations but often serving a slightly different client base. One of the primary objectives of demand-responsive transit service integration strategies is to reduce these redundancies and associated inefficiencies. Demand-responsive service integration includes a wide range of potential specific activities, ranging from simple coordination to full integration. Examples of specific strategies include consolidation of scheduling and/or dispatch functions (where multiple agencies can share the cost of improvements and share access), agreements to share access to vehicles under specified circumstances, and consolidation of ride reservation systems.		X	X	**$750**		
3.2E	**COMMON FARE EQUIPMENT DEPLOYMENT**	Golden Empire Transit (GET)	This project would coordinate the fare payment systems of one or more transit systems, allowing riders to use the same fare media, such as a magnetic strip swipe card, interchangeably on any of the participating systems. The objective of this project would be to increase the convenience of fare payment for riders and promote transfers between systems. The introduction of electronic fare collection systems can also reduce fare-handling costs for transit operators. In addition to on-board fare collection equipment, this project would also include the computing and communications resources necessary to coordinate fare accounting among the participating agencies. This project could involve two or more agencies that do not have electronic fare payment systems (e.g., implement new equipment at all participating agencies), or expand upon a system already implemented by one or more agencies by equipping additional agencies.	X	X		**$2,000**		
4.0 Traveler Information Systems									
5.0 Regional ITS Configuration Management/Coordination/Planning									

ID	Program Area/Project	Involved Agency	Brief Description	Project Initiation*			Capital Cost Estimates 2001 (Thousands of $)**		
				N	M	L	Total		
							Phase 1	Phase 2	Phase 3
5.1KE	**KERN COUNTY REGIONAL COMMUNICATION LINKS**	Kern County City of Bakersfield	Communication links to other regions in California and surrounding areas, will enable coordination among agencies and will optimize information gathering and dissemination for incident and traffic management purposes. These links are all estimated for future deployment (ten to twenty years), but are listed here to emphasize the importance of establishing these links as soon as is feasible and cost-effective. Ultimately these links will become part of a statewide system. The objective of the statewide/regional communications links is to enable travelers to receive information from areas outside of the immediate region and to facilitate incident management and traffic control activities by sharing information among agencies. SR 58, which runs east-west through the Kern region, links with I-40 to the east of Kern. An Early Deployment Plan has recently been completed for this I-40 Corridor as it traverses northern Arizona. Traveler information systems will be implemented and enhanced for all segments of the route, including the segment through Kern County (SR 58) as a result of these EDPs. The high percentages of tourist and truck traffic on this route makes the integration of the various traveler information systems highly desirable to advise travelers of safety and road closure issues on this route.	X	X		**$50**		
			Total Estimated Capital Deployment Costs for All Potential ITS Projects Over 20 Years						**$19,122**

Notes:

* Project initiation timeframes - N = Years 1-5, M = Years 6-10, L = Years 11+

**All capital costs are approximate and rounded for purposes of this table.

Table A.12: Timeline of Kern County ITS Projects

		NEAR TERM					MID-TERM					LONG TERM										TOTAL COSTS
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
	1.0 Traffic/Freeway Management Systems (ATMS)																					
1.1KE	EVP DEPLOYMENTS																					$1,500
1.2KE	BAKERSFIELD TOC EXPANSION, PHASE II																					$500
1.3KE	COMMUNICATION LINKS WITH BAKERSFIELD SONET NETWORK, PHASE II																					$6,500
1.4KE	INTEGRATED SMART CORRIDORS																					$1,917
1.5KE	KERN COUNTY SMART STUDIS DEMONSTRATION PROJECT																					$2,500
1.6KE	ALTERNATE ROUTE SIGNING																					$3,000
1.7KE	ROADSIDE WEATHER INFORMATION SATIONS (RWIS) WITH CCTV																					$275
	2.0 Incident Management/Emergency Services																					
2.1KE	KERN COUNTY COORDINATED INCIDENT MANAGEMENT PROCEDURES																					$30
	3.0 Transit Systems																					
3.1KE	DEMAND RESPONSIVE TRANSIT SYSTEM INTEGRATION STUDY																					$750
3.2KE	COMMON FARE EQUIPMENT DEVELOPMENT																					$2,000
	4.0 Traveler Information System																					
	5.0 Regional ITS Configuration Management/ Coordination/ Planning																					
5.1KE	KERN COUNTY REGIONAL COMMUNICATION LINKS																					$50
																						$19,122

Revised September 28, 2001

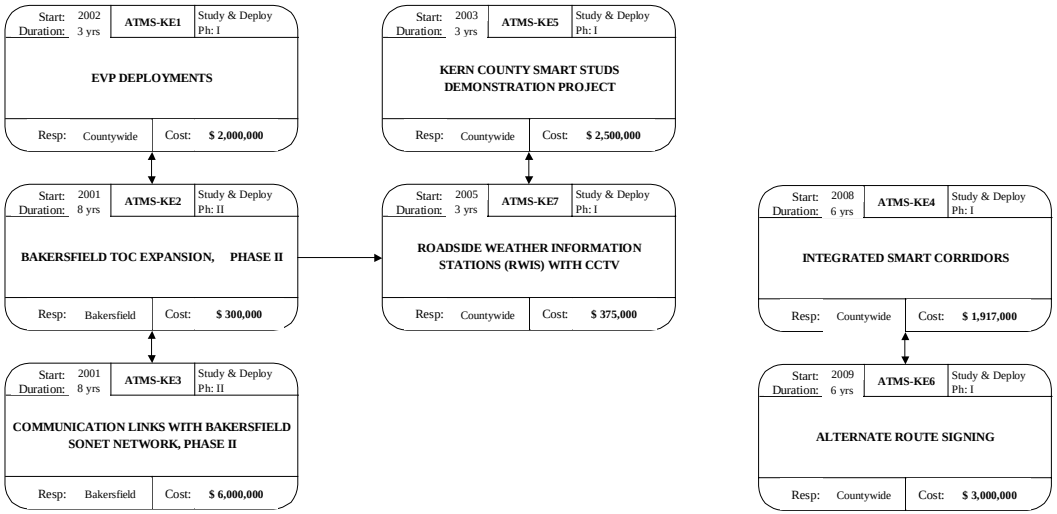
Phase 1 Deployment
Phase 2 Deployment
Phase 3 Deployment

Notes:

1. All values are displayed in 2001 dollars
2. Timeline does not reflect operations and maintenance timeframes
3. All budget estimates are preliminary and should be utilized for planning purposes only

Figure A.11: Sequence of Proposed ITS Implementation Activities for Kern County

Advanced Traffic Management System (ATMS)



Incident Mgmt/ Emergency Services (IM/ES)

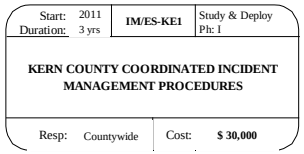
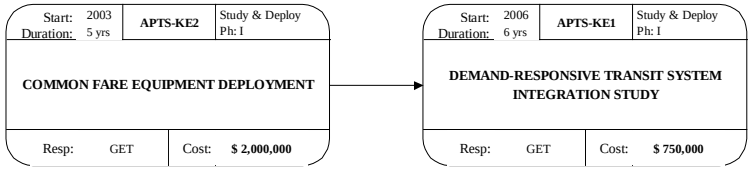


Figure A.11: Sequence of Proposed ITS Implementation Activities for Kern County (cont)

Transit Systems (APTS)



Traveler Information Systems (ATIS)

Regional ITS Config./ Mgmt./ Coordination Planning

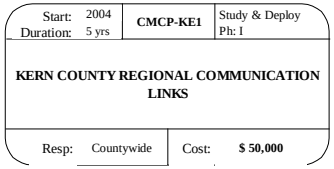
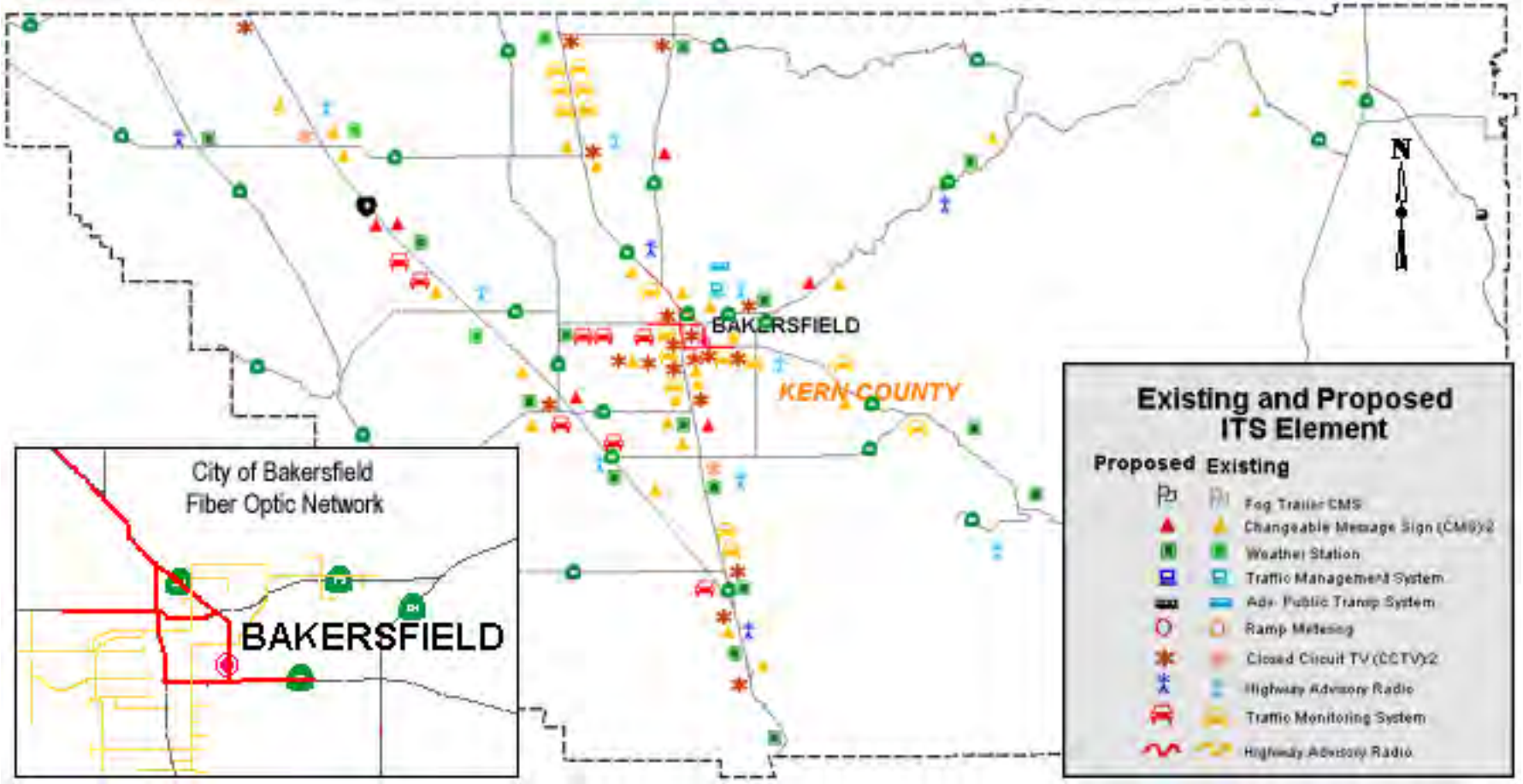


Figure A.12: Existing and Proposed ITS Elements for Kern County



1.7 Fresno County

The total estimated capital deployment costs for all potential ITS projects over 20 years is $79,860,000.

1.7.1 TRAFFIC/FREEWAY MANAGEMENT SYSTEMS (ATMS)

1.7.1.1 Ramp Metering and Communications Gap Closure

General Description:

- There are three principle components to this project:
- Deployment of approximately 16 miles of fiber-optic communications along SR99, SR180, SR41, and to the Caltrans TMC as displayed in Figure 6-3. Another potential fiber-optics deployment has been identified for this project consisting of an additional 35 miles of fiber-optics along SR99, SR168, and SR180.
- Deployment of approximately 18 ramp meter sites (4 initial and 14 future) as growth in travel demands dictate.
- Installation and integration of the Caltrans Advanced Transportation Management System (ATMS) software into the District 6 TMC. The Statewide TMC Standardization Plan has identified District 6 as receiving this software in the Year 2013. This timeline could adversely impact the ability of District to integrate with other on-going ITS deployment efforts in the Region, and an interim integration effort has been identified.

The most current version of the Caltrans ATMS software (version 2.0) is currently operational in District 7. This version contains a great deal of functionality, and would likely fulfill most of the functional requirements for Caltrans in the Fresno Region. Currently, the ATMS has somewhat simplified ramp metering management functions when compared with the special-purpose systems developed in some Districts, but the functions inherit in the ATMS are probably sufficient for the needs in the Region, so no specialized ramp metering software is proposed. In any event, Caltrans, District 6 is likely to receive some future version of the ATMS (3.0+) with enhanced functionality.

The pressing need at this time for Caltrans, is to maximize the effectiveness of its field infrastructure through enhancing communications and management systems. Currently, most of the systems/field devices connected to the TMC must be operated independently. A simple spreadsheet/database has been adopted as an interim reporting tool, but the TMC lacks any substantial integration of its systems at this time.

This project proposes an interim solution to provide some level of systems integration prior to full deployment of the Caltrans ATMS system in the District. The specifics of this solution should be worked out by Caltrans in cooperation with the Region. Viable solutions include the interim adoption of an existing version of the ATMS with some funding assistance being provided by the Region. Another option is that Caltrans District 6 could opt to use the proposed Regional Integrated Workstation (RIW) project for the interim period.

Project Objectives:

- Design and deploy appropriate communications infrastructure along State facilities to eliminate existing gaps in the FCMA, and to provide a communications backbone for the Region.

- Design and deploy additional ramp meters along SR41 to complete the planned system, and to manage travel demands on the freeway network.
- Develop an interim solution for systems integration at the Caltrans TMC.

Sponsorship: Caltrans

Deployment Phasing: This is a three phase deployment.

	Phase Components
Phase 1	➢ 16 miles of fiber communications. ➢ Interim software integration solution for the TMC. ➢ Deployment of 4 ramp meter sites (as determined by Caltrans D6).
Phase 2	➢ 35 miles of fiber communications. ➢ Interim development/porting of ramp metering software. ➢ Deployment of 14 ramp meter sites.
Phase 3	➢ Development/installation of the Caltrans ATMS software into District 6.

All deployment efforts should be preceded by the appropriate studies and design documentation consistent with Caltrans standards.

Deployment Locations: Countywide

Deployment Timeframes: The project would begin deployment in the near-term – ASAP.

	Phase Timelines
Phase 1	Years 1-4
Phase 2	Years 5-8
Phase 3	Year 14

Benefits:

General Benefits:

- Ramp metering can reduce the number of accidents in merge areas reducing both bodily injuries and economic impacts.
  - In Denver, CO, in some areas where ramp meters were installed, the number of accidents decreased by up to 50%. Minneapolis/St. Paul has shown a 38% reduction in accidents per vehicle mile traveled after the installation of ramp metering. Accidents in Seattle also decreased by 39% where ramp meters were installed.
  - Ramp meters show good results in reducing travel times on congested roadway segments. In Seattle, WA, area freeway traffic volumes grew by 10% to 100% along Interstate 5 over a six-year period. The speeds along I-5 have remained steady or increased by as much as 20%.
- Closing the gaps in the communication systems will improve the flow transportation conditions information from roadway sensors, potentially reduce costs, and allow improved cooperation between various agencies within the Region.

- Improving the communications systems will improve roadway monitoring, as well as lower incident detection frequencies assuming appropriate sensors are in place (reference projects 1.3 & 1.6).

Emission Reductions:

- Emissions impacts of ramp metering are very controversial. On a site by site basis, it can be argued that ramp metering increases emissions as vehicles are forced to accelerate in a much more rapid fashion. The balancing factor is that emissions over the length of the freeway should be reduced as traffic congestion is eased and hours of travel fall. In general, emissions reductions are not a valid argument for the installation of ramp meters. Proponents of metering should work with COFCG to identify issues specific to the proposed project.
- On the other hand, communications projects have traditionally been considered as supportive of emissions reductions as long as they provide the capability to install traffic management or signal coordination equipment. Once again, project proponents should work with COFCG on a case by case basis. To support emissions reduction goals, it may be appropriate to require that communications projects clearly define what traffic management equipment will be connected and what benefits this equipment provides.

Budget Estimate:

	Phase Budget Estimates	
	Capital Costs	**Operations and Maintenance Per Year**
Phase 1	$4,480K	$200K
Phase 2	$10,920K	$400K
Phase 3	$1,300K	$50K
Totals	$16,700K	$650K

Fiber-optic deployment costs were based on a unit cost of $25/LF. Design costs were assumed to be 15% of capital costs, and contingencies were 15% of capital costs for traditional project components and 30% for software development.

Evaluation Criteria:

- MOE
  - Miles of congested freeway
  - Freeway travel times
  - Amount of transportation conditions information delivered to the public over the proposed fiber network
  - Reduction in freeway accidents near metered interchanges
  - Incident detection/response time (ATMS)
  - Time needed for traffic operations staff to monitor/control field devices (ATMS)
- MOP
  - Connection/data transfer times/rates from field devices to the TMC
  - Communications packet loss
  - Time to access data from the database (ATMS)
  - Screen refresh rates (ATMS)

- MOS
  - Mean-time between system failures
  - O&M costs

O&M Considerations:

There are no particular O&M considerations for this project. However, if the communications backbone is to be shared by agencies other than Caltrans then some form of cost-sharing agreement may be necessary.

Architecture Considerations:

The infrastructure items in this project are not a concern, however the ATMS deployment and the flexibility of the communications backbone are. Caltrans should discuss its standards with Regional stakeholders to assist in ensuring that some common standards are utilized. Note that communications have many different standards or protocol "layers" that may impact the ability of systems to communicate over any given network. Many of these layers are not necessarily discussed in the National Architecture, but are commonly used in the computer-networking world. For example, the Internet utilizes the TCP-IP standard, which is only one of the many standards, which make the Internet work. Common fiber network standards include SONET and ATM. Additional discussion of this information can be found in the Technology Options Document (available under separate cover).

Within the National Architecture, it may prove helpful for readers to review market packages ATMS 1, 4, and 6.

1.7.1.2 Multi-Jurisdictional Interconnects

General Description:

This project would provide fiber-optic communications interconnects between the City of Fresno, Clovis, and the County along Shaw, McKinley, Ashlan, and Peach Avenues (to the airport). Fiber-optics deployment was assumed to an approximate 12 miles in length. Deployment of communications and information devices along the Peach Avenue corridor to the airport has been noted as a priority focus area because of planned developments to airport access. Communications projects along this corridor should consider linkages directly to the airport for supporting traveler information devices such as airport status, etc. The project would include necessary hardware/software upgrades and installations to support the communications. These areas were identified as priority interconnection gaps by the ITS Subcommittee. In the last CMAQ funding cycle, the ITS Subcommittee was successful in obtaining some interconnect funds for communications gaps along local arterial streets. This should be viewed as an early success by the ITS Subcommittee. The funded interconnect projects are not included in this project.

In addition to the communications interconnect, there are three other important components to this project as displayed in Figure 6-4 and discussed below:

- Deployment of local agency centralized signal control systems for the City of Clovis, Fresno County, and Caltrans. The City of Fresno has already procured a Bi-Tran QuicNet4 traffic signal control system. It was assumed that Caltrans would utilize the new CT-Net software currently being developed within

Caltrans. CT-Net is free to Caltrans, Districts, and may be offered free to other agencies. The controller software used with CT-Net may not be available free of charge. The City of Clovis and County have not yet made a decision regarding which software they will deploy. For purposes of this project definition, it was assumed that the software would be consistent with that deployed by the City of Fresno.

- Integration of regional signal control systems. Many regions have undertaken efforts to integrate their signal control systems to provide for the rapid exchange of timing information and enhanced interjurisdictional signal coordination. Sustained signal coordination requires more than simple communications interconnects between various agencies traffic signals, it requires closely coordination agency operations. Various models for interagency signal system coordination exist. Orange County, Los Angeles, and the San Diego regions all have on-going efforts. The San Diego region effort maybe particularly interesting to the Fresno County Region, as the predominate signal software in the region is the same one recently procured by the City of Fresno (QuicNet4). The San Diego region is undertaking an effort, beginning in late 1999, that would enhance the existing QuicNet4 functionality to better coordinate between separate signal control systems (assuming both are QuicNet4). The Fresno County Region may be able to utilize a similar approach and gain the economies of scale of utilizing the San Diego efforts.
- Incorporation of rural signal control. Many of the smaller cities in the Region have a handful of traffic signals, and many are likely to put more signals in place as regional growth continues. Most of the smaller cities of signals are too few in number to justify a separate signal control system. Many of the rural signals are maintained under contract by other larger agencies, such as Caltrans and the City of Fresno. The QuicNet4 system being deployed by the City of Fresno is capable of remote access and operation of dial-up signals. Some of the small cities already have short signal interconnect runs of conduit and/or communications but lack any substantial way to monitor and control the signals. It is proposed that these smaller agencies could benefit from the signal systems of the larger agencies at a small incremental cost. The involvement of the smaller agencies could include controlling their own signals via a remote workstation, or simply leaving control functions with the larger cities as many already do. The benefits for the larger cities would then be reduced time and effort required to identify faults and correct timing problems with signals in remote areas. The system and number of agencies connected to the system could be expanded as growth dictates. All of the technologies needed to implement this component of the project are already well established, and are available through most major signal software packages.

Project Objectives:

- Design and deploy appropriate communications infrastructure along Shaw, McKinley, Ashlan, and Peach.
- Design and deploy a regionally integrated signal system to improve interagency coordination and cooperation.
- Establish regional signal system standards.
- Provide signal system support for smaller cities with a limited number of signals.

Sponsorship: Phase 1 - City of Fresno (supported by City of Clovis and the County of Fresno)
Phases 2 & 3– Cities and Caltrans

Deployment Phasing:

	Phase Components
Phase 1	➢ 8 miles of local fiber communications. ➢ Deployment of centralized signal software at the City of Clovis and County of Fresno. ➢ Upgrade of outdated controllers. ➢ Network equipment & services for communications between signal systems & with remote cities.
Phase 2	➢ 4 miles of local fiber communications. ➢ Deployment of 5 signal workstations to smaller cities. ➢ Upgrade of outdated controllers. ➢ Addition network equipment and expanded services.

The Traffic Systems Workgroup (Section 9.0) should determine regional signal system standards and the details of regional signal integration.

Deployment Locations: Countywide

Deployment Timeframes: The project would begin deployment in the near-term – ASAP.

	Phase Timelines
Phase 1	Years 1-4
Phase 2	Years 5-8

Benefits:

General Benefits:

- Communications infrastructure along Shaw, McKinley, Ashlan, and Peach will allow for improved signal coordination along those corridors.
- Traffic signals coordination can improve the flow of traffic, even during unexpected traffic conditions.
- In Los Angeles, traffic signals can adjust for current traffic conditions, even when incidents divert traffic from the freeways. As a result, 41% fewer vehicles are stopped at red lights.
- By using improved communications and control techniques, traffic management can reduce delay in both uncongested and congested situations.
  - The Automated Traffic Surveillance and Control (ATSAC) program in Los Angeles reported an 18% reduction in travel time, a 16% increase in speed, and a 44% decrease in delay.
  - Toronto, Canada evaluated a computerized signal control system on two corridors and the central business district network, totaling about 75 signals. The two-month evaluation period compared the computerized system to a “best effort” fixed timing plan, and showed that the computerized control system resulted in an 8% decrease in travel time, as well as a 17% decrease in delay.
  - The City of Abilene, Texas installed a closed-loop computerized signal system, and reported that the travel times decreased by 14%, the delays decreased by 37%, and the travel speeds increased by 22%.

- Regional system standards will ease the process of coordination among systems in the different agencies, such as cities, counties, and Caltrans by providing a common base for all of the agencies to work from.

Emission Reductions:

- Emissions reductions from signal coordination and centralized signal control have been well established through testing and evaluation. A notable example of background information on the emissions and fuel reduction of signal coordination is California's FETSIM program.
- Emissions reductions from signal coordination and control result from increased travel speeds, fewer stops, and decreased acceleration cycles. COFCG has already established procedures for estimating the emissions reductions of these types of projects.
- In order for signal interconnection projects to provide emissions reductions, it is essential that an effective operational plan be put in place to implement improved signal timing.

Budget Estimate:

	Phase Budget Estimates	
	Capital Costs	**Operations and Maintenance Per Year**
Phase 1	$2,190K	$100K
Phase 2	$1,910K	$60K
Totals	$4,100K	$160K

Fiber-optic deployment costs based on a unit cost of $25/LF. Design costs were assumed to be 15% of capital costs, and contingencies were 15% of capital costs for traditional project components and 30% for software development. The fiber-optic interconnect portions of this project represent approximately 60% of the total estimated budget.

Evaluation Criteria:

- MOE
  - Intersection delay
  - Arterial travel times
  - Average time to diagnose and resolve a signal problem at a remote location
  - Emissions reduction
  - Data traffic between cities and other signal control agencies
  - Number of interjurisdictional coordinated signals
- MOP
  - Time to access information on another agency's signal
- MOS
  - Mean-time between failures
  - O&M costs

O&M Considerations: The Traffic Systems Workgroup should develop a set of informal guidelines to assist agencies in interjurisdictional signal coordination. In addition, the Workgroup should draft some

example bi-lateral letters of agreement between agencies to share signal information, timing plans, and (in some cases) control.

Architecture Considerations:

Throughout the nation there are significant efforts underway to enhance signal interconnectivity and operations between jurisdictions. Three efforts are of primary importance to the project outlined in this Plan.

- Development of CT-Net – CT-Net is the Caltrans developed version of a centralized signal control system. The main software is free to Caltrans Districts, and it is generally being adopted by Districts throughout most of the State, including District 6. There is some discussion that the CT-Net software will be available for free to local jurisdictions that request it, however the controller firmware (C8 v4) is not. It is not clear at this time whether or not CT-Net will be fully compatible with the Bi-Trans QuicNet 4 software currently being deployed by the City of Fresno. Interested jurisdictions should contact their District office for further information.
- Development of QuicNet 4+ - QuicNet 4.0 is the central signal control software currently available from Bi-Trans. The City of Fresno is currently deploying this software. A more advanced version of QuicNet is about to enter development in the San Diego Region. This development may offer opportunities for the Fresno County Region and should be carefully followed.
- NTCIP – Class E - Many signal software packages are beginning to support the new NTCIP– Class E standard for center to center communications. The continued adoption of this standard by vendors may simplify signal integration efforts in the Region. Compliance with this standard should be an important consideration for any future signal control system. .

Reference should be made to market package ATMS 3 in the National Architecture.

1.7.1.3 Integrated Smart Corridors (SR41/168/180)

General Description:

This effort would establish an integrated corridor between SR41, SR168, SR180 and Blackstone and First Avenue using technologies such as Changeable Message Signs (CMS), Highway Advisory Radio (HAR), Closed-Circuit Television Cameras (CCTV), Vehicle Detection Systems (VDS), and enhanced signal timing. Overall, this project would represent an intensification of the ITS infrastructure deployments within the urban area of the Region. The project would allow for multi-jurisdictional sharing of information and control amongst these devices. An integrated workstation would be developed along with the necessary communications and supporting infrastructure.

This project will require a cooperative effort between Caltrans, Cities of Fresno and Clovis, and the County. Integrated corridors require extensive infrastructure and cooperative agreements between participating agencies. The proposed integrated corridor does represent one of the heaviest traveled areas of the County.

Project Objectives:

- Design and deploy appropriate ITS infrastructure along the proposed smart corridors.
- Develop common standards for ATMS functions.

- Consider the integration of freeway and major arterial operations (managing the overall transportation network).
- Design and develop integrated corridor system tools that can be deployed throughout the Region.

Sponsorship: COFCG (representing the combined participating agencies)

Deployment Phasing:

	Phase Components
Phase 1	➢ 2.5 miles of fiber communications (in addition to project 1.1) ➢ 7 miles of smart corridor including appropriate (CMS, CCTV, HAR, and freeway/arterial integration) along SR168/180/41.
Phase 2	➢ 5.5 miles of fiber communications. ➢ 9.5 miles of smart corridor along SR168/180/41.
Phase 3	➢ 3 miles of smart corridor along SR41.

Deployment of smart corridors is a complex undertaking task for any region. The Fresno County Region has the advantage of a less complex institutional arena than the Los Angeles region, but it also has far fewer funds available. While the smart corridors project is outlined in a separate definition, it is important to note that many of the project efforts build towards or support the smart corridor concept. It is important that the Region consider its future goal for smart corridors when deploying smaller-scale ITS efforts in order to move towards that goal

Deployment Locations: Urban areas along SR168/180/41 for a total deployment of 19.5 miles of Smart Corridor and 8 miles of fiber communications (in addition to that identified in project 1.2).

Deployment Timeframes: Development of this project would follow deployment of some higher priority and less complex ITS systems throughout the Region. It is slated to begin in approximately the 6th year of ITS deployment efforts.

	Phase Timelines
Phase 1	Years 6-10
Phase 2	Years 11-15
Phase 3	Years 16-18

Benefits:

General Benefits:

- The Smart Corridor Project for the City of Los Angeles involving I-10 and adjacent arterials is an example of an "integrated" ITS system. A preliminary evaluation of this system was performed to evaluate its impacts. It was estimated that total travel time along the Smart Corridor would be reduced by 11 to 15%. Intersection delay is expected to be reduced by nearly 20%. Vehicle emission will generally decrease as follows: CO (15%), HC (8%). Freeway speeds during peak hours will increase by nearly 70 to 80 %. Stop-and-go freeway conditions will decrease substantially. Average surface street speeds during peak periods will increase by nearly 11%. These same benefits are anticipated for the Fresno County project. A conservative 8% reduction in travel time is assumed for benefit-cost analysis.

- The Information for Motorist (INFORM) program in Long Island, New York, is an integrated program using changeable message signs, ramp meters, in-road traffic detectors, and signal coordination on parallel streets. INFORM has increased rush hour speeds on Long Island from 34 mph to 46 mph. Drivers will divert to an alternate route 5% to 10% of the time when passive messages are displayed on electronic signs, and will divert even more frequently when the message recommends an alternate route.
- Integrated systems have the ability to lower costs by sharing infrastructure, staff, and equipment cost among a number of services and agencies. An analysis performed for the US DOT ITS Joint Program Office indicated that incorporation of the full metropolitan ITS infrastructure into a regional transportation improvement plan could reduce the cost of infrastructure expansion by approximately one-half. The analysis was based on published data regarding VMT growth, infrastructure component benefits, and FHWA cost estimates.
- In Detroit, Michigan, an expansion of the freeway management system is expected to reduce delays from incidents by about 40%. This could lead to an annual reduction of 41.3 million gallons of fuel used, a reduction of 122,000 tons of carbon monoxide, 1,400 tons hydrocarbons, and 1,200 tons of nitrogen oxides.

Emissions Reductions:

- See above.
- Smart Corridor projects reduce emissions by decreasing delay and traffic flow breakdown along congested facilities. The extent of emissions reduction is largely a function of the extent of congestion, volume of traffic, type of traffic management devices/operations, and the number of incidents along the facility in question. Generally, it should be possible to estimate emissions reduction by determining the likely reduction in either the number of incidents or the duration of these incidents and applying this to the affected vehicles.
- As with signal coordination, Smart Corridors are implementations of devices and the operation of those devices. It is essential that a sound operational plan be in place to take full advantage of Smart Corridor operations.

Budget Estimate:

	Phase Budget Estimates	
	Capital Costs	**Operations and Maintenance Per Year**
Phase 1	$3,630 K	$220 K
Phase 2	$5,270 K	$320 K
Phase 3	$1,370 K	$90 K
Totals	$10,780 K	$630 K

Fiber-optic deployment costs based on a unit cost of $25/LF. Design costs were assumed to be 15% of capital costs, and contingencies were 15% of capital costs for traditional project components and 30% for software development.

Evaluation Criteria:

- MOE
  - Traffic delays (arterial/freeway)
  - Number of primary and secondary incidents
  - Emissions reduction
  - Diverted traffic volumes
  - Survey of public perceptions

O&M Considerations: Smart Corridors are very dependent on interagency cooperation and coordination. Generally, specific response plans must be developed for each portion of the corridor to prescribe how agencies will react in certain situations. Continued coordination and the setting and following of common standards throughout ITS deployment will greatly assist the development of the Smart Corridor concept.

Architecture Considerations: Prerequisite efforts include software integration/systems elements of projects 1.1F, 1.2F, and 1.5F as discussed in this section of the Plan. It may also prove helpful to review market packages ATMS 1, 3, 4, 6, and 7, as well as ATMS 8.

1.7.1.4 Railroad/Highway Interface Technology for Railroad Crossings

General Description:

This project would provide enhanced detection and location information on trains within urban areas of the Region, along with improved notification to motorists of an approaching train. Fourteen preliminary major crossings have been discussed, but not specifically identified. The focus of the project is to enhance traveler information and safety.

It was conservatively assumed that leased communications would be necessary to the 14 sites, and that each site would include sensing and a CMS or similar device. Many options are currently being tested in this area in both the software and infrastructure areas. It is not yet clear which types of devices will prove to be the most successful, but some definitive answers should be available by the time deployment commences.

It was indicated by the ITS Subcommittee that the long-term solution to the rail/traffic interface problem in the Region is rail consolidation. This project should focus in two areas:

1. Near-term deployments which can be fielded quickly and provide enhanced safety to drivers. These deployments could be place in any location.
2. Longer-term deployments, which enhance the level of information, provided to drivers in terms of approaching train traffic and expected delays. These deployments should focus on primary rail routes only (those routes likely to remain following consolidation).

Project Objectives:

- Design and deploy either a single or a series of systems that enhance safety at high activity railroad crossings.
- Develop traveler information systems, which display accurate, timely, and useful information on expected train crossings and anticipated delays.

- Consider inexpensive options to enhance RR crossing safety.

Sponsorship: City of Fresno (potentially other cities as well)

Deployment Phasing: This project is a near to mid term project.

	Phase Components
Phase 1	➢ Deploy 14 smart crossing sites.

Deployment of smart corridors is a complex undertaking task for any region. The Fresno County Region.

Deployment Timeframes: This project is slated to begin in the mid-term of ITS deployment.

	Phase Timelines
Phase 1	Years 4-7

Deployment Locations: Fourteen locations have been noted as a scale of the project. Specific locations have not been identified. Deployments would focus on the heaviest traveled crossings for both vehicle and train traffic. A preliminary assessment would be performed by the City of Fresno to site prototype and initial deployment locations. A preliminary list of deployment locations should be provided with any funding application. If the prototype deployment proves successful, additional deployments may follow throughout Fresno, as well as some of the smaller cities in the Region.

Benefits:

General Benefits:

- Enhanced safety at grade crossings through improved warning of approaching trains.
- Decreased travel delays to travelers through enhanced information.

Emissions Reductions:

- Emissions reductions may result from these types of projects through the diversion of some traffic to alternative routes not delayed by train traffic. Based on the site being deployed, the volume of traffic, and availability of alternative routes to reach the same destination it should be possible to estimate the emissions reductions resulting from anticipated traffic diversions.
- Deployment of this type of equipment along high volume routes with viable alternative paths of travel should improve the emissions reduction potential of these projects.

Budget Estimate:

	Phase Budget Estimates	
	Capital Costs	**Operations and Maintenance Per Year**
Phase 1	$980 K	$90 K
Totals	$980 K	$90 K

Evaluation Criteria:

- MOE
  - Traffic delays at RR-xings
  - Number of incidents at crossings
  - Number of illegal crossings
  - Emissions reduction
  - Diverted traffic volumes
  - Survey of public perceptions

O&M Considerations: Concurrence of the California Public Utilities Commission (CPUC) and property owners will be required to place devices within the railroad right-of-way.

Architecture Considerations: Refer to market packages ATMS 14 and 15 of the National Architecture.

1.7.1.5 Communications Interties

General Description:

Whereas the Ramp Metering and Communications Gap Closure project would provide a significant communications backbone between Caltrans and freeway ITS elements, this project would establish/complete backbone wireline communications between the largest transportation players in the Region (City of Fresno, City of Clovis, County of Fresno, and Caltrans). Communications would likely utilize fiber-optics, however other opportunities should be reviewed for the various needs. This project should consider the establishment of regional standards for fiber communications deployment, including consideration of modes, capacity needs, communications protocols, and perhaps equipment types. It is likely that the best communications solution from the regional perspective will include a combination of agency owned communications in the urban areas and a leased solution for outlying or rural areas.

The focus of the interties will be on linking Transportation Management Centers (TMC). Development of the project should consider the Implementation Plan developed by the City of Fresno. The development of common communications standards and protocols will be critical, as will the development of common data definitions. The potential for linkages with CHP and other emergency service providers should also be considered, as should linkages with information service providers.

Establishing physical communications is only the first step in developing a cooperative and integrated transportation management environment between agencies. Each agency must have the tools to communicate and cooperate. For example, a person sending spreadsheet information to another person who lacks the software to read it, is likely to become frustrated.

As a part of this project, it is proposed that a Regional Integrated Workstation (RIW) would be developed. This workstation would provide basic local ATMS functions (traffic information, incident notification, planned lane closures, traffic advisories, CCTV control, CMS control, possibly HAR) in a single integrated package. The RIW could be utilized by agencies inside and outside the Region to

perform common traffic management and advisory functions. Several options exist for the development and deployment of such a workstation:

- Southern California Efforts – The Orange County Transportation Authority (OCTA), Los Angeles Metropolitan Transportation Authority (MTA), and the San Diego region are currently developing various forms of a local integrated workstation based on the Southern California Showcase Architecture. These workstations offer a range of capabilities within an open systems architecture.
- Sutter County Efforts – A simple workstation was developed for the remote sensing devices located in Sutter County. This project was discussed with the ITS Subcommittee as a good example of a low-cost yet useful deployment. The Fresno County Region could establish a common regional standard and develop a simple RIW.
- Vendor Products – Some RIW type software packages are available from vendors. Some software modifications would be required to support Region specific functions, but these vendor packages offer the advantages of previous lessons learned.

Overall, it is probably advisable that the Region utilize a workstation development (agency or vendor) effort in another region as a starting point for developing the RIW. This approach should lower deployment costs and risks with relatively few trade-offs in terms of functionality.

Project Objectives:

- Design and construct a communications backbone linking the various TMCs in the Region.
- Establish common communications standards and protocols, as well as common data definitions.
- Design and deploy a common Intertie workstation (Regional Integrated Workstation) for use by transportation and emergency service agencies.

Sponsorship: Cities of Fresno and Clovis, County of Fresno, Caltrans.

Deployment Phasing: The development of this project is important to the goals defined in this SDP. Many of the elements of this project will support other ITS deployment efforts, therefore this project has been identified for near-term deployment.

	Phase Components
Phase 1	➢ 12 miles of local fiber communications plus supporting communications equipment. ➢ Leased communications equipment and services for 6 agencies. ➢ Development of the Regional Integrated Workstation (RIW) software. ➢ Necessary device driver upgrades and computer equipment.
Phase 2	➢ Leased communications equipment and services for 6 additional agencies. ➢ Additional RIW equipment for 6 agencies.

Deployment Locations: Fiber communications deployed along major arterials between TMCs.

Deployment Timeframes: This project has been identified for near-term deployment. Deployment efforts would be expanded to include additional agencies and departments once the initial RIW network is established. Additional expansion should be relatively simple once the RIW core is in place.

	Phase Timelines
Phase 1	Years 1-4
Phase 2	Year 5

Benefits:

General Benefits:

- Enhanced coordination and cooperation between agencies on a day-to-day basis resulting in improved transportation management.
- Decreased incident response and duration due to improved coordination.
- Enhanced management of special event situations.
- Lower deployment costs for future ITS projects.

Emissions Reductions:

- Emissions reductions should result from this project type provided that some form of interagency communications and coordination system is put in place such as the RIW suggested in this project. Use of such as system should result in improved coordination and fewer non-recurring congestion events. The specific benefits of this system will be difficult to estimate. Estimations may be based upon an overall estimate in the number of hours of congestion due to enhanced coordination and operations.

Budget Estimate:

	Phase Budget Estimates	
	Capital Costs	**Operations and Maintenance Per Year**
Phase 1	$3,380K	$160K
Phase 2	$160K	$20K
Totals	$3,540K	$180K

Fiber-optic deployment costs based on a unit cost of $25/LF. Design costs were assumed to be 15% of capital costs, and contingencies were 15% of capital costs for traditional project components and 30% for software development. Leased communication equipment costs were assumed to be $5,000 per agency with service charges of $150/month.

Evaluation Criteria:

- MOE
  - Number of incident advisories exchanged between agencies
  - Number of planned incident entries
  - Average time to diagnose and resolve a signal problem at a remote location

- Average hours of active system use

- MOP
  - Time to access and control a field device.
  - Accuracy of displayed information on traffic conditions.
  - Time to transmit/receive an advisory.
- MOS
  - Mean-time between failures
  - O&M costs

O&M Considerations: The development of TMC-TMC communications and a RIW allows for much greater flexibility on the part of agencies to utilize information and respond to situations in a cooperative manner. The Traffic Systems Workgroup and Traffic Safety Team should consider the desired functions of the RIW carefully, and support the deployment with the appropriate institutional and policy guidelines.

Architecture Considerations: As noted above, the Region should consider building off of another region's efforts in developing an integrated workstation.

1.7.1.6 Integrated Surveillance Stations/ Callbox Deployment

General Description:

The need for additional surveillance along some urban and most rural roadways/highways prompted the introduction of this project. The ITS Subcommittee noted the need for improved incident identification and information, especially along portions of I-5 and SR180. This project includes the possible deployment of callboxes with the added advantage of remote sensing capabilities that callboxes have been proven capable of providing. Even if callboxes are not deployed, remote sensing stations with some form of wireless communications are clearly needed in many areas.

The ITS Subcommittee noted that the system should be developed in a manner that supports surveillance in areas other than freeways/roadways. For example, it was suggested that a simple low cost surveillance/emergency telephone box system be deployed in regional parks and along trails. Whether or not the deployment of a full callbox system moves forward, the application of low-cost remote sensing sites remains valid. Consideration should be given to integrating deployment of this system with the Communications Interties project. The RIS could be utilized as a common workstation to monitor and control both systems.

There are three primary components to the project:

- **Remote Sensing Applications** – These sites would be remotely located at key locations within the Region to fill many of the gaps in the existing ITS sensing infrastructue. The remote stations would be capable of utilizing various CCTV, CMS, vehicle detection systems
- **VDS and weather sensors.** Data would be communicated back to the Caltrans TMC through wireless means, most likely cellular. Information could then be passed on to other agencies through the regional network and RIW identified in the Communications Interties project.
- **Smart Callbox Applications** – Similar to the remote sensing stations, but with the added capability of a motorist aide callbox, Smart Callboxes have been deployed in various regions of the State including

Sutter, Riverside, and San Bernardino Counties. Kern County has also identified the use of Smart Callboxes as a part of its ITS SDP. Smart Callboxes utilize a "smart card" placed within the Callbox to connect to various sensing devices. Data from the sensors would be transmitted via cellular communications to the Caltrans TMC, and would be made available to the wider Region over the regional network.

- **Callbox Applications** – The majority of devices contained in this project are simple motorist aide callboxes. Callbox systems have been deployed in the neighboring Counties of San Luis Obispo and Kern, as well as throughout many other regions of the State. Callbox calls can be handled either through a contracted answering service or through the CHP communications/call-taking center. In either case, funding support to the call answering party would be required. If the call taking center is private then emergency calls are passed to the CHP and simple motorist aide needs are dealt with through auto clubs and/or towing services. The deployment of a callbox system should include appropriate program management funding and functions to deal with contracting, servicing, and installation issues.

The deployment of a callbox system, as well as the installation of Smart Callboxes and other ITS components, can be supported through the development of a Service Authority for Freeway Emergencies (SAFE) within the Region. State law allows the Region to collect a small fee on vehicle registrations within the County to support deployment of a motorist aide system. The creation of the SAFE would require political support from the Region and approval from the County Board of Supervisors.

Some basic assumptions were made for deployment of remote sensing stations and callboxes along the freeways and highways within the Region. Following the basic priorities, deployments were broken down into percentages for spacing of the devices. For example, it was assumed that 60% of the deployment considered in this project would be at one mile spacing. Specific details of this breakdown are provided in the deployment phasing description for this project.

The ITS Subcommittee indicated that the more rural areas of the major freeways and highways should be a priority area for deployment. A separate assessment is included as part of this project to site and further prioritize deployment of callboxes within the Region. Eventually, callbox deployment may seek to cover all feasible/major state facilities within the Region. The project also includes a handful of callbox deployments at Regional parks and along trails. While these deployment cannot be fully funded through the same mechanism, they can utilize the same system resulting in much reduced costs. Finally, it is important to note that the general concept that "everyone" will have cellular phones is far from valid. Even in many urban areas, cell phone market penetration is not expected to go too far beyond 35%. In most areas with callbox systems, the total number of calls has continued to climb over time as traffic levels have increased. Given the projected demographics, growth, and rural character of the Region, a motorist aide callbox system seems highly beneficial.

Project Objectives:

- Design and deploy remote surveillance stations with a common architecture, standards, and interface.
- Design and deploy a regional callbox system along applicable facilities.
- Provide for multi-jurisdictional access to the surveillance components of the system.
- Develop an institutional structure to provide continued support and maintenance of the overall system.

Sponsorship: Caltrans/COFCG (with support from local agencies)

Deployment Phasing: This project has been broken down into three basic phases.

	Phase Components
Phase 1	➢ Study for location of remote sensors, Smart Callboxes, and callboxes. ➢ Answering center start-up & support. ➢ Callbox program support. ➢ Deployment of 298 normal and 34 Smart callboxes/remote sensing stations along I-5 and SR99, as well as in some regional parks/trails. ➢ Procurement of supporting software.
Phase 2	➢ Continued answering center support. ➢ Callbox program support. ➢ Deployment of 500 normal and 56 Smart callboxes/remote sensing stations along Phase 2 facilities identified in Figure 6-7.
Phase 3	➢ Continued answering center support. ➢ Callbox program support. ➢ Deployment of 126 normal and 15 Smart callboxes/remote sensing stations along Phase 3 facilities identified in Figure 6-7.

Deployment and spacing of callboxes was based on the following assumptions:

Assumptions	Phase 1 (apx. 100 miles)	Phase 2 (apx. 170 miles)	Phase 3 (apx. 42 miles)
One-mile spacing	120	204	50
½ mile spacing	120	204	50
¼ mile spacing	80	162	33
% of Smart devices	10%	10%	10%
Park/Trails	12	12	7
Total Normal/Smart Devices	298/34	500/56	126/15
Total Callboxes/Devices			1,029

Callboxes and Smart Callboxes were assumed to be deployed two to a location (one on either side of the facility). Actual deployment should be based on the findings of the preliminary location study proposed in this project.

Deployment Locations: Countywide

Deployment Timeframes: This project has been identified for near-term deployment, and promises to provide substantial near-term benefits if deployment proceeds expeditiously.

	Phase Timelines
Phase 1	Years 1-4
Phase 2	Years 5-9
Phase 3	Years 10-14

Benefits:

General Benefits:

- Reduced incident detection times, especially in rural areas.
- Enhanced motorist aide services.
- Positive public perception of public services and support.
- Low-cost provision of remote transportation conditions information.
- Additional data to be obtained from other regions.

Emissions Reductions:

- Emissions reductions from this project are likely to be somewhat limited due to the dispersed and rural character of the proposed deployment. Emissions reduction potential should not serve as a primary purpose for deploying this project type.

Budget Estimate:

	Phase Budget Estimates	
	Capital Costs	**Operations and Maintenance Per Year**
Phase 1	$4,580K	$890K
Phase 2	$6,550K	$720K
Phase 3	$1,690K	$190K
Totals	$12,800K	$1,800K

Based on deployments in other regions, the basic costs were conservatively assumed to be $8,000 for a basic callbox installation and $12,000 (+ $10,000 for sensing devices) for Smart Callboxes installed.

Once the basic motorist aide and Smart Callbox systems are in place, funds obtained through the regional fee can be applied to maintenance, replacement, and deployment of additional motorist aide and transportation management devices.

Evaluation Criteria:

- MOE
  - Number of calls
  - Number of secondary incidents
  - Clearance time for disabled vehicles
  - Call answer/response times
  - Number of incidents
- MOP
  - Time to answer/respond to calls
  - Connect times to remote devices
  - Reliability of remote connections

- MOS
  - Mean-time between failures
  - O&M costs

O&M Considerations: This project involves a substantial operational program and funding requirements. It also provides a funding mechanism for continued operations. Many existing callbox deployments have displayed a lifespan in excess of that originally anticipated (approx. 15 years could now be assumed applicable with regular maintenance).

Architecture Considerations: Refer to market package ATMS 1 in the National Architecture and the Fresno County Region specific version of this market package.

1.7.1.7 Regional Intersection Safety and Enhancement Program

General Description:

The general concept behind this project is to develop a series of low-cost systems that may be applied to urban and rural signalized intersections to enhance motorist and pedestrian safety. The near-term focus of this effort is likely to be on red-light photo enforcement due to the significant problem and accident hazard this represents in the Region. Problem locations will be identified and the appropriate equipment installed. Contractual relationships may need to be established with third parties to deal with red-light photo enforcement issues. In addition, pedestrian safety applications will be included in this effort. This effort will define regional standards for each of the independent intersection safety tools. Based on recent deployments of similar systems throughout the State it should be possible to display proven benefits.

Eventual regional deployment was assumed to consist of:

- Thirty five (35) red-light photo enforcement locations (equipment can be moved). Problem intersections should be identified through recent accident records and based on the local knowledge of traffic engineers. Deployment costs for red light deployment was assumed to be $50,000 per intersection based on efforts in other Regions.
- 20 pedestrian safety deployments including high-visibility crossings and video detection. Unit costs for pedestrian safety deployments were assumed to average to approximately $30,000 per location.

Project Objectives:

- Design and deploy independent intersection ITS systems to enhance motorist and pedestrian safety.
- Develop the appropriate institutional arrangements to address legal and operational concerns.
- Develop a regional standard for the deployment of intersection safety systems.

Sponsorship: COFCG & County of Fresno (with support from cities as appropriate).

Deployment Phasing: This project consists of a single phase to be deployed over five years. Deployment efforts should be prioritized based on the extent of the problem at individual intersections. No independent software development should be required for this effort.

	Phase Components
Phase 1	➢ Preliminary assessment of priority locations (agency staff) ➢ Deployment of 30 red-light photo enforcement locations. ➢ Deployment of 20 pedestrian applications at locations.

Deployment Locations: Problem locations identified through a preliminary study and identification effort by agency or contracted staff.

Deployment Timeframes: This project has been identified for mid-term deployment.

	Phase Timelines
Phase 1	Years 4-9

Benefits:

General Benefits:

- Deployment of nighttime ped crossing (visibility) devices in Petaluma, CA resulted in an increase of the number of vehicles yielding to pedestrians from 52% to 80% at one problem location.
- In San Francisco, red light violators cause 25% of all injury collisions at signalized intersections. Deployment of red-light photo enforcement devices at intersections has resulted in violation reductions of 30% to 90% in San Francisco, New York, and El Cajon (CA).

Emissions Reduction:
No emissions reduction can be directly associated with this project.

Budget Estimate:

	Phase Budget Estimates	
	Capital Costs	**Operations and Maintenance Per Year**
Phase 1	$3,050K	$330K
Totals	$3,050K	$330K

Evaluation Criteria:

- MOE
  - Number of accidents at deployed intersections involving red-light violations/pedestrians.
  - Number of citations
  - Number of red-light violations
- MOS
  - O&M costs

O&M Considerations: Red-light photo enforcement generates revenue from violations. This revenue serves to off-set the costs of the system, however existing deployments have continued to incur operational costs in excess of revenue. Much of the operational costs can be associated with processing violations. Recent State legislation SB833 originally provide legislation to allow red-light photo

enforcement, but it included a sunset clause. The Region should review the status of SB1136 to determine the current legal status.

1.7.1.8 Alternate Route Signing

General Description:

This project would include the installation of 70 static alternate route signs within the County for designated detour routes by implementing changeable message signs specifically sited, and primarily devoted, to detouring traffic onto alternate routes during incidents, including accidents and weather related road closures. These signs could differ from the large, permanent changeable message signs deployed by Caltrans at key decision points in several respects. First, they would be sited in conjunction with a specific alternate route/detour strategy developed for a particular route and alternate routes. Second, the signs could be smaller than the Caltrans signs. Third, the signs could include features, such as arrows or flashing beacons that are not included on the traditional CMS. Finally, the alternate routes signs could be deployed as trailblazers along the alternate route, rather than merely in advance of the main route/alternate route decision point. The objective of this project would be to improve compliance with detours and reduce driver uncertainty along detour routes. If successful in reducing the volume of vehicles entering hazardous or congested roadway segments, this project holds the potential to reduce congestion, delay and accidents. In order to be successful, it would be critical that this project include development of an alternate route plan and procedures to support the usage of the signs, and that this plan be effectively linked to an overall multi-agency coordinated incident management strategy. This project would also require a commitment on behalf of the operating agency to devote the time and attention necessary to utilize the signs effectively. Even more so than a single CMS, keeping the dynamic message signs current and accurate would be critical.

Project Objectives:

- Provide efficient routing around major incidents on the highway system.
- Design and deploy alternate route signs.

Sponsorship: Fresno County, the City of Fresno, and the City of Clovis

Deployment Phasing: This project is a single-phase deployment.

	Phase Components
Phase 1	➢ Identify potential sign locations. ➢ Design and deploy CMS at strategic locations.

Deployment Locations: Countywide: Fresno County Urban Traffic Corridors

Deployment Timeframes: This project is a mid term deployment.

	Phase Timelines
Phase 1	Mid Term

Benefits:

- Improved mobility
- Reduced congestion related to highway incidents
- Improved traffic management
- Reduced delay time to major incidents
- Reduced impact on adjacent communities

Budget Estimate:

	Phase Budget Estimates	
	Capital Costs	**Operations and Maintenance Per Year**
Phase 1	$3,000K	$300K
Totals	$3,000K	$300K

Evaluation Criteria:

- *MOE*
  - Travel Time
  - Delay
  - Incident work zone safety

O&M Considerations: Operational and maintenance costs were estimated at $2,000 per location.

1.7.1.9 EVP Deployments

General Description:

The project would implement Emergency Vehicle Preemption (EVP) along key arterials throughout the County for use by City and County fire departments. The implementation EVP at a traffic signal modifies normal signal operation to provide a nearly immediate green signal for an approaching emergency vehicle. This type of system is most often deployed on fire trucks because of the nature of the fire truck vehicle performance. The acceleration rate of fire trucks is rather slow due to their relatively low power-to-weight ratio. If fire trucks must slow down (and sometimes stop) when they encounter signalized intersections along their emergency run, the overall delay in responding to their emergency destination can easily exceed 1 to 2 minutes. For fire events, this delay can mean a significant difference in the level of destruction, the level of effort in suppressing the fire, the level of personal danger for firefighters at the scene, and the number and extent of injuries for victims. Depending on the level of congestion and the distance traveled, fire trucks can encounter many traffic signals, and heavy congestion. Driving in oncoming traffic lanes is a “last resort” maneuver, which fire departments rightly avoid. If the fire truck encounters a red signal, it can assert the right of way and go through, but only after gaining assurance that it can safely cross through the intersection. EVP isn’t needed in every community. Only when traffic congestion is very significant, or only when long emergency vehicle runs are likely to encounter a large number of signalized intersections, would the provision of EVP be cost effective. Some cities in the Central Valley already have EVP in place, the

3M Opticom™ system being predominant. Priority request equipment would be installed in each fire truck and matching reception equipment would be installed at each signalized intersection where EVP is to be granted.Some larger agencies that have used EVP for many years have broadened the application to also equip ambulance vehicles and, in some cases, police vehicles with this on-board preemption request equipment. While these vehicles have much better acceleration characteristics, and the added delay at signals while on their emergency runs is much lower, granting EVP to these vehicles may provide another benefit. The crossing of very wide and very busy signalized intersections is very difficult in today's traffic. Each year, many such emergency vehicles are "totaled" after being T-boned when crossing a busy intersection. EVP helps reduce and prevent this occurrence. However, this project assumes only fire department vehicles would be equipped with EVP devices.

Project Objectives:

- Improved emergency response time

Sponsorship: The City of Fresno, the City of Clovis, and Fresno County

Deployment Phasing: This project is a single-phase deployment.

	Phase Components
Phase 1	➢ EVP detectors at key intersections ➢ EVP emitters on emergency response vehicles

Deployment Locations: Fresno FUA·

Deployment Timeframes: This project is a near term deployment.

	Phase Timelines
Phase 1	Near Term

Benefits:

- Improved emergency response time
- Reduction in vehicles accidents during an emergency response

Budget Estimate:

	Phase Budget Estimates	
	Capital Costs	**Operations and Maintenance Per Year**
Phase 1	$2,000K	$0K
Totals	$2,000K	$0K

Evaluation Criteria:

- Emergency response time
- Emergency vehicle related accident history

O&M Considerations: Operation and Maintenance of EVP detectors by traffic signal maintenance staff. Additional funds should be considered if traffic signal maintenance is outsourced.

1.7.1.10 Urban Area Taffic Signal Coordination Project

General Description:

This project would implement local traffic signal coordination plans at specific urbanized locations along regionally significant arterials in the County not currently developed. The objective of this project would primarily be to reduce delays at traffic signals by improving coordination between adjacent signals, with improved safety a possible secondary benefit depending on the specific improvements made. The specific improvements to be made would vary by location, which could include intra- and inter-jurisdictional efforts. The types of improvements that are possible include upgrading traffic signal controllers and detection, adding or upgrading signal interconnects, and communications systems enabling centralized (i.e., remote) timing plan updating and maintenance and malfunction monitoring. Although providing emergency vehicle preemption, transit vehicle priority or automated enforcement would not be the focus or justification for these improvements, the equipment installed as part of this project may support these features. Local agency traffic operations staff would lead this project.

The provision of traffic signal coordination for small communities is most often initiated with use of either time-based coordination (TBC) or a closed-loop system (CLS). Depending on the type of controller equipment now in place, and depending on the level of staffing support that the City (or County) is able to make in the maintenance of signal coordination plans, the initial cost and recurring effort to achieve signal coordination in Hanford would vary from a very low cost, to a moderate cost. A number of communication alternatives are possible to tie the intersection controllers to a supervisory computer at City Hall (in the CLS alternative). With a CLS, the capability is created to remotely monitor intersection operation and the capability to remotely change both basic and coordination timing. A first step in the signal coordination capability would be the design and implementation of TBC timing plans.

A feasibility study on possible and appropriate upgrade plans for creation and installation of a traffic signal system could be completed at the same time. Any small community that has more than 10 traffic signals would probably benefit from having signal coordination implemented along its heaviest-traveled street(s) so that vehicles can progress through a series of signalized intersections without stopping. The initial effort to achieve this basic level of coordination is relatively low, especially if it is contracted out. The resulting basic timing plans (perhaps just 2 or 3 plans which run between 7AM and 6 PM) can be left in place with very little subsequent retiming effort required or needed. Traffic signal coordination typically has one of the very highest benefit-to-cost ratios of any public works activity.

Project Objectives:

- Provide improved signal coordination that one upgrades for revised traffic conditions.

Sponsorship: The Cities of Fresno and Clovis, and Fresno County.

Deployment Phasing: This project is a single-phase deployment.

	Phase Components
Phase 1	➢ Develop time based traffic timing plans ➢ Develop alternative solutions for signal communication such as fiber optic cable and wireless spectrum signal interconnect ➢ Upgrade signal controllers as necessary

Deployment Locations: Fresno County – The remaining uncoordinated arterials in Fresno/Clovis metropolitan area.

Deployment Timeframes: This project is a mid to long term deployment.

	Phase Timelines
Phase 1	Mid to Long Term

Benefits:

- Improved mobility
- Reduction in congestion and delays
- Reduced emissions

Budget Estimate:

	Phase Budget Estimates	
	Capital Costs	**Operations and Maintenance Per Year**
Phase 1	$4,000K	$400K
Totals	$4,000K	$400K

- LOS and overall delay
- Travel Time
- Emissions

O&M Considerations: An increase in Operation and Maintenance budget should be considered to provide the proper level of system maintenance.

1.7.2 INCIDENT MANAGEMENT/EMERGENCY SERVICES

1.7.2.1 Weather Sensing/ATMS Integration

General Description:

This project includes two primary components:

- Deployment of additional weather sensors to fill-in gaps in the existing weather sensing infrastructure.
- Replacement/upgrade of some existing weather sensing stations.
- Integration of weather sensing data into the Region's ATMS efforts including the Caltrans ATMS and the Regional Integrated Workstations.

The ITS Subcommittee has indicated that due to the frequent weather related transportation problems experienced in this region, all ATMS projects should include some type of real-time tie to weather forecasting, weather conditions, and visibility levels on a 24-hour basis.

Caltrans, District 6, currently maintains a series of existing weather sensors in the Fresno County Region. However, deployment of these sensors is currently too sparse to provide accurate and timeline information on low visibility conditions. Fog, dust, and high-winds are highly mobile weather phenomenon, which can often be localized in nature. Caltrans does receive information from the weather system and then makes decisions regarding altering CMS and dispatching management resources, however the limited data makes accurate decisions often difficult to make. The ITS Subcommittee has noted that the public's perception of traveler information, especially from CMS, is related to the consistent accuracy of the information. They noted that with the current system, it is not possible for the CMS to always reflect local conditions as the sensors may be located some distance away. This project would significantly enhance the weather-sensing infrastructure in the Region by deploying both comprehensive weather sensing stations, as well as a large number of visibility only sensors.

Project Objectives:

- Improve weather conditions information received by transportation managers along major facilities.
- Reduce the potential for large-scale incidents through the improved identification and tracking of severe weather conditions which lower visibility.
- Enhance and integrate weather-sensing functions into the Caltrans ATMS and the Regional Integrated Workstation development efforts.
- Provide inputs for variable speed sign deployment along freeways and highways.
- Provide weather information to other agencies in the Central Valley.
- Increase accuracy and timeliness of incident related motorists information.

Sponsorship: Caltrans with support from CHP, COFCG and other regional agencies

Deployment Phasing: The project is divided into three phases described below.

	Phase Components
Phase 1	➢ Study for detailed location of remote weather stations and low-visibility sensors. ➢ Deployment of 5 full weather stations and 42 visibility sensors along 100 miles of freeway/highway facilities. ➢ Weather systems software upgrade for Caltrans and integration with RIW. ➢ Communications support.
Phase 2	➢ Deployment of 5 full weather stations and 71 visibility sensors along 170 miles of freeway/highway facilities. ➢ Communications support.
Phase 3	➢ Deployment of 2 full weather stations and 18 visibility sensors along 42 miles of facilities. ➢ Integration of weather information/functions into the Caltrans ATMS software. ➢ Communications support.

Deployment and spacing of visibility sensors was based on the following assumptions:

Assumptions	Phase 1 (apx. 100 miles)	Phase 2 (apx. 170 miles)	Phase 3 (apx. 42 miles)
Three-mile spacing	32	54	13
½ mile spacing	10	17	4
Total Visibility Sensors			130

Deployment Locations: Countywide

Deployment Timeframes: This project is a near term deployment. The project offers a viable phased solution to a very visible safety and incident issue in the Region.

	Phase Timelines
Phase 1	Years 1-4
Phase 2	Years 5-9
Phase 3	Years 10-12

Benefits:

General Benefits:

- Much improved information on current weather conditions impacting safety and mobility on the Region's transportation network.
- Operator benefits resulting from enhanced systems integration.
- Improved information to the travelers on the nature of the weather conditions confronting them both at their current location and down the road.
- Enhanced motorist safety.
- Reduction in the number and severity of incidents.

Emissions Reductions:

- Emissions reductions may result from this project by a reduction in the number and severity of major incidents in poor weather conditions. Reduction estimates can be made by comparing the number of major incidents, hours of delay, and number of vehicles involved in poor weather conditions. The actual estimated emissions reduced by limiting such major incidents are usually quite significant, but apply to only a few days out of any one year. This means that the overall reduction potential of this project type may be somewhat limited as relatively few large scale incidents occur each year, and then only under special weather conditions such as blowing dust or fog.

Budget Estimate:

	Phase Budget Estimates	
	Capital Costs	**Operations and Maintenance Per Year**
Phase 1	$1,500K	$120K
Phase 2	$1,790K	$160K
Phase 3	$650K	$10K
Totals	$3,940K	$290K

Unit costs were assumed to be $75,000 per weather station and $15,000 per visibility sensor. Integration costs for weather functions into the Caltrans ATMS were set at $100,000. All communications to sensing devices were considered to be cellular leased.

Evaluation Criteria:

- MOE
  - Number/occurrence of poor conditions notifications
  - Number of incidents
  - Number of CMS activation occurring from enhanced information
  - Public perceptions of the accuracy of CMS data
- MOP
  - Accuracy of weather devices
  - Connect times to remote devices
  - Reliability of remote connections
- MOS
  - Mean-time between failures
  - O&M costs

O&M Considerations: In order to share weather information regionally in a meaningful manner some basic standards should be established for describing conditions. For example, the Region might define ¼ mile visibility as Moderate or Poor. Whatever the specific standards they should be common to the entire Region and provide concise and easy to use for both transportation managers and information disseminators. The parallel is the speed dots used by many agencies on ATMS maps where each color represents a specific speed threshold.

Architecture Considerations: Statewide developments in the Caltrans ATMS may eliminate the need for a specific integration effort of weather functions for the Fresno Region. Caltrans, District 6, should promote the integration of this functionality into future versions of the ATMS.

1.7.2.2 Variable Speed System/Smart or Intelligent Roadway Studs

General Description:

This project consists of two separate components that both serve the same purpose of enhancing motorist safety by increasing their awareness of roadway conditions.

- **Variable Speed Notification System** - A fog/dust detection system with variable messaging and variable speed limit advisories should be deployed along stretches of regional freeways and highways that experience low visibility or poor weather conditions. Variable Speed Signs (VSS) would be placed together with visibility sensors identified in project 1.1 at key locations. The signs would display an advisory speed based on the visibility conditions detected by the nearby sensor. The speed is advisory and would not be enforced as a "legal" speed limit. The ability of drivers to recognize their speed becomes obscured in low visibility situations, and the purpose of the sign is to "remind" people to watch their speed. A similar system is in use near Chattanooga, Tennessee, and another system is planned for deployment in Duluth, Minnesota. They have not experienced any serious fog related accidents since it was installed. For purposes of this project definition, VSS deployments were assumed to occur on one side of a facility every three miles for those facilities identified in Figure 6-10. It should be noted that the variable speed signs in Tennessee and Washington is actually enforceable. The variable message signs are legal restrictive signs by state law. Obviously, during inclement weather, very little if any enforcement is done, but the key is if a driver has an accident, the speed calculations can be critical in assessing fault.
- **Smart or Intelligent Road Studs (IRS)** – In addition to recognizing speeds in low visibility, drivers' ability to recognize their roadway location is diminished significantly. Caltrans is currently testing the application of (IRS) technologies. Current options for vendors are somewhat limited. IRS roadway markers contain a microprocessor enabling them to detect low-visibility conditions. When poor conditions are detected the IRS markers illuminate with an LED light approximately four times more intense than the light reflected from standard passive markers. The IRS markers may also be utilized to pass on the location of poor visibility conditions to a management center when appropriate communications are provided. Power to the markers has been provided by either solar or through inductive loops. IRS systems are also be tested in Europe and have been deployed in Virginia since the 1980's. For purposes of this project definition IRS deployments were assumed to occur in ¼ mile increments along approximately 5% of the facilities identified in Figure 6-10.

Together these two technologies offer some tested and viable solutions to the transportation problems caused by low-visibility conditions. Fresno County typically experiences some of the most dense ground (i.e. Tule Fog) in the nation between November and March.

Project Objectives:

- Improve driver recognition of the conditions surrounding them.

- Reduce the potential for large-scale incidents through the use of advisory speeds and improved roadway delineation.
- Reduce the number of incidents in poor weather conditions.

Sponsorship: Caltrans with support from CHP, COFCG and other regional agencies.

Deployment Phasing: This project has been broken down into three basic phases.

	Phase Components
Phase 1	➢ Study of the locations of VSS and IRS deployments should stem from efforts conducted in the Weather Sensing/ATMS project. ➢ Deployment of 33 VSS along 100 miles of facilities. ➢ Deployment of 20 (1/4 mile increments) of IRS along facilities. ➢ Procurement of VSS misc. support equipment and software.
Phase 2	➢ Deployment of 57 VSS along 170 miles of facilities. ➢ Deployment of 34 IRS increments.
Phase 3	➢ Deployment of 14 VSS along 42 miles of facilities. ➢ Deployment of 8 IRS increments.

Deployment Locations: Countywide.

Deployment Timeframes: Weather/ATMS Integration should be in place prior to deployment. The project is slated to begin in the near-term.

	Phase Timelines
Phase 1	Years 5-9
Phase 2	Years 10-14
Phase 3	Years 15-18

Benefits:

General Benefits:

- Improved notification to the driver of roadway/travel conditions will improve driver safety.
- See Weather Sensing/ATMS
- Reduced number of accidents at deployed locations, and reduced number of major incidents during poor weather conditions.

Emissions Reductions:

- See Weather Sensing/ATMS.
- Reduction in number of major incidents would lead to emissions reductions.

Budget Estimate:

	Phase Budget Estimates	
	Capital Costs	**Operations and Maintenance Per Year**
Phase 1	$680K	$40K
Phase 2	$920K	$60K
Phase 3	$280K	$20K
Totals	$1,880K	$120K

Unit costs were assumed to be $50,000 per VSS and $15,000 per IRS increment (1/4 mile deployment). Any communications necessary would be available through project 2.1.

Evaluation Criteria:

- MOE
  - Number of incidents
  - Number of VSS activations/speed adjustments
  - Public perceptions of the accuracy of VSS data/IRS effectiveness
  - Number of single vehicle incidents
  - Number of "reckless driving" citations
- MOS
  - Mean-time between failures
  - O&M costs

O&M Considerations: None.

Architecture Considerations: The Region should continue to follow the testing efforts by Caltrans in the use of IRS. The ITS SDP for Kern County also indicates the potential deployment of IRS, and the potential for a joint procurement should be considered.

1.7.2.3 Remote Surveillance and Incident Scene Management

General Description:

This new experimental program involves a video system capable of sending images via cellular or microwave technology to a TMC or dispatch center. The images are then put on the Internet and key experts who could provide technical advise to the responders at the scene can access the pictures with a password. This process would allow the expert to talk to the scene by telephone, look at the problems on the Internet, and help devise solutions for safe and timely resolution.

This technology has been purchased for the Washington State DOT and is being installed on their incident response trucks. There is also a handheld unit for getting close up images of truck equipment and other details. Trauma center doctors, hazardous materials specialists, recovery companies, and investigative specialists are some of the resource personnel that will be able to look at problems and give advice. This type of system has significant application for rural interstates. Problems that require special

knowledge can now close roads for several hours while the experts respond to the scene. The two-way communication link with video going to the experts can potentially save hours of delay for motorists.

Project Objectives:

- Decrease the time associated with roadway closures to special hazardous spills or other hazards not easily handled by normal incident commanders.
- Provide support specialized and timely support to incident commanders.
- Enhance the safety of emergency personnel and motorists at incident scenes.

Sponsorship: Caltrans, CHP, and fire emergency services (Hazardous Materials response personnel).

Deployment Phasing: This project consists of a single phase of deployment.

	Phase Components
Phase 1	➢ Procurement of three remote incident surveillance equipment sets. Suggested deployment with regional hazardous materials groups. ➢ Associate software and communications.

Deployment Locations: Equipment is mobile and can be utilized throughout the Region provided that wireless communications are available.

Deployment Timeframes: This project has been identified for mid-term deployment.

	Phase Timelines
Phase 1	Years 5-6

Benefits:

General Benefits:

- Reduced incident duration and increased safety for emergency service crews.
- Enhanced flexibility of incident management responders.
- Increased public safety through improved information at emergency sites.

Emissions Reduction:

- No emissions reduction can be directly associated with this project. However, there is a potential for individual large reductions in emissions if the system helps reduce major closures by several hours.

Budget Estimate:

	Phase Budget Estimates	
	Capital Costs	**Operations and Maintenance Per Year**
Phase 1	$280K	$30K
Totals	$280K	$30K

Unit costs for each equipment set were assumed to approximate $15,000, and communications costs were considered at $200 per month per connection.

Evaluation Criteria:

- MOE
  - Number of times the system is used
  - Time for the system to reach the scene of an incident
- MOP
  - Communications rates
  - Video refresh rates
- MOS
  - O&M costs
  - Mean time between failures

O&M Considerations: Operations costs were assumed to be relatively high in order to account for the wireless communications needs of this project.

Architecture Considerations: Reference should be made to Figure 5-4 of Section 5.0 of this Plan to assess relationships between the fixed-end components of incident management systems and the mobile components proposed in this project.

1.7.2.4 Computer Aided Dispatch Integration

General Description:

The ITS Subcommittee has indicated that all emergency response communication centers in the area that have Computer Aided Dispatch (CAD) systems should be approached to seek access to real time response data of any incidents that may impact traffic. This would allow the TMC to learn of problems on a timely basis, which in turn would allow traffic control measures such as CMS and HAR to be activated sooner.

It is relatively common for State police and DOT centers to share CAD information. By adding the Fire and Police centers, cities, county, and state TMC's could improve traffic management considerably. The police concern about confidential information control can be overcome by using a separate database or part of a database for non-criminal incident data.

There are several CAD integration efforts on-going throughout the State. Two notable examples are the InterCAD project in San Diego and the FIRST program in Los Angeles.

- InterCAD – utilizes IBM's MQM series products to allow communication between a series of independent terminals, some of which are directly integrated into emergency service CAD systems. The original focus was on the integrating operations and exchanging information between law enforcement agencies, but this has recently shifted to more of a fire agency emphasis.
- FIRST – utilizes a separate system to extract information from the CHP CAD system in a non-intrusive manner, filter the information, and make it available for other transportation agencies.

Both projects have met with some difficulty in regards to the CHP CAD system, which is outdated and operating at capacity. The CHP has determined that in order to ensure the basic functions of the CAD, that extraneous interfaces should be limited until such time as a replacement CAD system can be put in place. The timeframe for replacement is currently unknown, but is likely to exceed five years.

Fresno Fire and Police have recently implemented a new CAD system with AVL support, and some other agencies in the Region plan to undertake similar efforts in the near-future. There is a national standard being developed for the exchange of information between CAD systems. As systems are replaced, integration between CAD systems should be simplified.

Given the status of the CHP CAD the Region has two basic deployment options in terms of this project:

- Integrate certain CAD functions into the Regional Integrated Workstation (RIW) project identified in the Communications Interties project – This may provide the necessary exchange of incident information between emergency services, but is likely to offer somewhat limited capabilities when compared with a true CAD integration effort.
- Deploy a separate series of CAD integration workstations similar to InterCAD - This provides simple CAD functions to an agency that either does not have a CAD or does not wish to directly integrate with its existing CAD system. This also offers the opportunity to integrate a CAD system if desired.

In either event, if the FIRST project prototype is approved for use by CHP then the possibility of exists for using FIRST in the Fresno area to access CHP CAD information and place it in either the RIW or a separate system.

Project Objectives:

- Enhance communications and interoperations between dispatch centers within the Fresno Region.
- Provide enhanced incident information for freeways and arterials.
- Integrate basic CAD functions throughout the Region.

Sponsorship: CHP, emergency services, Caltrans

Deployment Phasing: This project consists of a single phase of deployment.

	Phase Components
Phase 1	➢ Development of a common regional CAD integration software component either separately or within the RIW. ➢ Implementation of a FIRST or similar interface to the CHP CAD system. ➢ Deployment of appropriate workstations and associated equipment at 20 different locations throughout the Region including police, fire, CHP, Caltrans, and other emergency services. ➢ Leased communications for each agency.

Deployment Locations: As noted in Deployment Phasing.

Deployment Timeframes: This project has been identified for mid-term deployment.

	Phase Timelines
Phase 1	Years 5-9

Benefits:

General Benefits:

- Swifter interagency response to major incidents.
- Improved coordination capabilities between various emergency management services.
- Improved communications in emergency or disaster situations.
-

Emissions Reduction:

- No emissions reduction can be directly associated with this project. Some emissions reduction may occur through decreased incident duration and or response time in major incidents.

Budget Estimate:

	Phase Budget Estimates	
	Capital Costs	**Operations and Maintenance Per Year**
Phase 1	$1,200K	$160K
Totals	$1,200K	$160K

Evaluation Criteria:

- MOE
  - Number of messages exchanged across the system
  - Number of incidents logged
  - Perception of CAD operators
- MOP
  - Communications rates

- Message update/refresh rates

- MOS
  - O&M costs
  - Mean time between failures

O&M Considerations: Operational procedures should be developed/updated along with the CAD integration effort in order to maximize the benefits of the project. In addition, interagency cost-sharing agreements may be required depending on the specific CAD integration approach utilized.

Architecture Considerations: As noted above, the Region should follow development of the national standards regarding CAD integration and data definitions. In addition, readers may want to review market package ATMS 8 in the National Architecture.

1.7.2.5 Integration of Communications Channels

General Description:

There are channels for County agencies and for city agencies to talk to others within their own government, but they can't always communicate with outside government agencies. Technology exists to allow cross communication for major incidents and consideration should be given to establishing a link to be used in case of large multi-agency incidents.

This project could follow two basic deployment paths:

- Enhancement of communications at dispatch centers to provide or enhance "link" positions- These positions include those individuals within a dispatch center responsible for interagency communications. This path may also include various communications patching equipment. The disadvantage of this approach is that all communication between different agencies must be "patched" through a dispatcher, which slows or complicates communications efforts.
- Provision of a simple on-site communications system for on-site communications – Perhaps the simpler of the two paths, this effort would provide hand-held communications devices to common incident commanders and responders within the Region. Caltrans has utilized cellular two-way radio equipment in some regions for this type of communications. The disadvantage of this approach is that some personnel may have to use more than one radio/communications device. Advanced satellite and other cellular options are available with excellent coverage capabilities and advanced features.

Project Objectives:

- Enhance the ability of emergency service personnel to communicate with one another either at or in responding to an incident.
- Provide interagency communications for coordination activities.
- Enhance interoperations between emergency service agencies.
- Limit duplication or conflicting efforts through common inter-agency communications.

Sponsorship: CHP, Police Depts., Fire Depts., Sheriff, Others.

Deployment Phasing: This project consists of a single phase of deployment.

	Phase Components
Phase 1	➢ Procurement of either communications channel patching equipment; or ➢ Procurement of 2-way handheld communications for Caltrans Traffic Operations/Maintenance, CHP, Clovis Fire/PD, Fresno Fire/PD, Sheriff, CDF, EMS, County Fire and other emergency service agencies (20 units to each agency). ➢ Communications support/leased communications.

Deployment Locations: No specific locations – agencies would be provided equipment as noted in Deployment Phasing.

Deployment Timeframes: This project has been identified for mid-term deployment.

	Phase Timelines
Phase 1	Years 5-8

Benefits:

General Benefits:

- Reduced confusion, duplication of effort, danger at incident sites.
- Improved communications between inter-agency incident response agencies resulting ultimately in less delay to traveler.
- Possible reduction in incident duration due to enhanced communications between responding emergency agency resources.

Emissions Reduction:

- No direct emissions reduction can be associated with this project, however some emissions reduction could be expected from reduced incident duration at major incidents (see projects 2.1 and 2.2 as examples).

Budget Estimate:

	Phase Budget Estimates	
	Capital Costs	**Operations and Maintenance Per Year**
Phase 1	$740K	$630K
Totals	$740K	$630K

Unit costs assumed $20,000 for each involved agency, and $250,000 for enhanced communications patching.

Evaluation Criteria:

- MOE
  - Number of calls/incidents the system is utilized at
  - Incident clearance times
  - Collective incident response times to inter-agency situations
- MOS
  - O&M costs

O&M Considerations: Project costs include some overall management of the communications resources. Operational charges for communications (especially cell based) should be incorporated into agency budgets. An interagency agreement may be necessary to support long-term O&M costs.

Architecture Considerations: If enhanced inter-agency communications are to be provided through a communications patching solution, then a careful assessment of communications equipment and needs should be performed by a specialist in communications.

1.7.2.6 Incident Management/ Response Coordination Task Force

General Description:

First it should be noted that emergency service agencies in the Region have adopted and trained for the use of ICS. All of the agencies involved in incident management meetings for this Plan indicated that ICS does work. However, these agencies agreed that greater training and coordination on non-disaster incidents would be beneficial, especially in term of interagency coordination.

Traffic Safety teams are best suited for regional issues. They are made up of mid level managers and supervisors who have actual response duties. They tend to be heavily weighted toward police, fire, DOT and towing.

Task forces are a very good concept to use when the recommendations will require executive level approval, budget appropriations, or legislative action. It is best for start up of new, or major overhaul of existing incident management programs when there is a set time duration and a clear objective. Teams are best used to resolve local issues, facilitate interagency training and develop long term working relationships between agencies. They can also develop interagency agreements for senior management approval.

Incident management priorities may be focused on one or more areas of the Region; however, task forces should be at state level. If only one urban area or region needs improvement, the task force will still be best at state level if state agencies are involved and legislative action may be required. The task forces should have ample representation from the areas most in need of incident management improvements so first hand information and experience is available to the entire task force. Teams are best used to resolve local issues, facilitate interagency training and develop long term working relationships between agencies. They can also develop interagency agreements for senior management approval.

When forming a task force or team, consideration must be given to involving all organizations, public and private, that have a direct responsibility for incident response. Highway user groups with large memberships, major employers including large military installations, transit, traffic media, and insurance companies all have indirect but important involvement with this issue and should be considered for membership. They can provide valuable input and excellent lobbying support when legislative approval is needed. Unions or employee association's involvement can also be necessary if they can effect the approval or implementation of programs. Federal highway representatives can provide valuable information about programs in other states, funding opportunities, and training opportunities. Finally, state legislative staff involvement with the committee can be crucial to facilitate development of legislation and maintain information flow with elected officials.

When task force or team members are solicited, a set of criteria should be attached. The prospective members should have adequate knowledge and experience to contribute meaningfully to the group. They should be able and willing to work with others who may have a different set of priorities. They should be able to present the agenda of their organization, have the support of their executive leadership, be able to commit their support for task force recommendations, and they should attend nearly all meetings.

Selecting members to represent several similar organizations such as fire departments or tow companies is necessary to keep the attendance at a manageable number and may best be handled by contacting state level associations that represent those organizations. Care must be taken to select members that have the support of a majority of their organizations.

Task forces or Team may require professional facilitation or a neutral moderator if there are conflicting priorities within the group. The moderator can also distribute agendas, notes, and research information for the committee as well as prepare progress and final reports.

Project Objectives:

- Provide a forum for emergency service agencies to propose needed projects, operational agreements, and cooperative efforts.
- Provide for inter-agency training.
- Fund some site visits to other regions implementing desirable incident management systems, policies, and/or procedures.

Sponsorship: CHP, Caltrans, COFCG with heavy involvement from all other emergency service agencies.

Deployment Phasing: This project consists of a single phase of deployment.

	Phase Components
Phase 1	➢ Development of a Regional Traffic Safety Plan for large-scale interagency incidents. ➢ Funding of appropriate site visits to regions with desirable IC-EMS deployments. ➢ Inter-agency training support – the importance of this element should

	not be underestimated. ➢ IC-EMS program management by agency/other staff.

Deployment Locations: Applies to entire Region.

Deployment Timeframes: This effort is critical to successful inter-agency cooperation in the IC-EMS program area, and is a prerequisite to the other projects in this program area.

	Phase Timelines
Phase 1	Years 1-2 (w/continued support)

Benefits:

General Benefits:

- Enhanced interagency coordination and communications
- Provides an interagency structure upon which deployment efforts can be constituted
- Provides institutional structure necessary to support interagency incident management coordination.

Emissions Reduction:

- None direct associated with this project.

Budget Estimate:

	Phase Budget Estimates	
	Capital Costs	**Operations and Maintenance Per Year**
Phase 1	$130K	$60K
Totals	$130K	$60K

Evaluation Criteria:

- MOE
  - Participation of emergency service agencies.

O&M Considerations: Long-term programming and support should be provided to support the basic functions of the Task Force.

Architecture Considerations: The Task Force should follow and report to the ITS Deployment Steering and Review group on emerging important standards, as regional and State issues, relating to the area of incident management.

1.7.3 TRANSIT SYSTEMS

1.7.3.1 Coordinated Transit District Operations

General Description:

Transit agency representatives present at the workshop indicated that institutional adjustments will be an important part of continued effective ITS transit deployment in Fresno County Region. This effort provides for institutional coordination of the various transit providers in the Fresno County Region. In addition to the institutional efficiencies likely to be achieved, the coordinated transit district concept would simplify the continued deployment of ITS to transit service throughout the Region.

This effort would be institutionalized through the Transit Systems Workgroup. The purpose of the Workgroup is to coordinate ITS deployment within the Region. The size and scale of transit services in the Region dictate that a coordinate approach utilizing common standards is highly desirable for transit ITS deployment efforts. The focus of the Workgroup should be to maximize the effectiveness of existing and future efforts through potential joint procurement and deployment efforts. This effort does not imply that operations would be co-located.

Project Objectives:

- Provide for coordinated transit ITS deployments within the Region.
- Enhance inter-agency coordination.
- Look for joint procurement and deployment opportunities.

Sponsorship: COFCG (supported by FAX, FCRTA, Clovis Transit)

Deployment Phasing: This project consists of a single phase of deployment.

	Phase Components
Phase 1	➢ Development of a Coordinated Transit Operations and ITS Deployment Plan ➢ Agency administrative and coordination support.

Deployment Locations: Applies to entire Region.

Deployment Timeframes: This effort is critical to successful inter-agency cooperation in the TS program area, and is a prerequisite to the other projects in this program area.

	Phase Timelines
Phase 1	Year 1 (w/continued support)

Benefits:

General Benefits:

- Enhanced interagency coordination and communications
- Provides an interagency structure upon which deployment efforts can be constituted.

- Improved service to transit patrons in the Region.
-

Emissions Reduction:

- No emissions reductions can be specifically associated with this project.

Budget Estimate:

	Phase Budget Estimates	
	Capital Costs	**Operations and Maintenance Per Year**
Phase 1	$80K	$20K
Totals	$80K	$20K

Evaluation Criteria:

- MOE
  - Participation of regional transit agencies.

O&M Considerations: Long-term administrative support should be provided to support the basic functions of the Transit Systems Workgroup.

Architecture Considerations: The Workgroup should follow and report to the ITS Deployment Steering and Review group on emerging important standards, as well as regional and State issues, relating to the area of incident management.

1.7.3.2 Transit Operations/ Dispatch Centers Integration

General Description:

In conjunction with Coordinated Transit District Operations, this project would integrate the various transit dispatching operations. Some dispatch centers may be co-located, while others may be remotely integrated. Integration would allow for improved coordination and improved efficiencies along routes where transit patrons must transfer from one system to another.

At the current time, it seems likely that FAX and FCRTA dispatch operations could be co-located, while Clovis Transit dispatch services would operate from another location. The dispatch centers could be coordinated through deployment of enhanced dispatch capabilities centering on upgrades and expansion of the existing systems.

Coordinated dispatch operations could work in coordination with the Transit Management System Completion/Expansion project to provide highly effective coordination between the various transit agencies in the Region.

During the development of the Plan, some of the transit representatives expressed a desire to see a combined dispatch operations for all transit services in the Region. While a combined dispatch center could provide some economies of scale and may increase coordination of transit services in the Region,

it became clear that significant institutional issues are involved with the combined dispatch concept. For this reason, the focus of this Plan, and more specifically, this project is on enhancing communications and coordination between transit services without requiring a combined dispatch operation. This concept of coordinated dispatch operations has been applied to transit operations in the Denver and Detroit regions, as well as at other locations throughout the nation.

Project Objectives:

- Enhance the level of cooperation and integration between various transit dispatch operations within the Region.
- Co-located FCRTA and FAX dispatch operations.
- Provide remote communications and dispatch integration between FAX/FCRTA and Clovis Transit.

Sponsorship: FAX, FCRTA, Clovis Transit, COFCG

Deployment Phasing: This project consists of a single phase of deployment.

	Phase Components
Phase 1	➢ Procure/develop dispatch software enhancements to allow remote integration and communications. ➢ Procure needed workstations/communications/network equipment. ➢ Procure furniture/dispatch positions equipment. ➢ Additional software upgrades.

Deployment Locations: Applies to entire Region.

Deployment Timeframes: This effort is slated for mid-term deployment.

	Phase Timelines
Phase 1	Years 5-7

Benefits:

General Benefits:

- Enhanced interagency coordination and communications.
- Provides an interagency structure upon which deployment efforts can be constituted.
- Ability for improved time-transfers.
- True regional integrated transit operations.

Emissions Reduction:

- To the extent that coordinated operations results in service improvements and enhance ridership, this project could offer some emissions reduction benefits. When this project is proposed for funding, any hoped for service enhancements or adjustments should be noted in order to assess emission impacts.

Budget Estimate:

	Phase Budget Estimates	
	Capital Costs	Operations and Maintenance Per Year
Phase 1	$1,630K	$10K
Totals	$1,630K	$10K

Evaluation Criteria:

- MOE
  - Number of messages exchanged across the system
  - Number of timed transfers between agencies
  - Perception of transit dispatch operators
- MOP
  - Communications rates
  - Screen/message update/refresh rates
  - Ability to track a specified number of vehicles
- MOS
  - O&M costs
  - Mean time between failures

O&M Considerations: An institutional arrangement would be required between the various transit agencies to account for on-going operations and maintenance costs. The details of this agreement should be worked out by the Transit Systems Workgroup.

Architecture Considerations: The Workgroup should perform a review of existing and planned dispatch systems to determine potential integration difficulties. The Workgroup should seek to define regional standards for transit data definitions (objects) and ITS equipment. Readers may want to review market packages APTS 1, 2, and 3 of the National Architecture.

1.7.3.3 Transit Information System (Regional)

General Description:

FAX has clearly come a long way in the deployment of its Transit Management System (TrMS), which includes AVL on 20+ of its vehicles and the necessary MIS components. As indicated in the Transit Management System Completion/Expansion project, the deployment of a regional TrMS is planned. The transit agencies would like to make the improved information, currently only available to its staff, also available to its customers. Of course, this information would have to be in a simple format easily digested by the transit patrons and readily available to them. The near-term focus of the project would include deployment of real-time information displays at transit centers. This project should include an evaluation of various information dissemination alternatives, as well as careful review of Seattle's SmartTrek efforts towards improving real-time transit information at stops and centers.

This project definition assumes the deployment of real-time transit information displays at ten locations throughout the Region. These displays would most likely be located in transit centers and at transfer locations. Some additional software development would be required to provide appropriately formatted data and communicate the transit status information in a format easily digested by the public. It was assumed that leased communications would be required to each of the ten transit information sites.

Project Objectives:

- Provide real-time transit status information to transit patrons including delays, arrival times, and schedules.
- Promote transit ridership through enhanced information to the public.

Sponsorship: FAX, Clovis Transit, COFCG

Deployment Phasing: This project consists of a single phase of deployment.

	Phase Components
Phase 1	➢ Deploy real-time transit information displays at ten locations (2 displays each/secure casings). ➢ Procure or develop software to upgrade the TrMS to support the transit information displays. ➢ Provide communications for each of the locations. ➢ Provide monitoring/management workstations for the system.

Deployment Locations: Ten prominent transit centers/transfer locations within the FCMA.

Deployment Timeframes: This effort is slated for mid-term deployment.

	Phase Timelines
Phase 1	Years 5-7

Benefits:

General Benefits:

- Provides simple, accurate, and timely transit information to transit patrons on the status of the next bus, delays, schedules, etc.
- Promotes transit ridership by improving the perception of the service.

Emissions Reduction:

- Improved information for transit patrons should help to enhance ridership. Short- and Long-Range transit plans should include this project, and the anticipated impacts on ridership. These estimates could be used to determine emissions reduction potential.

Budget Estimate:

	Phase Budget Estimates	
	Capital Costs	**Operations and Maintenance Per Year**
Phase 1	$850K	$70K
Totals	$850K	$70K

Evaluation Criteria:

- MOE
  - Survey of transit patrons
- MOS
  - O&M costs
  - Mean time between failures

O&M Considerations: None

Architecture Considerations: Reference should be made to market packages APTS 4 and 8 of the National Architecture.

1.7.3.4 Transit Management System completion/ Expansion

General Description:

The ITS Subcommittee emphasized the point that they do not want to "recreate the wheel," and that FAX's transit management system deployment efforts should act as a building block for the rest of the Region. This project would look at the most effective options for continuing FAX's TrMS deployment efforts by deploying AVL on uninstrumented rural and urban transit vehicles. Additional TrMS functions should be deployed with a view towards eventual regionwide deployment. Options for deploying compatible components across all vehicles should be sought. FAX's system is J1708 compliant, and this is an important standards consideration. The example provided was that fare equipment in a large bus may not be appropriate to a small rural service vehicle. Different devices may be used, but they should operate across a common software/system with completely compatible standards.

Project Objectives:

- Complete regional TrMS deployment by using FAX's TrMS as a building block.
- Establish regional standards for the deployment of transit AVL equipment.
- Enhance the efficiency of transit services throughout the Region by deployment of a common TrMS.
- Allow transit agencies to operate remotely of the core FAX TrMS system with appropriate security features.
- Enhance the TrMS to effectively support demand based transit operations.

Sponsorship: FAX, FCRTA, Clovis Transit, COFCG

Deployment Phasing: This project has been broken down into two basic phases.

	Phase Components
Phase 1	➢ Perform a focused transit communications study to determine the specific communications needs of TrMS expansion. ➢ Deploy 50 transit vehicles (apx. 1/2 of FCRTA - including fixed route & paratransit) with standard AVL/GPS equipment. ➢ Deploy 15 vehicles with enhanced equipment (passenger counting, etc.) ➢ Develop/procure software upgrades for TrMS to support regional needs and paratransit services. ➢ Install radio/communications system upgrades for FCRTA. ➢ Procure additional workstations.
Phase 2	➢ Deploy 30 standard vehicles (FCRTA/Clovis Transit). ➢ Radio system upgrades for Clovis Transit. ➢ Procure additional workstations.

Deployment Locations: Regional deployment.

Deployment Timeframes: This project has been identified for mid-term deployment.

	Phase Timelines
Phase 1	Years 5-7
Phase 2	Years 10-12

Benefits:

General Benefits:

- Enhanced information for transit managers.
- Provides enhanced potential for real-time transit operations integration.
- Improved coordination between various transit agencies.
- Expands core for the TrMS deployment to support other ITS transit deployment efforts.

Emissions Reductions:

- Transit management systems generally have a significant potential for positive impacts on emissions reductions resulting from more effective use of the transit fleet.
- This project focuses on FCRTA, demand responsive, and Clovis Transit services. Enhanced management and dispatching for these systems could reduce out-of-direction travel and increased service effectiveness.

Budget Estimate:

	Phase Budget Estimates	
	Capital Costs	**Operations and Maintenance Per Year**
Phase 1	$1,590K	$160K
Phase 2	$680K	$70K
Totals	$2,270K	$230K

Based on deployments in other regions, the basic costs were conservatively assumed to be $7,500 for a standard vehicle deployment and $20,000 for an advanced vehicle deployment.

Evaluation Criteria:

- MOE
  - Transit O&M
  - Ridership
  - On-time performance
- MOS
  - Mean-time between failures
  - O&M costs

O&M Considerations: None

Architecture Considerations: The Transit Systems Workgroup should establish regional standards for TrMS deployment based on FAX's existing system and existing/emerging national standards. Reference should be made to APTS 1 of the National Architecture.

1.7.3.5 Common Fare Equipment Deployment

General Description:

While certain fare transfer policies have been established between the region's transit agencies, there is difficulty in properly monitoring and managing fare transfers. Some agencies lack the more advanced fare equipment which is useful in terms of reporting ridership, patron types, travel patterns, etc. This project would establish a regional fare standard and deploy appropriate fare equipment and software. The potential for flexible fare media and smart cards should be reviewed. As with the expansion of the TrMS, the specific equipment needs of agencies may vary, but a common standard is important to inter-compatibility and economies of scale.

Project Objectives:

- Establish a common regional transit fare system.
- Simplify fares for transit patrons.

Sponsorship: FAX, FCRTA, Clovis Transit

Deployment Phasing: This project has been broken down into two basic phases.

	Phase Components
Phase 1	➢ Perform a needs definition and installation plan. ➢ Deployment of new fare system on 146 vehicles (FAX/FCRTA) ➢ Procurement of fare management software, workstations, and interface equipment.
Phase 2	➢ Deployment of new fare system on 25 vehicles (Clovis Transit) ➢ Procurement of fare management software, workstations, and interface equipment.

Deployment Locations: Regional deployment, reference Figure 6-11.

Deployment Timeframes: This project has been identified for mid-term deployment.

	Phase Timelines
Phase 1	Years 5-7
Phase 2	Years 10

Benefits:

General Benefits:

- Improve regional integration of the transit fare system.
- Benefits patrons making transfers.
- Improves extent and quality of information available to transit managers.
- Allows for integration with the TrMS.

Emissions Reductions:

- No specific emissions reductions can be associated with this project.

Budget Estimate:

	Phase Budget Estimates	
	Capital Costs	**Operations and Maintenance Per Year**
Phase 1	$1,500K	$90K
Phase 2	$320K	$20K
Totals	$1,820K	$110K

Evaluation Criteria:

- Number of units deployed and mean time between failures.

O&M Considerations: None

Architecture Considerations: The Transit Systems Workgroup should establish regional standards for fare systems deployment based on existing/emerging national standards. Reference market package APTS 4 of the National Architecture.

1.7.4 TRAVELER INFORMATION SYSTEMS

1.7.4.1 Regional Transportation User Information System

General Description:

This project was added by the ITS Subcommittee to address the dissemination of transportation conditions and related data to the users of the transportation network (the general public). The Subcommittee noted that any TUIS deployed in the Fresno County Region would need to address the needs of local residents, as well as recreational travelers or tourists. Currently, information is provided through the Caltrans, District 6 TMC/CHP dispatch center to various TV and radio media outlets. Other dissemination techniques are limited to non-existent. This project will need to review opportunities for additional information outlets, as well as necessary improvements in the types and accuracy of information available through various management systems.

This project focuses on TUIS needs within the Fresno County Region. Project 4.2 focuses on connections with neighboring regions and the rest of the State. Regional enhancement of TUIS consists of four primary components:

- Freeway/ Highway CMS Deployments – additional deployments of freeway and highway CMS for specific traveler information purposes rather than traffic management. These signs would be deployed on key routes throughout the Region and controlled by Caltrans or through the RIW. A specific application of special traveler information CMS devices noted by stakeholders was potential deployments of airport information signs along the Peach Avenue and other airport approach corridors. Deployment at these location should be considered a priority for this project.
- Internet Application of the Regional Integrated Workstation (RIW) – would take filtered information from the RIW network and make it available to the public over the Internet.
- Upgrades Highway Advisory Radio – would upgrade Caltrans and regional HAR systems to provide digital/remotely updated equipment.
- Additional Deployment of RIWs – would deploy addition RIW at radio and television stations broadcasting traffic information to the public.

Project Objectives:

- Provide timely, accurate, and complete information on real-time transportation conditions to the users of the transportation network within the Fresno County Region.
- Enhance existing TUIS services through the deployment of upgraded and additional dissemination devices.
- Make TUIS data widely available over the Internet.
- Provide enhanced transportation conditions information to television and road broadcast stations.

Sponsorship: COFCG and Caltrans

Deployment Phasing: This project consists of a single phase of deployment.

	Phase Components
Phase 1	➢ Deploy 12 freeway/highway CMS signs for TUIS purposes. ➢ Develop Internet integration component for RIW data. ➢ Upgrade/procure 10 HARs ➢ Deploy 5 additional RIWs to regional TV and radio broadcast services.

Deployment Locations: Should be determined by COFCG in cooperation with member agencies.

Deployment Timeframes: This effort is slated for mid-term deployment.

	Phase Timelines
Phase 1	Years 7-9

Benefits:

General Benefits:

- Provides real-time transportation conditions information to travelers in the Fresno County Region.
- May moderate people's travel patterns during commute periods resulting in overall reductions in delay.
- Reduced delay through diverted traffic.

Emissions Reduction:

- Emissions reductions from information systems are difficult to estimate. Estimation is usually based on the number of trips likely to be diverted or changed due to the information provided. This diversion results in an overall reduction in hours of congestion and number of vehicles delayed in incidents.
- Once the details of the proposed project have been decided upon (whichever components are deployed), the proponents should work with COFCG to assess the emissions reduction potential of the project.

Budget Estimate:

	Phase Budget Estimates	
	Capital Costs	**Operations and Maintenance Per Year**
Phase 1	$3,920K	$370K
Totals	$3,920K	$370K

Evaluation Criteria:

- MOE
  - Survey of travelers & origin-destination surveys.
  - Traffic volumes

- Overall traffic delay
- Incident induced traffic delay
- Number of messages displayed/transmitted
- Perceptions of broadcast media

➢ MOS
- O&M costs
- Mean time between failures

O&M Considerations: Information projects offer the greatest potential for public/private partnerships to support O&M considerations.

Architecture Considerations: It is critical that the Region's ITS projects follow a common architecture as discussed in this Plan in order to provide data in a common format to transportation user information systems. The Region should carefully follow and participate in statewide and valleywide efforts that establish specific standards and architectures for information systems.

1.7.4.2 Coordination with Valleywide/ Statewide Information Systems

General Description:

This project was added to assist the Fresno County Region in maintaining consistency with Statewide and valleywide TUIS efforts. It is anticipated that the State will be providing support and funding for several TUIS deployment efforts, and that funds may be distributed to each Caltrans District. The Region should be prepared to capitalize on this potential by conducting:

➢ Planning/Configuration Management Efforts – Integration with Statewide and valleywide efforts will take planning and coordination with agencies outside of the Region. This element of this project accounts for travel, planning, and meeting costs associated for the Region to participate in these efforts.

➢ Performing Appropriate Software Modifications to the RIW – This element of the project would make modifications to the RIW to allow integration based on valleywide and Statewide TUIS standards.

Project Objectives:

➢ Provide for the integration of the RIW to Statewide and valleywide TUIS efforts.

➢ Coordinate with Statewide and valleywide TUIS efforts.

➢ Act as a placeholder for potential State funded TUIS opportunities.

Sponsorship: COFCG and Caltrans

Deployment Phasing: This project consists of a single phase of deployment.

	Phase Components
Phase 1	➢ Valleywide/Statewide TUIS meetings, coordination, configuration management. ➢ RIW software modifications to allow integration with Statewide/valleywide TUIS efforts.

Deployment Locations: N/A

Deployment Timeframes: This effort is slated for mid-term deployment.

	Phase Timelines
Phase 1	Year 10

Benefits:

General Benefits:

- This project represents largely a coordination effort to tie in the Fresno County Region with statewide and valleywide traveler information efforts. The greatest benefits of this project include the potential to receive funds to support information projects in the Region, as well as gaining economies of scale through coordination with other Regions.

Emissions Reduction:

- No specific emissions reductions can be associated with this project, however see project 4.1.

Budget Estimate:

	Phase Budget Estimates	
	Capital Costs	**Operations and Maintenance Per Year (3 yr. lifespan)**
Phase 1	$260K	$40K
Totals	$260K	$40K

Evaluation Criteria:

- MOE
  - State funds received for TUIS deployments.

O&M Considerations: None

Architecture Considerations: The Region should carefully follow developments in the statewide and valleywide system architectures.

1.7.5 REGIONAL ITS CONFIGURATION MANAGEMENT/COORDINATION/PLANNING

1.7.5.1 Valleywide/ Statewide Communications Linkages

General Description:

Communications throughout the wider Central Valley and the State are likely to be supported by Caltrans through their TMC-to-TMC communications network. Caltrans –ISSC is generally responsible for the deployment and development of this network. This project simply accounts for the regional costs associated with being part of this network.

Project Objectives:

- Provide for coordination with Caltrans Statewide communications activities.
- Provide minor communications upgrades for the Region to communicate on the State network.

Sponsorship: Caltrans and COFCG

Deployment Phasing: This project consists of a single phase of deployment.

	Phase Components
Phase 1	➢ Staff time to coordinate with Statewide communications efforts. ➢ Additional communications equipment for connecting the RIW network to the Statewide network.

Deployment Locations: N/A

Deployment Timeframes: This project is a mid term deployment.

	Phase Timelines
Phase 1	Year 10 (w/continued support)

Benefits:

- N/A – requirement for communication outside of the Region.

Budget Estimate:

	Phase Budget Estimates	
	Capital Costs	**Operations and Maintenance Per Year**
Phase 1	$70K	$20K
Totals	$70K	$20K

Evaluation Criteria:

- N/A

O&M Considerations: N/A

Architecture Considerations: Compliance with Caltrans Statewide communications standards will be required. Coordination between agencies to establish and maintain common standards will be critical.

1.7.5.2 Regional Configuration Management

General Description:

This project provides for Regional Configuration Management of ITS projects being deployed in the Fresno County Region. The majority of this project represents either an agency staff or contracted effort. The person(s) responsible for the configuration management activities should be performed by someone familiar with systems and standards development. The goal of the effort should be to generate clear and concise materials that assist agencies in maintaining conformity with the regional standards and guidelines suggested by the various Workgroups.

The importance of configuration management to regional deployment efforts cannot be understated. It is not enough that the regional architecture has been developed and included in this Plan. A system architecture occurs at many levels, of which the national and regional architectures represent only one. Actual deployment of systems at a level that allows proper integration and data exchange requires the use of common specific standards, protocols, and translators between standards and protocols. All of these issues cannot be addressed prior to the detailed design phase of a project. Configuration management represents the combined efforts of agencies working together at a technical and institutional level to occur upon the use of certain standards and protocols available through the national, statewide, and regional architectures.

Project Objectives:

- Provide for a consistent and standardized ITS deployment effort throughout the Region
- Lower deployment and integration costs by making agencies aware of their ITS deployment and procurement options in relation to the overall regional deployment effort. In other words, what standards are being utilized by the Region, and how can they best be applied in a deployment effort?

Sponsorship: Caltrans and COFCG

Deployment Phasing: This project consists of a single phase of deployment.

	Phase Components
Phase 1	➢ Staff time to coordinate with Statewide communications efforts. ➢ Configuration management, ITS support, systems requirements studies as needed.

Deployment Locations: Regional

Deployment Timeframes: This project is a near to mid term deployment.

	Phase Timelines
Phase 1	Years 1-8 (with continued support)

Benefits:

- Without proper configuration management the likelihood of developing system interoperability and maintaining the ability of exchanging data are extremely low. Configuration management should be an on-going effort and the standards selected by the Region should be thoroughly documented.
- Proper configuration management lowers deployment risks and costs.
- Regional configuration management should result in economies of scale in deployment.
- Continuing configuration management should help to ensure continuing consistency with the national and statewide system architectures.

Budget Estimate:

	Phase Budget Estimates	
	Capital Costs	**Operations and Maintenance Per Year**
Phase 1	$30K	$10K
Totals	$30K	$10K

Evaluation Criteria:

- N/A

O&M Considerations: Agencies involved in ITS deployment will have to dedicated staff time and resources to configuration management issues. At a regional level this may amount to only a few hours a month, but the time spent on these efforts is critical.

Architecture Considerations: Configuration management should draw on national and statewide architecture and standards information and resources. This information is frequently updated, and it is necessary that appropriate steps be taken to keep up to date on current events. Stakeholders involved in configuration management should also look to the activities of neighboring regions to determine if any useful information can be derived from their efforts.

1.7.5.3 Common/ Standard Regional/ County Map

General Description:

The issue of standard and AVL accurate maps is a key issue in the Region. While accurate maps have been established for urban service areas, they do not exist for rural areas. American Ambulance does use AVL, although specific map accuracy is not a critical issue, as they only desire to know the general location and direction of the vehicles. This project would review options for development of a regional standard map for AVL applications. Potential sources to be reviewed include the Fresno County GIS files, American Ambulance GIS files, etc. At a minimum the potential for a common mapping standard should be reviewed, and funds potentially sought for update, creation, and/or correction of a regional AVL map.

This effort was originally proposed by the transit providers in the Region, however input from the Subcommittee has resulted in it being moved to a new category of projects. The update and standardization of mapping for ITS and AVL purposes is seen as a broad regional need.

This project would provide for County staff or contracted staff time, as well as needed surveys to improve the regional GIS map for ITS purposes. The focus of this effort should be enhancing the accuracy of rural areas for AVL/GPS purposes, as well as working with emergency services to establish a common inter-agency grid system for emergency services.

Fresno County has a GIS department and a GIS working group, which can serve as a core resource for Region in its mapping efforts. The development of more accurate maps should strike a careful balance between level of detail required and the costs involved in developing the maps. Emergency service personnel should be involved in map development efforts to ensure that their needs for a common grid/coordinate system are met.

Project Objectives:

- Enhance the County of Fresno GIS files to provide more accurate mapping outside of the urban area for purposes of AVL/GPS.
- Provide a common emergency services map reference grid overlay.

Sponsorship: County GIS Group, COFCG

Deployment Phasing: This project consists of a single phase of deployment.

	Phase Components
Phase 1	➢ Perform appropriate surveys necessary to enhance the regional GIS map as directed by County of Fresno GIS staff. ➢ Project provides for 1.5 full time employee equivalents for two years to perform necessary support tasks.

Deployment Locations: Regional

Deployment Timeframes: This project is a near term deployment.

	Phase Timelines
Phase 1	Year 4 (w/continued support for 2 years)

Benefits:

- A more accurate map should reduce future AVL deployment costs and ensure greater accuracy in data.
- A more accurate regional map will also assist in ensuring that all ITS applications utilize an accurate and common mapping base.
- A common grid/coordinate system for emergency services would assist in interagency coordination and cooperation in interagency emergency response situations.

Budget Estimate:

	Phase Budget Estimates	
	Capital Costs	**Operations and Maintenance Per Year**
Phase 1	$360K	$150K
Totals	$360K	$150K

Evaluation Criteria:

- Accuracy of the regional map for ITS applications.

O&M Considerations: Prior to proceeding with this effort, the project stakeholders should carefully define the allowed uses of the map.

Architecture Considerations: Reference should be made to the National Architecture Location Referencing Standards currently under development.

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Table A.13: Summary of Fresno County ITS Projects

ID	Program Area/Project	Involved Agency	Brief Description	Project Initiation*			Capital Cost Estimates 2001 (Thousands of $)**		
				N	M	L	Total		
							Phase 1	Phase 2	Phase 3
FRESNO COUNTY									
1.0 Traffic/Freeway Management Systems (ATMS)									
1.1F	**RAMP METERING AND COMMUNICATIONS GAP CLOSURE**	Caltrans	There are three principle components to the ramp metering and communications gap closure project. First is the deployment of approximately 16 miles of fiber-optic communications along SR99, SR180, SR41, and to the Caltrans TMC. Another potential fiber-optics communications deployment has been identified for this project consisting of an additional 35 miles of fiber-optics along SR99, SR168, and SR180. Second is the deployment of approximately 18 ramp meter sites (4 initial and 14 future) as growth in travel demands dictate. Third is the installation and integration of the Caltrans Advanced Transportation Management System (ATMS) software into the District 6 TMC. The Statewide TMC Standardization Plan has identified District 6 as receiving this software in the Year 2013. This timeline could adversely impact the ability of District to integrate with other on-going ITS deployment efforts in the Region, and an interim integration effort has been identified. The project is divided into three phases. Phase 1 consists of16 miles of fiber communications, an interim software integration solution for the TMC, and deployment of 4 ramp meter sites (as determined by Caltrans D6). Phase 2 consists of 35 miles of fiber communications, an interim development/porting of ramp metering software, and deployment of 14 ramp meter sites. Phase 3 consists of the development/installation of the Caltrans ATMS software into District 6.	X	X	X	**$4,480**	**$10,920**	**$1,300**
1.2F	**MULTI-JURISDICTIONAL INTERCONNECTS**	Phase 1 • City of Fresno (supported by City of Clovis and the County of Fresno) Phase 2 • Caltrans • City of Clovis • County of Fresno	This project would provide fiber-optic communications interconnects between the City of Fresno, Clovis, and the County along Shaw, McKinley, Ashlan, and Peach Avenues (to the airport). Fiber-optics deployment was assumed to an approximate 12 miles in length. Deployment of communications and information devices along the Peach Avenue corridor to the airport has been noted as a priority focus area because of planned developments to airport access. Communications projects along this corridor should consider linkages directly to the airport for supporting traveler information devices such as airport status, etc. The project would include necessary hardware/software upgrades and installations to support the communications. These areas were identified as priority interconnection gaps by the ITS Subcommittee. In the last CMAQ funding cycle, the ITS Subcommittee was successful in obtaining some interconnect funds for communications gaps along local arterial streets. This should be viewed as an early success by the ITS Subcommittee. The funded interconnect projects are not included in this project. This project is divided into 2 phases. Phase 1 consists of 8 miles of local fiber communications, the deployment of centralized signal software at the City of Clovis and County of Fresno, the upgrade of outdated controllers, and network equipment & services for communications between signal systems & with remote cities. Phase 2 consists of 4 miles of local fiber communications, the deployment of 5 signal workstations to smaller cities, the upgrade of outdated controllers, and additional network equipment and expanded services.	X	X		**$2,190**	**$1,910**	
1.3F	**INTEGRATED SMART CORRIDORS (SR41/168/180)**	COFCG (representing the combined participating agencies)	This effort would establish an integrated corridor between SR41, SR168, SR180 and Blackstone and First Avenue using technologies such as Changeable Message Signs (CMS), Highway Advisory Radio (HAR), Closed-Circuit Television Cameras (CCTV), Vehicle Detection Systems (VDS), and enhanced signal timing. Overall, this project would represent an intensification of the ITS infrastructure deployments within the urban area of the Region. The project would allow for multi-jurisdictional sharing of information and control amongst these devices. An integrated workstation would be developed along with the necessary communications and supporting infrastructure. The project is divided into three phases. Phase 1 consists of 2.5 miles of fiber communications and 7 miles of smart corridor including appropriate (CMS, CCTV, HAR, and freeway/arterial integration) along SR168/180/41. Phase 2 consists of 5.5 miles of fiber communications and 9.5 miles of smart corridor along SR168/180/41. Phase 3 consists of 3 miles of smart corridor along SR41.		X	X	**$3,630**	**$5,270**	**$1,370**
1.4F	**RAILROAD/HIGHWAY INTERFACE TECHNOLOGY FOR RAILROAD CROSSINGS**	City of Fresno (potentially other cities as well)	This project would provide enhanced detection and location information on trains within urban areas of the Region, along with improved notification to motorists of an approaching train. Fourteen preliminary major crossings have been discussed, but not specifically identified. The focus of the project is to enhance traveler information and safety. It was conservatively assumed that leased communications would be necessary to the 14 sites, and that each site would include sensing and a CMS or similar device. Many options are currently being tested in this area in both the software and infrastructure areas. It is not yet clear which types of devices will prove to be the most successful, but some definitive answers should be available by the time deployment commences.	X	X		**$980**		
1.5F	**COMMUNICATIONS INTERTIES**	Cities of Fresno and Clovis, County of Fresno, Caltrans	Whereas project 1.1 (Ramp Metering and Communications Gap Closure) would provide a significant communications backbone between Caltrans and freeway ITS elements, this project would establish/complete backbone wireline communications between the largest transportation players in the Region (City of Fresno, City of Clovis, County of Fresno, and Caltrans). Communications would likely utilize fiber optics, however other opportunities should be reviewed for the various needs. This project should consider the establishment of regional standards for fiber communications deployment, including consideration of modes, capacity needs, communications protocols, and perhaps equipment types. It is likely that the best communications solution from the regional perspective will include a combination of agency owned communications in the urban areas and a leased solution for outlying or rural areas. The focus of the interties will be on linking Transportation Management Centers (TMC). Development of the project should consider the Implementation Plan developed by the City of Fresno. The development of common communications standards and protocols will be critical, as will the development of common data definitions. The potential for linkages with CHP and other emergency service providers should also be considered, as should linkages with information service providers. This project is divided into 2 phases. Phase 1 consists of 12 miles of local fiber communications plus supporting communications equipment, leased communications equipment and services for 6 agencies, the development of the Regional Integrated Workstation (RIW) software, and the necessary device driver upgrades and computer equipment. Phase 2 consists of leased communications equipment and services for 6 additional agencies and additional RIW equipment for 6 agencies.	X			**$3,380**	**$160**	
1.6F	**INTEGRATED SURVEILLANCE STATIONS/CALLBOX DEPLOYMENT**	Caltrans/COFCG	This project includes the possible deployment of callboxes with the added advantage of remote sensing capabilities that callboxes have been proven capable of providing. Even if callboxes are not deployed, remote sensing stations with some form of wireless communications are clearly needed in many areas. This project is divided into 3 phases. Phase 1 consists of the study for location of remote sensors, Smart Callboxes, and callboxes, an answering center start-up & support, callbox program support, the deployment of 298 normal and 34 Smart callboxes/remote sensing stations along I-5 and SR99, as well as in some regional parks/trails, and the procurement of supporting software. Phase 2 consists of continued answering center support, a callbox support program, and the deployment of 500 normal and 56 Smart callboxes/remote sensing stations along Phase 2 facilities. Phase 3 consists of continued answering center support, a callbox support program, and the deployment of 126 normal and 15 Smart callboxes/remote sensing stations along Phase 3 facilities.	X	X	X	**$4,580**	**$6,550**	**$1,690**

ID	Program Area/Project	Involved Agency	Brief Description	Project Initiation*			Capital Cost Estimates 2001 (Thousands of $)**		
				N	M	L	Total		
							Phase 1	Phase 2	Phase 3
1.7F	**REGIONAL INTERSECTION SAFETY AND ENHANCEMENT PROGRAM**	COFCG & County of Fresno (with support from cities as appropriate).	The general concept behind this project is to develop a series of low-cost systems that may be applied to urban and rural signalized intersections to enhance motorist and pedestrian safety. The near-term focus of this effort is likely to be on red-light photo enforcement due to the significant problem and accident hazard this represents in the Region. Problem locations will be identified and the appropriate equipment installed. Contractual relationships may need to be established with third parties to deal with red-light photo enforcement issues. In addition, pedestrian safety applications will be included in this effort. This effort will define regional standards for each of the independent intersection safety tools. Based on recent deployments of similar systems throughout the State it should be possible to display proven benefits. Eventual regional deployment was assumed to consist of 35 red-light photo enforcement locations (equipment can be moved) and 20 pedestrian safety deployments including high-visibility crossings and video detection. Problem intersections should be identified through recent accident records and based on the local knowledge of traffic engineers. Deployment costs for red light deployment was assumed to be $50,000 per intersection based on efforts in other Regions. Unit costs for pedestrian safety deployments were assumed to average to approximately $30,000 per location. The project will consist of a single phase to be deployed over five years. Deployment efforts should be prioritized based on the extent of the problem at individual intersections. No independent software development should be required for this effort.	X	X		**$3,050**		
1.8F	**ALTERNATE ROUTE SIGNING**	Fresno County Urban Traffic Corridors in: • Fresno County • City of Fresno • City of Clovis	This project would include the installation of 70 static alternate route signs within the County for designated detour routes. This project would implement changeable message signs specifically sited, and primarily devoted, to detouring traffic onto alternate routes during incidents, including accidents and weather related road closures. These signs could differ from the large, permanent changeable message signs deployed by Caltrans at key decision points in several respects. First, they would be sited in conjunction with a specific alternate route/detour strategy developed for a particular route and alternate routes. Second, the signs could be smaller than the Caltrans signs. Third, the signs could include features, such as arrows or flashing beacons that are not included on the traditional CMS. Finally, the alternate routes signs could be deployed as trailblazers along the alternate route, rather than merely in advance of the main route/alternate route decision point. The objective of this project would be to improve compliance with detours and reduce driver uncertainty along detour routes. If successful in reducing the volume of vehicles entering hazardous or congested roadway segments, this project holds the potential to reduce congestion, delay and accidents. In order to be successful, it would be critical that this project include development of an alternate route plan and procedures to support the usage of the signs, and that this plan be effectively linked to an overall multi-agency coordinated incident management strategy. This project would also require a commitment on behalf of the operating agency to devote the time and attention necessary to utilize the signs effectively. Even more so than a single CMS, keeping the dynamic message signs current and accurate would be critical		X	X	**$3,000**		
1.9F	**EVP DEPLOYMENTS**	Fresno FUA • City of Fresno • City of Clovis • Fresno County	The project would implement Emergency Vehicle Preemption (EVP) along key arterials throughout the County for use by City and County fire departments. The implementation EVP at a traffic signal modifies normal signal operation to provide a nearly immediate green signal for an approaching emergency vehicle. This type of system is most often deployed on fire trucks because of the nature of the fire truck vehicle performance. The acceleration rate of fire trucks is rather slow due to their relatively low power-to-weight ratio. If fire trucks must slow down (and sometimes stop) when they encounter signalized intersections along their emergency run, the overall delay in responding to their emergency destination can easily exceed 1 to 2 minutes. For fire events, this delay can mean a significant difference in the level of destruction, the level of effort in suppressing the fire, the level of personal danger for firefighters at the scene, and the number and extent of injuries for victims. Depending on the level of congestion and the distance traveled, fire trucks can encounter many traffic signals, and heavy congestion. Driving in oncoming traffic lanes is a "last resort" maneuver, which fire departments rightly avoid. If the fire truck encounters a red signal, it can assert the right of way and go through, but only after gaining assurance that it can safely cross through the intersection. EVP isn't needed in every community. Only when traffic congestion is very significant, or only when long emergency vehicle runs are likely to encounter a large number of signalized intersections, would the provision of EVP be cost effective. Some cities in the Central Valley already have EVP in place, the 3M Opticom™ system being predominant. Priority request equipment would be installed in each fire truck and matching reception equipment would be installed at each signalized intersection where EVP is to be granted. Some larger agencies that have used EVP for many years have broadened the application to also equip ambulance vehicles and, in some cases, police vehicles with this on-board preemption request equipment. While these vehicles have much better acceleration characteristics, and the added delay at signals while on their emergency runs is much lower, granting EVP to these vehicles may provide another benefit. The crossing of very wide and very busy signalized intersections is very difficult in today's traffic. Each year, many such emergency vehicles are "totaled" after being T-boned when crossing a busy intersection. EVP helps reduce and prevent this occurrence. However, this project assumes only fire department vehicles would be equipped with EVP devices.	X			**$2,000**		
1.10F	**URBAN AREA TRAFFIC SIGNAL COORDINATION PROJECT**	Fresno County- Remaining uncoordinated arterials in Fresno/Clovis metropolitan area	This project would implement local traffic signal coordination plans at specific urbanized locations along regionally significant arterials in the County not currently developed. The objective of this project would primarily be to reduce delays at traffic signals by improving coordination between adjacent signals, with improved safety a possible secondary benefit depending on the specific improvements made. The specific improvements to be made would vary by location, which could include intra- and inter-jurisdictional efforts. The types of improvements that are possible include upgrading traffic signal controllers and detection, adding or upgrading signal interconnects, and communications systems enabling centralized (i.e., remote) timing plan updating and maintenance and malfunction monitoring. Although providing emergency vehicle preemption, transit vehicle priority or automated enforcement would not be the focus or justification for these improvements, the equipment installed as part of this project may support these features. This project would be led by local agency traffic operations staff. The provision of traffic signal coordination for small communities is most often initiated with use of either time-based coordination (TBC) or a closed-loop system (CLS). Depending on the type of controller equipment now in place, and depending on the level of staffing support that the City (or County) is able to make in the maintenance of signal coordination plans, the initial cost and recurring effort to achieve signal coordination in Hanford would vary from a very low cost, to a moderate cost. A number of communication alternatives are possible to tie the intersection controllers to a supervisory computer at City Hall (in the CLS alternative). With a CLS, the capability is created to remotely monitor intersection operation and the capability to remotely change both basic and coordination timing. A first step in the signal coordination capability would be the design and implementation of TBC timing plans. A feasibility study on possible and appropriate upgrade plans for creation and installation of a traffic signal system could be completed at the same time. Any small community that has more than 10 traffic signals would probably benefit from having signal coordination implemented along its heaviest-traveled street(s) so that vehicles can progress through a series of signalized intersections without stopping. The initial effort to achieve this basic level of coordination is relatively low, especially if it is contracted out. The resulting basic timing plans (perhaps just 2 or 3 plans which run between 7AM and 6 PM) can be left in place with very little subsequent retiming effort required or needed. Traffic signal coordination typically has one of the very highest benefit-to-cost ratios of any public works activity.		X	X	**$4,000**		
2.0 Incident Management/Emergency Services									
2.1F	**WEATHER SENSING/ATMS INTEGRATION**	Caltrans with support from CHP, COFCG and other regional agencies.	This project includes two primary components to this project. First is the deployment of additional weather sensors to fill-in gaps in the existing weather-sensing infrastructure. Second is the replacement/upgrade of some existing weather sensing stations. Integration of weather sensing data into the Region's ATMS efforts including the Caltrans ATMS and the Regional Integrated Workstations identified in the Ramp Meter Gap Closure project and the Communications Intertie project respectively. The project is divided into threee phases. Phase 1 consists of a study for detailed location of remote weather stations and low-visibility sensors, the deployment of 5 full weather stations and 42 visibility sensors along 100 miles of freeway/highway facilities, weather systems software upgrade for Caltrans and integration with RIW, and communications support. Phase 2 consists of the deployment of 5 full weather stations and 71 visibility sensors along 170 miles of freeway/highway facilities and communications support. Phase 3 consists of the deployment of 2 full weather stations and 18 visibility sensors along 42 miles of facilities, the integration of weather information/functions into the Caltrans ATMS software, and communications support.	X	X	X	**$1,500**	**$1,790**	**$650**

ID	Program Area/Project	Involved Agency	Brief Description	Project Initiation*			Capital Cost Estimates 2001 (Thousands of $)**		
				N	M	L	Total		
							Phase 1	Phase 2	Phase 3
2.2F	**VARIABLE SPEED SYSTEM/SMART OR INTELLIGENT ROADWAY STUDS**	Caltrans with support from CHP, COFCG and other regional agencies	This project consists of two separate components that both serve the same purpose of enhancing motorist safety by increasing their awareness of roadway conditions. Variable Speed Notification System - A fog/dust detection system with variable messaging and variable speed limit advisories should be deployed along stretches of regional freeways and highways that experience low visibility or poor weather conditions. Variable Speed Signs (VSS) would be placed together with visibility sensors identified in project 1.1 at key locations. The signs would display an advisory speed based on the visibility conditions detected by the nearby sensor. The speed is advisory and would not be enforced as a "legal" speed limit. The ability of drivers to recognize their speed becomes obscured in low visibility situations, and the purpose of the sign is to "remind" people to watch their speed. A similar system is in use near Chattanooga, Tennessee, and another system is planned for deployment in Duluth, Minnesota. They have not experienced any serious fog related accidents since it was installed. For purposes of this project definition, VSS deployments were assumed to occur on one side of a facility every three miles for those facilities. It should be noted that the variable speed signs in Tennessee and Washington is actually enforceable. The variable message signs are legal restrictive signs by state law. Obviously, during inclement weather, very little if any enforcement is done, but the key is if a driver has an accident, the speed calculations can be critical in assessing fault. Smart or Intelligent Road Studs (IRS) – In addition to recognizing speeds in low visibility, drivers' ability to recognize their roadway location is diminished significantly. Caltrans is currently testing the application of (IRS) technologies. Current options for vendors are somewhat limited. IRS roadway markers contain a microprocessor enabling them to detect low-visibility conditions. When poor conditions are detected the IRS markers illuminate with an LED light approximately four times more intense than the light reflected from standard passive markers. The IRS markers may also be utilized to pass on the location of poor visibility conditions to a management center when appropriate communications are provided. Power to the markers has been provided by either solar or through inductive loops. IRS systems are also be tested in Europe and have been deployed in Virginia since the 1980's. For purposes of this project definition IRS deployments were assumed to occur in ¼ mile increments along approximately 5% of the facilities. Together these two technologies offer some tested and viable solutions to the transportation problems caused by low-visibility conditions. Fresno County typically experiences some of the most dense ground (i.e. Tule Fog) in the nation between November and March.		X	X	**$680**	**$920**	**$280**
2.3F	**REMOTE SURVEILLANCE AND INCIDENT SCENE MANAGEMENT**	Caltrans, CHP, and fire emergency services (Hazardous Materials response personnel).	This new experimental program involves a video system capable of sending images via cellular or microwave technology to a TMC or dispatch center. The images are then put on the internet and key experts who could provide technical advise to the responders at the scene can access the pictures with a password. This process would allow the expert to talk to the scene by telephone, look at the problems on the internet, and help devise solutions for safe and timely resolution. This technology has been purchased for the Washington State DOT and is being installed on their incident response trucks. There is also a handheld unit for getting close up images of truck equipment and other details. Trauma center doctors, hazardous materials specialists, recovery companies, and investigative specialists are some of the resource personnel that will be able to look at problems and give advice. This type of system has significant application for rural interstates. Problems that require special knowledge can now close roads for several hours while the experts respond to the scene. The two-way communication link with video going to the experts can potentially save hours of delay for motorists. The project would include the procurement of three remote incident surveillance equipment sets, the suggested deployment with regional hazardous materials groups, and the associated software and communications.	X	X		**$280**		
2.4F	**COMPUTER AIDED DISPATCH INTEGRATION**	CHP, emergency services, Caltrans	Given the status of the CHP CAD the Region has two basic deployment options in terms of this project. First would be to integrate certain CAD functions into the Regional Integrated Workstation (RIW) project, Communications Interties. This may provide the necessary exchange of incident information between emergency services, but is likely to offer somewhat limited capabilities when compared with a true CAD integration effort. Second is to deploy a separate series of CAD integration workstations similar to InterCAD. This would provide simple CAD functions to an agency that either does not have a CAD or does not wish to directly integrate with its existing CAD system. This would also offer the opportunity to integrate a CAD system if desired. In either event, if the FIRST project prototype is approved for use by CHP then the possibility of exists for using FIRST in the Fresno area to access CHP CAD information and place it in either the RIW or a separate system.	X	X		**$1,200**		
2.5F	**INTEGRATION OF COMMUNICATIONS CHANNELS**	CHP, Police Depts., Fire Depts., Sheriff, Others.	There are currently common channels for State agencies to talk to each other. There are channels for County agencies and for city agencies to talk to others within their own government, but they can't always communicate with outside government agencies. Technology exists to allow cross communication for major incidents and consideration should be given to establishing a link to be used in case of large multi-agency incidents. This project could follow two basic deployment paths. Enhancement of communications at dispatch centers to provide or enhance "link" positions- These positions include those individuals within a dispatch center responsible for interagency communications. This path may also include various communications patching equipment. The disadvantage of this approach is that all communication between different agencies must be "patched" through a dispatcher, which slows or complicates communications efforts. Provision of a simple on-site communications system for on-site communications – Perhaps the simpler of the two paths, this effort would provide hand-held communications devices to common incident commanders and responders within the Region. Caltrans has utilized cellular two-way radio equipment in some regions for this type of communications. The disadvantage of this approach is that some personnel may have to use more than one radio/communications device. Advanced satellite and other cellular options are available with excellent coverage capabilities and advanced features.	X	X		**$740**		
2.6F	**INCIDENT MANAGEMENT/ RESPONSE COORDINATION TASK FORCE**	CHP, Caltrans, COFCG with heavy involvement from all other emergency service agencies.	This project would develop, for a specific focused area within the County, an interjurisdictional and cross-agency teaming arrangement that would be mobilized to respond to any major traffic related incident in the team's coverage area. Once a specific geographic area has been selected for this project (due in large part to the presence of a project champion), an ad-hoc working group would be established to bring this Incident Management Team into existence. In order to be self-sustaining, such a Team would need to be activated, on average, at least 4 times per year. Therefore, the coverage area should be large enough so that this would be achieved. The Team would need to have authority to activate itself. That is, within each organization where a Team member is employed, that Team member should have the capability to cease his/her routine and respond to a Team-declared incident when needed. The Team should be equipped with adequate and sufficient person-to-person communication devices (most likely cellular telephones with 3-way and/or conference calling capability) to contact other Team members as needed. Finally, a rigorous and extensive agency and staff networking outreach capability should be developed for use in this Team. The Team itself may or may not have independently owned and controlled traffic control devices for use in deployments responding to incidents. Each agency's own devices should be accessible if the Incident Management Team is created effectively. This Team creation would be a initiated as pilot project for duplication throughout all other areas of the Valley. The use of a contracted facilitator should be employed on this pilot project, with plenty of documentation, lessons learned, and formats to be followed for institutional acceptance of the IMT Team concept. Other areas within the Valley would then be able to model their own Team on the findings and documentation provided in this project. The project would include the development of a Regional Incident Management Plan for large scale interagency incidents, the funding of appropriate site visits to regions with desirable IC-EMS deployments, inter-agency training support (the importance of this element should not be underestimated), and the IC-EMS program management by agency/other staff.	X			**$130**		
3.0 Transit Systems									
3.1F	**COORDINATED TRANSIT DISTRICT OPERATIONS**	COFCG (supported by FAX, FCRTA, Clovis Transit)	This project would improve transit agency coordination throughout the Region to provide more seamless service to patrons and maximize economies of scale. The project would include the development of a Coordinated Transit Operations and ITS Deployment Plan, and agency administrative and coordination support.		X		**$80**		

ID	Program Area/Project	Involved Agency	Brief Description	Project Initiation*			Capital Cost Estimates 2001 (Thousands of $)**		
				N	M	L	Total		
							Phase 1	Phase 2	Phase 3
3.2F	**TRANSIT OPERATIONS/DISPATCH CENTERS INTEGRATION**	FAX, FCRTA, Clovis Transit, COFCG	This project would fund a study of demand-responsive transit system integration strategies, culminating in a specific set of recommendations to implement strategies within specified transit agencies. The primary objective of integrating multiple demand-responsive transit services is to improve operating efficiency by reducing service redundancies and sharing vehicles, staff and scheduling/dispatch technology among agencies. These improvements result in an overall better quality of service to riders, and riders may benefit directly through enhanced schedule and/or destination options enabled through the integration of services across agencies. Typically, especially in county-based or rural oriented demand respsonsive transit environments, a number of different agencies operate within a given geographic area, providing service to many of the same destinations but often serving a slightly different client base. One of the primary objectives of demand-responsive transit service integration strategies is to reduce these redundancies and associated inefficiencies. Demand-responsive service integration includes a wide range of potential specific activities, ranging from simple coordination to full integration. Examples of specific strategies include consolidation of scheduling and/or dispatch functions (where multiple agencies can share the cost of improvements and share access), agreements to share access to vehicles under specified circumstances, and consolidation of ride reservation systems. In conjunction with the coordinated transit district operations, this project would integrate the various transit dispatching operations. Some dispatch centers may be co-located, while others may be remotely integrated. Integration would allow for improved coordination and improved efficiencies along routes where transit patrons must transfer from one system to another. At the current time, it seems likely that FAX and FCRTA dispatch operations could be co-located, while Clovis Transit dispatch services would operate from another location. The dispatch centers could be coordinated through deployment of enhanced dispatch capabilities centering on upgrades and expansion of the existing systems. Coordinated dispatch operations could work in coordination with the Transit Management System Completion/Expansion project to provide highly effective coordination between the various transit agencies in the Region. While a combined dispatch center could provide some economies of scale and may increase coordination of transit services in the Region, it became clear that significant institutional issues are involved with the combined dispatch concept. For this reason, the focus of this Plan, and more specifically, this project is on enhancing communications and coordination between transit services without requiring a combined dispatch operation. This concept of coordinated dispatch operations has been applied to transit operations in the Denver and Detroit regions, as well as at other locations throughout the nation.	X	X		**$1,630**		
3.3F	**TRANSIT INFORMATION SYSTEM (REGIONAL)**	FAX, Clovis Transit, COFCG	FAX has clearly come a long way in the deployment of its Transit Management System (TrMS), which includes AVL on 20+ of its vehicles and the necessary MIS components. As indicated in project 3.4, the deployment of a regional TrMS is planned. The transit agencies would like to make the improved information, currently only available to its staff, also available to its customers. Of course, this information would have to be in a simple format easily digested by the transit patrons and readily available to them. The near-term focus of the project would include deployment of real-time information displays at transit centers. This project should include an evaluation of various information dissemination alternatives, as well as careful review of Seattle's SmartTrek efforts towards improving real-time transit information at stops and centers. This project definition assumes the deployment of real-time transit information displays at ten locations throughout the Region. These displays would most likely be located in transit centers and at transfer locations. Some additional software development would be required to provide appropriately formatted data and communicate the transit status information in a format easily digested by the public. It was assumed that leased communications would be required to each of the ten transit information sites.	X	X		**$850**		
3.4F	**TRANSIT MANAGEMENT SYSTEM COMPLETION/ EXPANSION**	FAX, FCRTA, Clovis Transit, COFCG	This project would look at the most effective options for continuing FAX's TrMS deployment efforts by deploying AVL on uninstrumented rural and urban transit vehicles. Additional TrMS functions should be deployed with a view towards eventual regionwide deployment. Options for deploying compatible components across all vehicles should be sought. FAX's system is J1708 compliant, and this is an important standards consideration. The example provided was that fare equipment in a large bus might not be appropriate to a small rural service vehicle. Different devices may be used, but they should operate across a common software/system with completely compatible standards. The project would be divided into 2 phases. Phase 1 would consist of performing a focused transit communications study to determine the specific communications needs of TrMS expansion, deploying 50 transit vehicles (apx. 1/2 of FCRTA - including fixed route & paratransit) with standard AVL/GPS equipment, deploying 15 vehicles with enhanced equipment (passenger counting, etc.), developing /procuring software upgrades for TrMS to support regional needs and paratransit services, installing radio/communications system upgrades for FCRTA, and procuring additional workstations. Phase 2 would consist of deploying 30 standard vehicles (FCRTA/Clovis Transit), a radio system upgrades for Clovis Transit., and a procurement of additional workstations.	X	X	X	**$1,590**	**$680**	
3.5F	**COMMON FARE EQUIPMENT DEPLOYMENT**	FAX, FCRTA, Clovis Transit	This project would establish a regional fare standard and deploy appropriate fare equipment and software. The potential for flexible fare media and smart cards should be reviewed. As with the expansion of the TrMS, the specific equipment needs of agencies may vary, but a common standard is important to inter-compatibility and economies of scale. The project would be divided into 2 phases. Phase 1 would include performing a needs definition and installation plan, the deployment of new fare system on 146 vehicles (FAX/FCRTA), and the procurement of fare management software, workstations, and interface equipment. Phase 2 would include the deployment of new fare system on 25 vehicles (Clovis Transit), and the procurement of fare management software, workstations, and interface equipment.	X	X		**$1,500**	**$320**	
4.0 Transportation User Information Systems									
4.1 F	**REGIONAL TRANSPORTATION USER INFORMATION SYSTEM**	COFCG and Caltrans	This project focuses on TUIS needs within the Fresno County Region, consisting of four primary TUIS components .The first is freeway/highway CMS deployments. This includes additional deployments of freeway and highway CMS for specific traveler information purposes rather than traffic management. These signs would be deployed on key routes throughout the Region and controlled by Caltrans or through the RIW. A specific application of special traveler information CMS devices noted by stakeholders was potential deployments of airport information signs along the Peach Avenue and other airport approach corridors. Deployment at these locations should be considered a priority for this project. The second is the Internet application of the Regional Integrated Workstation (RIW). This would take filtered information from the RIW network and make it available to the public over the internet. Third is the Highway Advisory Radio upgrade. This would upgrade Caltrans and regional HAR systems to provide digital/remotely-updated equipment. Fourth is the additional deployment of RIWs, which would deploy addition RIW at radio and television stations broadcasting traffic information to the public. The project would deploy 12 freeway/highway CMS signs for TUIS purposes, develop Internet integration component for RIW data, upgrade/procure 10 HARs, and deploy 5 additional RIWs to regional TV and radio broadcast services.		X		**$3,920**		
4.2 F	**COORDINATION WITH VALLEYWIDE/STATE WIDE INFORMATION SYSTEMS**	COFCG and Caltrans	This project was added to assist the Fresno County Region in maintaining consistency with Statewide and valleywide TUIS efforts. It is anticipated that the State will be providing support and funding for several TUIS deployment efforts, and that funds may be distributed to each Caltrans District. The Region should be prepared to capitalize on this potential by conducting Planning/Configuration Management Efforts and Performing Appropriate Software Modifications to the RIW. Planning/Configuration Management Efforts would integrate with Statewide and valleywide efforts will take planning and coordination with agencies outside of the Region. This element of this project accounts for travel, planning, and meeting costs associated for the Region to participate in these efforts. Performing Appropriate Software Modifications to the RIW would make modifications to the RIW to allow integration based on valleywide and Statewide TUIS standards.		X		**$260**		
5.0 Regional ITS Configuration Management/Coordination/Planning									

ID	Program Area/Project	Involved Agency	Brief Description	Project Initiation*			Capital Cost Estimates 2001 (Thousands of $)**		
				N	M	L	Total		
							Phase 1	Phase 2	Phase 3
5.1 F	**VALLEYWIDE/STATE WIDE COMMUNICATIONS LINKAGES**	Caltrans and COFCG	This project would coordinate and provide for communications linkages between the Fresno County Region, neighboring regions, as well as the State. Theproject would include staff time to coordinate with Statewide communications efforts, and additional communications equipment for connecting the RIW network to the Statewide network.		X		**$10**		
5.2F	**REGIONAL CONFIGURATION MANAGEMENT**	Caltrans and COFCG	This project provides for Regional Configuration Management of ITS projects being deployed in the Fresno County Region. The majority of this project represents either an agency staff or contracted effort. The person(s) responsible for the configuration management activities should be performed by someone familiar with systems and standards development. The goal of the effort should be to generate clear and concise materials that assist agencies in maintaining conformity with the regional standards and guidelines suggested by the various Workgroups. The importance of configuration management to regional deployment efforts cannot be understated. It is not enough that the regional architecture has been developed and included in this Plan. The system architecture occurs at many levels, of which the national and regional architectures represent only one. Actual deployment of systems at a level that allows proper integration and data exchange requires the use of common specific standards, protocols, and translators between standards and protocols. All of these issues cannot be addressed prior to the detailed design phase of a project. Configuration management represents the combined efforts of agencies working together at a technical and institutional level to occur upon the use of certain standards and protocols available through the national, statewide, and regional architectures.	X	X		**$30**		
5.3 F	**COMMON/STANDARD REGIONAL/COUNTY MAP**	County GIS Group, COFCG	This project would review options for development of a regional standard map for AVL applications. Potential sources to be reviewed include the Fresno County GIS files, American Ambulance GIS files, etc. At a minimum the potential for a common mapping standard should be reviewed, and funds potentially sought for update, creation, and/or correction of a regional AVL map. This project would provide for County staff or contracted staff time, as well as needed surveys to improve the regional GIS map for ITS purposes. The focus of this effort should be enhancing the accuracy of rural areas for AVL/GPS purposes, as well as working with emergency services to establish a common inter-agency grid system for emergency services. Fresno County has a GIS department and a GIS working group, which can serve as a core resource for Region in its mapping efforts. The development of more accurate maps should strike a careful balance between level of detail required and the costs involved in developing the maps. Emergency service personnel should be involved in map development efforts to ensure that their needs for a common grid/coordinate system are met. The project would perform appropriate surveys necessary to enhance the regional GIS map as directed by County of Fresno GIS staff, and provide for 1.5 full time employee equivalents for two years to perform necessary support tasks.	X			**$360**		
			Total Estimated Capital Deployment Costs for All Potential ITS Projects Over 20 Years						**$79,860**

Notes:

* Project initiation timeframes - N = Years 1-5, M = Years 6-10, L = Years 11+

**All capital costs are approximate and rounded for purposes of this table.

Table A.14: Timeline of Fresno County ITS Projects

Figure A.13: Sequence of Proposed ITS Implementation Activities for Fresno County

Advanced Traffic Management System (ATMS)

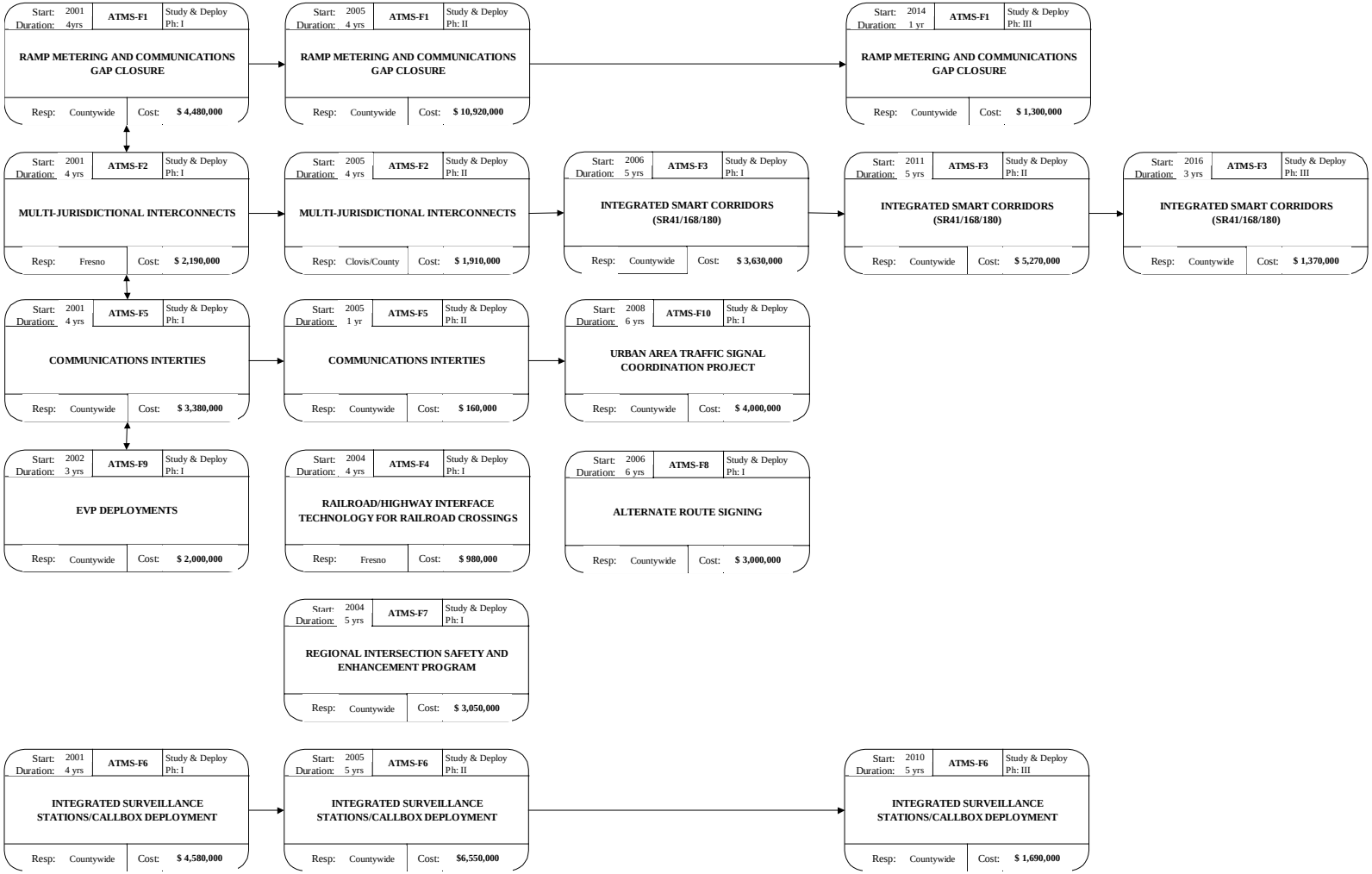


Figure A.13: Sequence of Proposed ITS Implementation Activities for Fresno County

Incident Mgmt./
Emergency Services
(IM/ES)

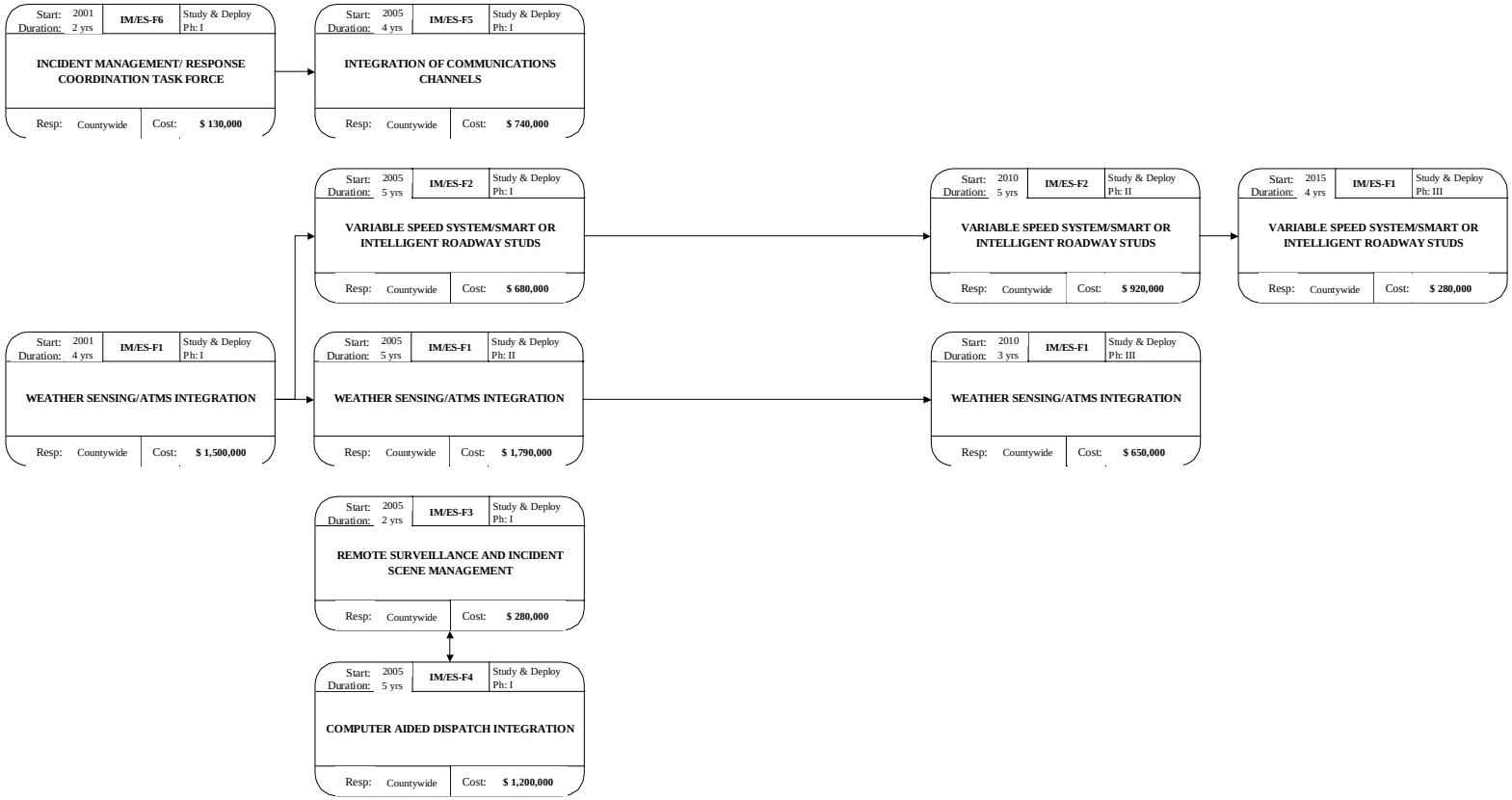


Figure A.13: Sequence of Proposed ITS Implementation Activities for the Fresno County (cont)

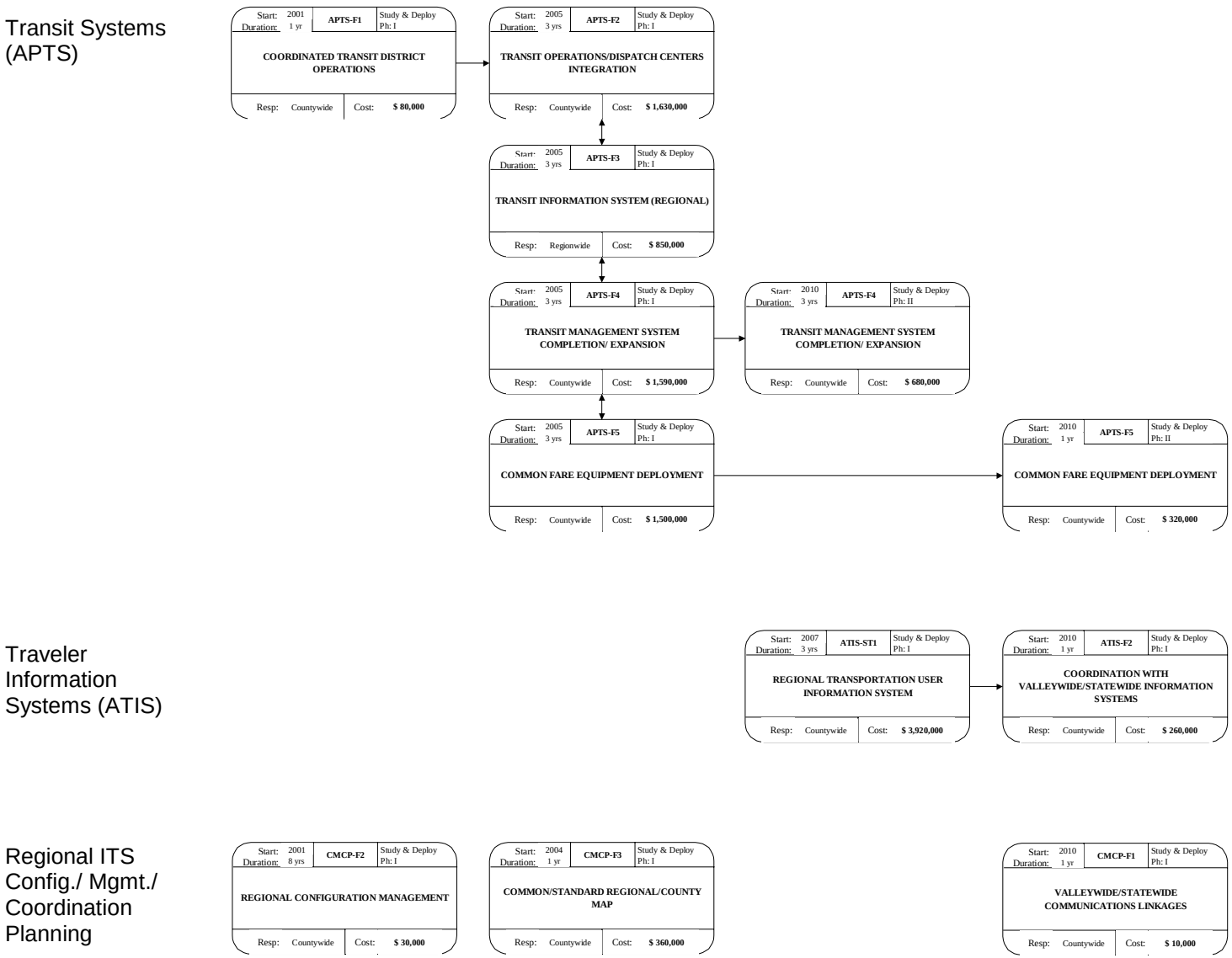
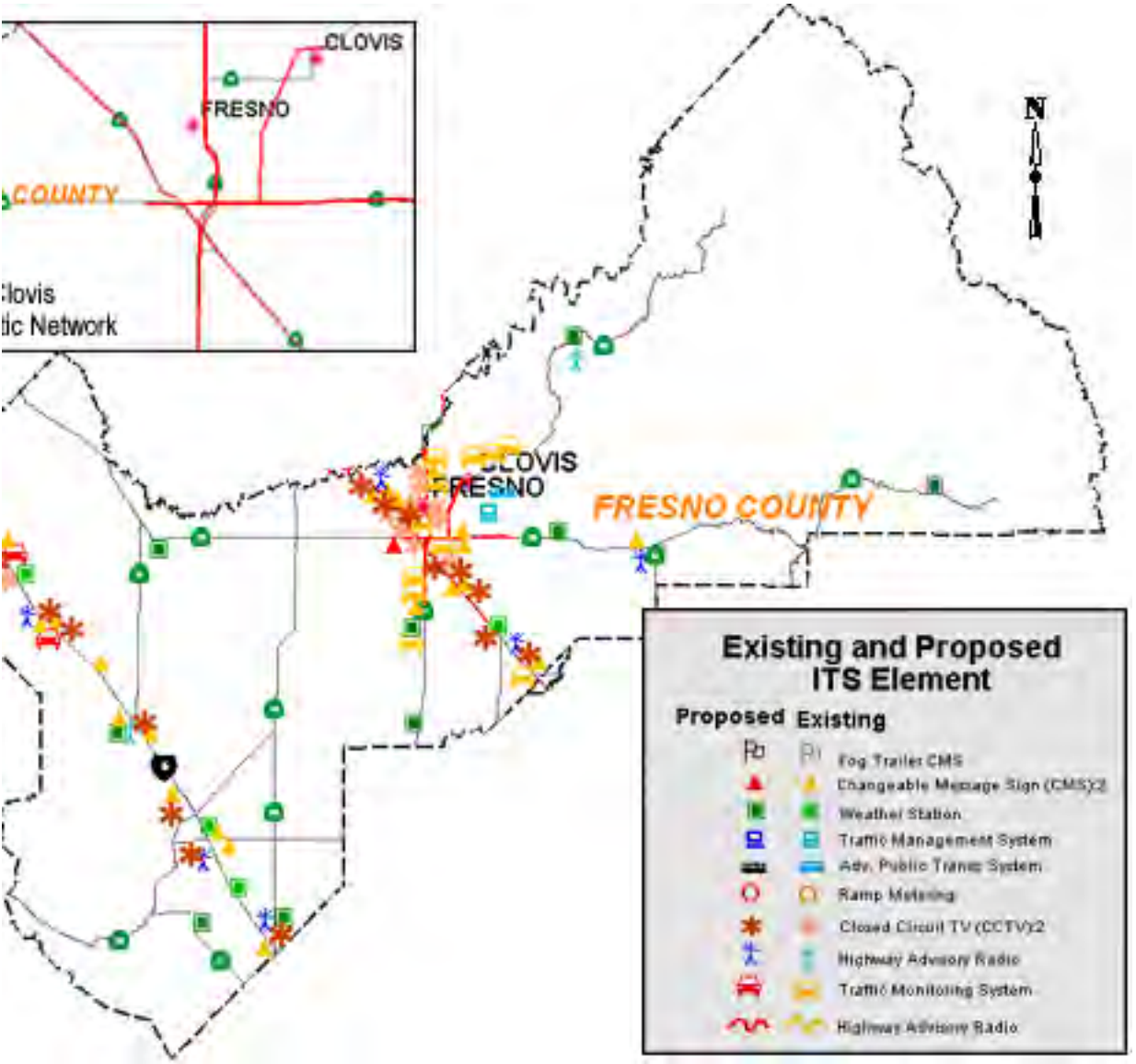


Figure A.14: Existing and Proposed ITS Elements for Fresno County



1.8 Madera County

The total estimated capital deployment costs for all potential ITS projects over 20 years is $4,600,000.

1.8.1 TRAFFIC/FREEWAY MANAGEMENT SYSTEMS (ATMS)

1.8.1.1 Curve Warning System on County Roads

General Description:

The purpose of this project is to deploy a more visible, "smart" warning system on county roads at locations identified potential rollover spots. The curve warning system, referred to by Caltrans as Truck Activated Rollover Warning System (TARWS), is primarily intended to increase the level of safety on this section of roadway, resulting in fewer rollovers and associated injuries. Several truck rollover accidents have occurred throughout the San Joaquin Valley, including Kings County. These accidents have been attributed to excessive speed and sharp curves that exist. While there is posted speed limits, many trucks do not slow down enough to safely negotiate curves. The curve warning system will consist of a static warning sign located well in advance of the curve, which reads "CURVE AHEAD". A speed detection system will be installed to determine vehicle speed. If a vehicle's speed indicates that safe curve negotiation is not likely, an LED display, attached to the static sign and reading "REDUCE SPEED" would be illuminated. Curve warning systems are available from a variety of manufacturers. Specifications, technologies and products will be detailed in the Technology Assessment and developed throughout the preliminary engineering process.

Project Objectives:

- Deploy a curve warning system at the approach to a ramp
- Increase the level of safety on this section of roadway, resulting in fewer rollovers and associated injuries

Sponsorship: MCTC

Deployment Phasing: This project is a single-phase deployment.

	Phase Components
Phase 1	➢ Changeable Message Sign (CMS), ➢ A radar speed- measuring device, ➢ Control/communications equipment ➢ (Optional) Two cameras with video detection software for one of the cameras

Deployment Locations: Countywide

Deployment Timeframes: This project is a near term deployment.

	Phase Timelines
Phase 1	Near Term

Benefits:

- Increased level of safety along curve ramps., resulting in fewer rollovers and associated injuries

Budget Estimate:

	Phase Budget Estimates	
	Capital Costs	Operations and Maintenance Per Year
Phase 1	$100K	$0K
Totals	$100K	$0K

Evaluation Criteria:

- Frequency of crashes/ erratic maneuvering
- Operating speeds
- Public acceptance and response
- Maintenance requirements

O&M Considerations: The annual operations and maintenance costs are estimated to equal $1,000 per unit.

Architecture Considerations: None applicable

1.8.1.2 TOS Expansion into County

General Description:

Caltrans considers most field elements that aid in traffic surveillance and management activities to be part of the TOS. The most common field elements deployed as a comprehensive TOS in urbanized areas include, but are not limited to: traffic detection (inductive loops, video, acoustic), closed circuit television (CCTV) cameras, changeable message signs (CMS), highway advisory radio (HAR), communications systems and centralized command and control systems/centers with expert systems to aid in incident detection and response as well as automated ramp metering operations. Additional elements that are typically added to rural settings include, but are not limited to: road weather information systems (RWIS) and other systems that aid in improved emergency response times and dissemination of travel advisory information.

Project Objectives:

- Develop an action plan based on existing Caltrans District 6 and 10 Master Plans to allow for common sense integration of TOS elements into a seamless central operating system, presumably in the Caltrans TMC(s)
- Develop Program of Projects, with potential funding sources, to implement the Action Plan and Master Plan.

- Design and deploy appropriate communications infrastructure along State facilities to eliminate existing gaps and to provide a communications backbone for the Region.
- Design and deploy appropriate field elements that aid in traffic surveillance and management activities.

Sponsorship: Caltrans District 6

Deployment Phasing: This project is a single-phase deployment.

	Phase Components
Phase 1	➢ Develop Implementation Plan ➢ Design and construct TDS elements

Deployment Locations: Countywide

Deployment Timeframes: This project is a mid term deployment.

	Phase Timelines
Phase 1	Mid Term

Benefits:

- Closing the gaps in the communication systems will improve the flow transportation conditions information from roadway sensors, potentially reduce costs, and allow improved cooperation between various agencies within the Region.
- Improving the communications systems will improve roadway monitoring, as well as lower incident detection frequencies assuming appropriate sensors are in place .

Emission Reductions:

- Communications projects have traditionally been considered as supportive of emissions reductions as long as they provide the capability to install traffic management or signal coordination equipment. Project proponents should work with the regional COG on a case by case basis. To support emissions reduction goals, it may be appropriate to require that communications projects clearly define what traffic management equipment will be connected and what benefits this equipment provides.

Budget Estimate:

	Phase Budget Estimates	
	Capital Costs	**Operations and Maintenance Per Year**
Phase 1	$2,000K	$0K
Totals	$2,000K	$0K

Evaluation Criteria:

- MOE

- Miles of congested freeway
- Freeway travel times
- Amount of transportation conditions information delivered to the public over the proposed fiber network
- Reduction in freeway accidents near metered interchanges
- Incident detection/response time (ATMS)
- Time needed for traffic operations staff to monitor/control field devices (ATMS)

➢ MOP
- Connection/data transfer times/rates from field devices to the TMC
- Communications packet loss
- Time to access data from the database (ATMS)
- Screen refresh rates (ATMS)

➢ MOS
- Mean-time between system failures
- O&M costs

O&M Considerations:

There are no particular O&M considerations for this project. However, if the communications backbone is to be shared by agencies other than Caltrans then some form of cost-sharing agreement may be necessary.

Architecture Considerations:

The infrastructure items in this project are not a concern, however the ATMS deployment and the flexibility of the communications backbone are. Caltrans should discuss its standards with Regional stakeholders to assist in ensuring that some common standards are utilized. Note that communications have many different standards or protocol "layers" that may impact the ability of systems to communicate over any given network. Many of these layers are not necessarily discussed in the National Architecture, but are commonly used in the computer networking world. For example, the Internet utilizes the TCP-IP standard which is only one of many of the standards which make the Internet work. Common fiber network standards include SONET and ATM. Additional discussion of this information can be found in the Technology Options Document (available under separate cover).

Within the National Architecture, it may prove helpful for readers to review market packages ATMS 1, 4, and 6.

1.8.1.3 Dynamic Warning System

General Description:

In response to a history of commercial vehicle accidents, Caltrans District 2 has implemented an interactive signing project at five locations on Interstate 5 in Shasta County. During the five years prior to installation of the five signing systems (May 1994 to April 1999), the five locations experienced a total of 32 truck crashes. During the 18-month period immediately following the installations (April 1999 to October 2000), only one truck crash was reported. A longer evaluation period would likely yield a more sound statistical finding, however, the project appears to have improved safety concerns at

the project locations during the initial evaluation period. The system consists of interactive changeable message signs equipped with radar and closed circuit TV (CCTV) cameras at each location. When the radar units detect vehicles exceeding the curve advisory speed, the changeable message sign automatically activates a warning message displaying the speed of the vehicle followed by the recommended speed for the curve. The curve warning system described above could be adapted into weather related speed advisory system by the addition of a road weather information station/system (RWIS). The weather parameters from the RWIS (temperature, visibility, pavement condition, etc.) would be incorporated into the dynamic signing system as an additional input. The system would then display to the driver an appropriate advisory message, such as a suggested safe speed, for the prevailing weather and traffic conditions. The system could be implemented anywhere in the San Joaquin Valley there is a concern about weather related speed safety issues. Ideally, the system would have some type of remote access capabilities so that agency operators could remotely check system diagnostics and operations. Caltrans District 10 has identified 93 locations in the district TOC study.

Project Objectives:

- Improve driver recognition of the conditions surrounding them.
- Reduce the potential for large-scale incidents through the use of advisory speeds and improved roadway delineation.
- Reduce the number of incidents in poor weather conditions.

Sponsorship: MCTC

Deployment Phasing: This project is a single-phase deployment.

	Phase Components
Phase 1	➢ Deployment of DSS at key locations in the area ➢ Deployment of RWI's along facilities. ➢ Procurement of DSS misc. support equipment and software.

Deployment Locations: Countywide

Deployment Timeframes: This project is a near term deployment.

	Phase Timelines
Phase 1	Near Term

Benefits:

- Improved notification to the driver of roadway/travel conditions will improve driver safety.
- Reduced number of accidents at deployed locations, and reduced number of major incidents during poor weather conditions.

Emissions Reductions:

- Reduction in the number of major incidents would lead to emissions reductions.

Budget Estimate:

	Phase Budget Estimates	
	Capital Costs	Operations and Maintenance Per Year
Phase 1	$500K	$0K
Totals	$500K	$0K

Evaluation Criteria:

- MOE
  - Number of incidents
  - Number of DSS activations/speed adjustments
  - Public perceptions of the accuracy of DSS data/RWI's effectiveness
  - Number of single vehicle incidents
  - Number of "reckless driving" citations
- MOS
  - Mean-time between failures
  - O&M costs

1.8.2 INCIDENT MANAGEMENT/EMERGENCY SERVICES

Currently, there are no Incident Management/Emergency Service projects proposed for the County.

1.8.3 TRANSIT SYSTEMS

1.8.3.1 Demand-Responsive Transit System Integration Study

General Description:

This project would fund a study of demand-responsive transit system integration strategies, culminating in a specific set of recommendations to implement strategies within specified transit agencies. The primary objective of integrating multiple demand-responsive transit services is to improve operating efficiency by reducing service redundancies and sharing vehicles, staff and scheduling/dispatch technology among agencies. These improvements result in an overall better quality of service to riders, and riders may benefit directly through enhanced schedule and/or destination options enabled through the integration of services across agencies. Typically, especially in county-based or rural oriented demand responsive transit environments, a number of different agencies operate within a given geographic area, providing service to many of the same destinations but often serving a slightly different client base. One of the primary objectives of demand-responsive transit service integration strategies is to reduce these redundancies and associated inefficiencies. Demand-responsive service integration includes a wide range of potential specific activities, ranging from simple coordination to full integration. Examples of specific strategies include consolidation of scheduling and/or dispatch functions (where multiple agencies can share the cost of improvements and share access), agreements to share access to vehicles under specified circumstances, and consolidation of ride reservation systems.

Project Objectives:

- Improve paratransit efficiency by providing coordinated operations and improved system purchasing power.

Sponsorship: MCTC

Deployment Phasing: This project is a single-phase deployment.

	Phase Components
Phase 1	➢ Prepare a study of the feasibility of integrated services.

Deployment Locations: Countywide

Deployment Timeframes: This project is a mid term deployment.

	Phase Timelines
Phase 1	Mid Term

Benefits:

- Improved paratransit service Countywide

Budget Estimate:

	Phase Budget Estimates	
	Capital Costs	**Operations and Maintenance Per Year**
Phase 1	$400K	$40K
Totals	$400K	$40K

1.8.3.2 Transit Information System (Website)

General Description:

This project would implement a system for collecting, processing and disseminating transit information, including "static" information such as routes and schedules, and in the cases of those operators with vehicle tracking systems, real-time information such as estimated vehicle arrival times at specific locations. The objective of the project would be to improve the availability and accessibility of transit information, thereby making transit more convenient and increasing transit utilization. Uncertainty about transit schedules, transit non-users as impediments often cite stops, fares and the timing of arrivals at specific stops. This project would establish a centralized transit information database, residing in a computer that would probably be housed at one of the San Joaquin Valley transit operations, or perhaps at a location, such as a Caltrans traffic management facility, where other traveler information is compiled. The project would include procedures and supporting communications infrastructure that would allow participating transit operators to submit information to the system. For static information, the communications system could be very minimal, such as via e-mail or Internet file transfer. The

communications necessary to support real-time information would be more costly and elaborate and could include a dial-up or dedicated phone connection. The project would also include dissemination tools to make the information available to travelers. These tools could include an Internet web site, telephone information system, and kiosks.

Project Objectives:

- Provide real-time transit status information to transit patrons including delays, arrival times, and schedules.
- Promote transit ridership through enhanced information to the public.

Sponsorship: MCTC

Deployment Phasing: This project is a single-phase deployment.

	Phase Components
Phase 1	➢ Deploy real-time transit information displays at ten locations (2 displays each/secure casings). ➢ Procure or develop software to upgrade the TrMS to support the transit information displays. ➢ Provide communications for each of the locations. ➢ Provide monitoring/management workstations for the system.

Deployment Locations: Countywide

Deployment Timeframes: This project is a mid term deployment.

	Phase Timelines
Phase 1	Mid Term

Benefits:

General Benefits:

- Provides simple, accurate, and timely transit information to transit patrons on the status of the next bus, delays, schedules, etc.
- Promotes transit ridership by improving the perception of the service.

Emissions Reduction:

- Improved information for transit patrons should help to enhance ridership. Short- and Long-Range transit plans should include this project, and the anticipated impacts on ridership. These estimates could be used to determine emissions reduction potential.

Budget Estimate:

	Phase Budget Estimates	
	Capital Costs	Operations and Maintenance Per Year
Phase 1	$200K	$20K
Totals	$200K	$20K

Evaluation Criteria:

- MOE
  - Survey of transit patrons
- MOS
  - O&M costs
  - Mean time between failures

O&M Considerations: None

Architecture Considerations: Reference should be made to market packages APTS 4 and 8 of the National Architecture.

1.8.3.3 Bus Arrival System/ Madera County Next Bus Arrival Signs

General Description:

This project would deploy dynamic message signs at selected higher-usage bus stops equipped with bus shelters. Currently, only one firm (NextBus) is providing this kind of service. Their equipment is placed on board transit vehicles, and GPS-derived current location and speed information is transmitted to NextBus computers at a remote location where the information is processed, and bus arrival prediction is then published to an Internet IP address. The IP address corresponds to a particular dynamic message sign. NextBus has a patent for this "arrival prediction using GPS coordinate data scheme, and their equipment combination uses a CDPD data modem to transmit the information from the bus to the NextBus servers. Their current coverage area does include the Merced area, but not with the CDPD provider that they have currently use (AT&T Wireless). Nonetheless, CDPD coverage is available in Merced, and the NextBus concept therefore may be workable there. The cost for the CDPD "air time" may make this more expensive than in AT&T's coverage area. Also, once an initial installation is completed (using capital funding from some source), then the agency would need to continue the payments for CDPD air time (currently ~$60 per month per bus, and $30 per month per dynamic message sign. Once the service is in place, transit patrons would be able to determine real-time bus locations and expected arrival times at their bus stop. The dynamic message sign at the bus stop would be one source of this information, but NextBus also publishes the information in map form to an Internet website, and in WAP form to hand-held PDAs. The information would therefore also be accessible to transit dispatchers as well as agencies that oversee and/or fund transit operations. NextBus can provide a broad cross-section of transit operations data that would be useful to these 2 management groups as well.

Project Objectives:

- Improve traveler information and increase ridership.
- Improve transit efficiency

Sponsorship: KART

Deployment Phasing: This project is a single-phase deployment.

	Phase Components
Phase 1	➢ Siting study for system. ➢ Deployment of up to 15 sign locations

Deployment Locations: Countywide

Deployment Timeframes: This project is a mid term deployment.

	Phase Timelines
Phase 1	Mid Term

Benefits:

- Provide real-time transit information to users

Budget Estimate:

	Phase Budget Estimates	
	Capital Costs	**Operations and Maintenance Per Year**
Phase 1	$400K	$40K
Totals	$400K	$40K

1.8.3.4 AVL/ Silent Alarm System

General Description:

This project would equip KART transit vehicles in the Kings County area with ITS equipment to both track vehicles and give the bus operator the capability to send a silent alarm for an emergency condition. Automatic Vehicle Location (AVL) equipment generally utilizes satellite technology for pinpointing the exact (to within 20 meters) location of the tracked vehicle. Such tracking is ongoing all the time, and is not limited to the Merced area. If a bus were removed from the area, it could still be located using the AVL equipment. Providing the bus operator with a silent alarm capability will increase the security level of both bus operators and transit patrons. Bus tracking would be viewed by transit dispatchers in the dispatch office. In many cases, the tracking information can be integrated into the same workstation that the dispatchers use in supervising and managing the transit vehicles.

Project Objectives:

- Design and implement an efficient AVL system

Sponsorship: KART

Deployment Phasing: This project is a single-phase deployment.

	Phase Components
Phase 1	➢ Deploy transit vehicles (including fixed route & paratransit) with standard AVL/GPS equipment. ➢ Procure new or additional workstations.

Deployment Locations: Countywide

Deployment Timeframes: This project is a near term deployment.

	Phase Timelines
Phase 1	Near Term

Benefits:

- Improved transit service
- Improved transit safety
- Enhanced information for transit managers.

Budget Estimate:

	Phase Budget Estimates	
	Capital Costs	**Operations and Maintenance Per Year**
Phase 1	$1,000K	$100K
Totals	$1,000K	$100K

1.8.4 TRAVELER INFORMATION SYSTEMS

Currently, there are no local traveler information systems projects proposed for the County.

1.8.5 REGIONAL ITS CONFIGURATION MANAGEMENT/COORDINATION/PLANNING

Currently, there are no regional ITS configuration management/coordination/planning projects proposed for the County.

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Table A.15: Summary of Madera County ITS Projects

ID	Program Area/Project	Involved Agency	Brief Description	Project Initiation*			Capital Cost Estimates 2001 (Thousands of $)**		
				N	M	L	Total		
							Phase 1	Phase 2	Phase 3
MADERA COUNTY									
1.0 Traffic/Freeway Management Systems (ATMS)									
1.1MA	**CURVE WARNING SYSTEM ON COUNTY ROADS**	MCTC	The purpose of this project is to deploy a more visible, "smart" warning system on county roads at locations identified potential rollover spots. The curve warning system, referred to by Caltrans as Truck Activated Rollover Warning System (TARWS), is primarily intended to increase the level of safety on this section of roadway, resulting in fewer rollovers and associated injuries. Several truck rollover accidents have occurred throughout the San Joaquin Valley, including Kings County. These accidents have been attributed to excessive speed and sharp curves that exist. While there is posted speed limits, many trucks do not slow down enough to safely negotiate curves. The curve warning system will consist of a static warning sign located well in advance of the curve which reads "CURVE AHEAD". A speed detection system will be installed to determine vehicle speed. If a vehicle's speed indicates that safe curve negotiation is not likely, an LED display, attached to the static sign and reading "REDUCE SPEED" would be illuminated. Curve warning systems are available from a variety of manufacturers. Specifications, technologies and products will be detailed in the Technology Assessment and developed throughout the preliminary engineering process.	X			**$100**		
1.2MA	**TOS EXPANSION INTO COUNTY**	Caltrans District 6	Caltrans considers most field elements that aid in traffic surveillance and management activities to be part of the TOS. The most common field elements deployed as a comprehensive TOS in urbanized areas include, but are not limited to: traffic detection (inductive loops, video, acoustic), closed circuit television (CCTV) cameras, changeable message signs (CMS), highway advisory radio (HAR), communications systems and centralized command and control systems/centers with expert systems to aid in incident detection and response as well as automated ramp metering operations. Additional elements that are typically added to rural settings include, but are not limited to: road weather information systems (RWIS) and other systems that aid in improved emergency response times and dissemination of travel advisory information.		X		**$2,000**		
1.3MA	**DYNAMIC WARNING SYSTEM**	MCTC	In response to a history of commercial vehicle accidents, Caltrans District 2 has implemented an interactive signing project at five locations on Interstate 5 in Shasta County. During the five years prior to installation of the five signing systems (May 1994 to April 1999), the five locations experienced a total of 32 truck crashes. During the 18-month period immediately following the installations (April 1999 to October 2000), only one truck crash was reported. A longer evaluation period would likely yield a more sound statistical finding, however, the project appears to have improved safety concerns at the project locations during the initial evaluation period. The system consists of interactive changeable message signs equipped with radar and closed circuit TV (CCTV) cameras at each location. When the radar units detect vehicles exceeding the curve advisory speed, the changeable message sign automatically activates a warning message displaying the speed of the vehicle followed by the recommended speed for the curve. The curve warning system described above could be adapted into weather related speed advisory system by the addition of a road weather information station/system (RWIS). The weather parameters from the RWIS (temperature, visibility, pavement condition, etc.) would be incorporated into the dynamic signing system as an additional input. The system would then display to the driver an appropriate advisory message, such as a suggested safe speed, for the prevailing weather and traffic conditions. The system could be implemented anywhere in the San Joaquin Valley there is a concern about weather related speed safety issues. Ideally, the system would have some type of remote access capabilities so that agency operators could remotely check system diagnostics and operations. Caltrans District 10 has identified 93 locations in the district TOC study.	X			**$500**		
2.0 Incident Management/Emergency Services									
3.0 Transit Systems									
3.1MA	**DEMAND-RESPONSIVE TRANSIT SYSTEM INTEGRATION STUDY**	MCTC	This project would fund a study of demand-responsive transit system integration strategies, culminating in a specific set of recommendations to implement strategies within specified transit agencies. The primary objective of integrating multiple demand-responsive transit services is to improve operating efficiency by reducing service redundancies and sharing vehicles, staff and scheduling/dispatch technology among agencies. These improvements result in an overall better quality of service to riders, and riders may benefit directly through enhanced schedule and/or destination options enabled through the integration of services across agencies. Typically, especially in county-based or rural oriented demand respsonsive transit environments, a number of different agencies operate within a given geographic area, providing service to many of the same destinations but often serving a slightly different client base. One of the primary objectives of demand-responsive transit service integration strategies is to reduce these redundancies and associated inefficiencies. Demand-responsive service integration includes a wide range of potential specific activities, ranging from simple coordination to full integration. Examples of specific strategies include consolidation of scheduling and/or dispatch functions (where multiple agencies can share the cost of improvements and share access), agreements to share access to vehicles under specified circumstances, and consolidation of ride reservation systems.		X		**$400**		
3.2MA	**TRANSIT INFORMATION SYSTEM (WEBSITE)**	MCTC	This project would implement a system for collecting, processing and disseminating transit information, including "static" information such as routes and schedules, and in the cases of those operators with vehicle tracking systems, real-time information such as estimated vehicle arrival times at specific locations. The objective of the project would be to improve the availability and accessibility of transit information, thereby making transit more convenient and increasing transit utilization. Uncertainty about transit schedules, stops, fares and the timing of arrivals at specific stops are often cited by transit non-users as impediments. This project would establish a centralized transit information database, residing in a computer that would probably be housed at one of the San Joaquin Valley transit operations, or perhaps at a location, such as a Caltrans traffic management facility, where other traveler information is compiled. The project would include procedures and supporting communications infrastructure that would allow participating transit operators to submit information to the system. For static information, the communications system could be very minimal, such as via e-mail or Internet file transfer. The communications necessary to support real-time information would be more costly and elaborate and could include a dial-up or dedicated phone connection. The project would also include dissemination tools to make the information available to travelers. These tools could include an Internet web site, telephone information system, and kiosks.		X		**$200**		

ID	Program Area/Project	Involved Agency	Brief Description	Project Initiation*			Capital Cost Estimates 2001 (Thousands of $)**		
				N	M	L	Total		
							Phase 1	Phase 2	Phase 3
3.3MA	**BUS ARRIVAL SYSTEM MERCED COUNTY NEXT BUS ARRIVAL SIGNS**		This project would deploy dynamic message signs at selected higher-usage bus stops equipped with bus shelters. Currently, only one firm (NextBus) is providing this kind of service. Their equipment is placed on board transit vehicles, and GPS-derived current location and speed information is transmitted to NextBus computers at a remote location where the information is processed, and bus arrival prediction is then published to an Internet IP address. The IP address corresponds to a particular dynamic message sign. NextBus has a patent for this "arrival prediction using GPS coordinate data scheme, and their equipment combination uses a CDPD data modem to transmit the information from the bus to the NextBus servers. Their current coverage area does include the Merced area, but not with the CDPD provider that they have currently use (AT&T Wireless). Nonetheless, CDPD coverage is available in Merced, and the NextBus concept therefore may be workable there. The cost for the CDPD "air time" may make this more expensive than in AT&T's coverage area. Also, once an initial installation is completed (using capital funding from some source), then the agency would need to continue the payments for CDPD air time (currently ~$60 per month per bus, and $30 per month per dynamic message sign. Once the service is in place, transit patrons would be able to determine real-time bus locations and expected arrival times at their bus stop. The dynamic message sign at the bus stop would be one source of this information, but NextBus also publishes the information in map form to an internet website, and in WAP form to hand-held PDAs. The information would therefore also be accessible to transit dispatchers as well as agencies that oversee and/or fund transit operations. NextBus can provide a broad cross-section of transit operations data that would be useful to these 2 management groups as well.		X	X	**$400**		
3.4MA	**AVL/ SILENT ALARM SYSTEM**		This project would equip transit vehicles in the Madera area with ITS equipment to both track vehicles and give the bus operator the capability to send a silent alarm for an emergency condition. Automatic Vehicle Location (AVL) equipment generally utilizes satellite technology for pinpointing the exact (to within 20 meters) location of the tracked vehicle. Such tracking is ongoing all the time, and is not limited to the Merced area. If a bus were removed from the area, it could still be located using the AVL equipment. Providing the bus operator with a silent alarm capability will increase the security level of both bus operators and transit patrons. Bus tracking would be viewed by transit dispatchers in the dispatch office. In many cases, the tracking information can be integrated into the same workstation that the dispatchers use in supervising and managing the transit vehicles.	X	X		**$1,000**		
4.0 Traveler Information Systems									
5.0 Regional ITS Configuration Management/Coordination/Planning									
			Total Estimated Capital Deployment Costs for All Potential ITS Projects Over 20 Years						**$4,600**

Notes:

* Project initiation timeframes - N = Years 1-5, M = Years 6-10, L = Years 11+

**All capital costs are approximate and rounded for purposes of this table.

Table A.16: Timeline of Madera County ITS Projects

	PROGRAM AREAS/PROJECTS	NEAR TERM					MID-TERM					LONG TERM										TOTAL COSTS
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
	1.0 Traffic/Freeway Management Systems (ATMS)																					
1.1MA	CURVE WARNING SYSTEM ON COUNTY ROADS																					$100
1.2MA	TOS EXPANSION INTO COUNTY																					$2,000
1.3MA	DYNAMIC WARNING SYSTEM																					$500
	2.0 Incident Management/Emergency Services																					
	3.0 Transit Systems																					
3.1MA	DEMAND RESPONSIVE TRANSIT SYSTEM INTEGRATION STUDY																					$400
3.2MA	TRANSIT INFORMATION SYSTEM (WEBSITE)																					$200
3.3MA	MADERA COUNTY NEXT BUS ARRIVAL SIGNS																					$400
3.4MA	AVL/GEM ALARM SYSTEM																					$1,000
	4.0 Traveler Information System																					
	5.0 Regional ITS Configuration Management/ Coordination/ Planning																					
	TOTAL ESTIMATED EXPENDITURES																					
																						$4,600

Revised September 24, 2001

Phase 1 Deployment
Phase 2 Deployment
Phase 3 Deployment

Notes:

1. *All values are displayed in 2001 dollars*
2. *Timeline does not reflect operations and maintenance timeframes*
3. *All budget estimates are preliminary and should be utilized for planning purposes only*

Figure A.15: Sequence of Proposed ITS Implementation Activities for Madera County

Advanced Traffic Management System (ATMS)

Start: 2003 Duration: 2 yrs | ATMS-MA1 | Study & Deploy Ph: I
CURVE WARNING SYSTEM ON COUNTY ROADS
Resp: Countywide Cost: $ 100,000

Start: 2001 Duration: 5 yrs | ATMS-MA3 | Study & Deploy Ph: I
DYNAMIC WARNING SYSTEM
Resp: Countywide Cost: $ 500,000

Start: 2006 Duration: 6 yrs | ATMS-MA2 | Study & Deploy Ph: I
CALTRANS TRAFFIC OPERATION SYSTEMS (TOS) GAP CLOSURE PROJECT (REGION)
Resp: Countywide Cost: $ 2,000,000

Incident Mgmt/ Emergency Services (IM/ES)

Transit Systems (APTS)

Start: 2003 Duration: 5 yrs | APTS-MA4 | Study & Deploy Ph: I
AVL/SILENT ALARM SYSTEM
Resp: Countywide Cost: $ 1,000,000

Start: 2006 Duration: 5 yrs | APTS-MA1 | Study & Deploy Ph: I
DEMAND-RESPONSIVE TRANSIT SYSTEM INTEGRATION STUDY
Resp: Countywide Cost: $ 400,000

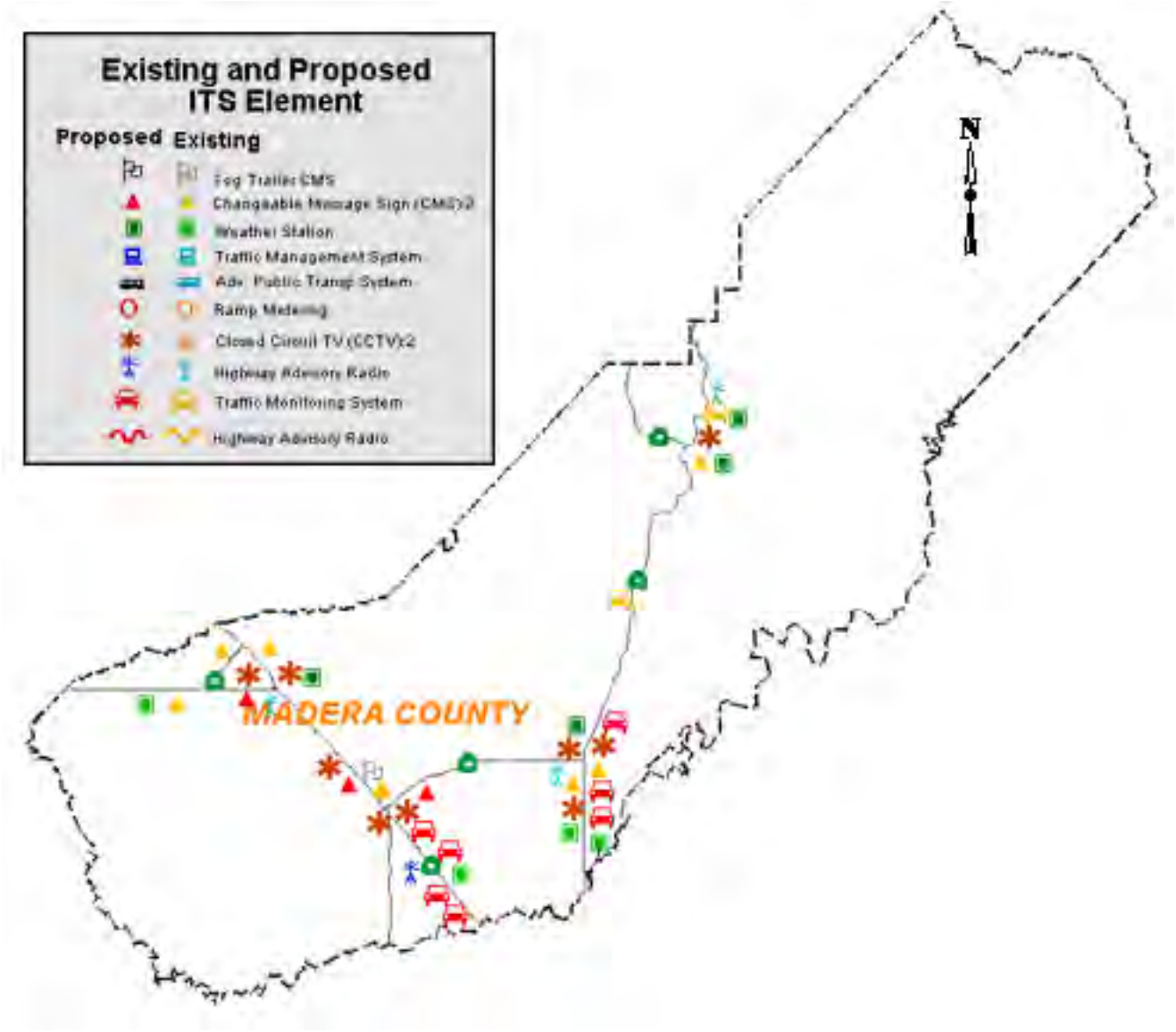
Start: 2008 Duration: 5 yrs | APTS-MA3 | Study & Deploy Ph: I
MADERA COUNTY NEXT BUS ARRIVAL SIGNS
Resp: Countywide Cost: $ 400,000

Start: 2006 Duration: 3 yrs | APTS-MA2 | Study & Deploy Ph: I
TRANSIT INFORMATION SYSTEM (WEBSITE)
Resp: Countywide Cost: $ 200,000

Traveler Information Systems (ATIS)

Regional ITS Config./ Mgmt./ Coord. Plan

Figure A.16: Existing and Proposed ITS Elements for Madera County



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San Joaquin Valley ITS Plan
Report #2 Final SDP: Appendix A
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San Joaquin Valley Intelligent Transportation System (ITS) Strategic Deployment Plan Working Paper #4 – Functional Areas and Technology Options

Prepared for:

San Joaquin Valley ITS Technical Advisory Committee
San Joaquin Council of Governments (SJCOG)

Prepared by:

URS
BRW

In Association with:

Meyer, Mohaddes Associates, Inc.

September 2001

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SECTION 1.0 INTRODUCTION

1.0 PURPOSE

This document identifies the concept of functional areas and technology options and presents the process of translating User Services and Market Packages into a clear and logical plan for ITS deployment within the San Joaquin Valley. The Functional Areas help provide the Intelligent Transportation System (ITS) building blocks within the National ITS Architecture.

1.1 Project Background and Goals

The eight counties of the San Joaquin Valley: Fresno, Kern, Kings, Madera, Merced, San Joaquin, Stanislaus, and Tulare are preparing a plan to guide the implementation of Intelligent Transportation Systems (ITS). The Intelligent Transportation System (ITS) Strategic Deployment Plan (SDP) for the San Joaquin Valley Region is a 20-month study jointly funded by Caltrans and the individual counties with San Joaquin Council of Governments (SJCOG) serving as project administrator. The San Joaquin Valley region represents one of the last geographic areas in California to develop an ITS Plan.

Figure 1.1 provides a graphic illustration of the numerous ITS projects and plans that have been implemented or are in progress throughout the state of California. As indicated in Figure 1.1, two ITS Strategic Plans have been completed for portions of the San Joaquin Valley: Fresno County (1999) and Kern County (1997). The San Joaquin Valley ITS Strategic Deployment Plan will reference and build upon these plans. The specific approach to coordinating the San Joaquin Valley ITS Strategic Deployment Plan with these two plans is explained in Section 1.5. The San Joaquin Valley plan will also reference, and as appropriate coordinate with, several other plans shown in Figure 1.1, including: Central Coast ITS Strategic Deployment Plan, SACOG EDP, San Francisco Bay Area EDP, Sierra Nevada EDP, and the LA/Ventura SDP.

ITS technologies refer to a wide variety of tools and techniques that focus on addressing transportation problems by improving the efficiency and safety of the existing transportation infrastructure through the application of communications, computing, information and other "high level technologies." They include more immediately recognizable features such as: emergency call boxes, changeable message signs, signal synchronization and preemption, and Highway Advisory Radio; and also more advanced technologies including Traffic Operations Centers, Automatic Vehicle Location devices, information kiosks, and electronic payment services for transit and tolls.

Figure 1.1: ITS Strategic Planning Projects in California

Although the San Joaquin Valley has seen the implementation of some basic technology-based strategies or intelligent transportation systems applications, there has not been a comprehensive, systematic look at ITS opportunities until now. The San Joaquin Valley ITS Strategic Deployment Plan will identify a 20-year strategy, but will also include a detailed, short-term component identifying specific projects for implementation in the first few years.

The Plan will include recommendations for Valley-wide and interjurisdictional initiatives to address problems that affect the entire region, as well as recommendations for projects that will address specific local problems throughout the Valley.

The Strategic Deployment Plan is intended to provide a starting point for regional ITS coordination, programming, and implementation efforts over the next twenty years. Over the past decade, ITS has become a recognized tool for improving the operation and efficiency of the transportation system. Several agencies in the San Joaquin Valley have already undertaken various ITS deployment efforts ranging from traffic signal system improvements to transit management systems and from enhanced emergency service Computer Aided Dispatch to freeway surveillance projects.

The development of this Plan represents a new level of effort in the coordinated deployment of ITS projects. The objectives of the study are to:

1) Gain the participation of transportation stakeholders and community members;
2) Identify transportation needs that have the potential to be addressed by ITS technologies;
3) Evaluate which ITS elements would be beneficial, cost-effective and implementable to meet the identified needs; and
4) Develop a plan outlining the short-, medium-, and long-range application of ITS technology including specific operations and maintenance plans and financing.

1.2 ITS Planning Process

The ITS planning process is much like any other transportation planning activity with the focus on technological solutions. One of the primary areas of emphasis of ITS planning is the extensive involvement and participation by the stakeholders of the region. This is especially important to ensure interagency integration, address potential institutional issues early, and to provide the necessary education and awareness of advanced technology transportation solutions.

Using the federal ITS planning process as a guideline, the overall approach to achieving the stated project goal will be to perform the following tasks:

- Task 1: Develop Institutional Framework and Consensus Building
- Task 2: Inventory of Existing and Planned Transportation Systems
- Task 3: Define Existing and Future Transportation Related Deficiencies and Opportunities
- Task 4: Identify User Service Objectives and ITS Vision
- Task 5: Establish Performance Criteria
- Task 6: Identify and Screen Market Packages

- Task 7: Develop ITS Market Package Plan
- Task 8: Identify and Analyze Functional Areas
- Task 9: Define Market Package Functional Requirements and Develop Regional Architecture
- Task 10: Identify and Screen Technology Options
- Task 11: Identify Near-Term Projects
- Task 12: Develop ITS Strategic Deployment Plan and Outreach Materials

The resulting products of these tasks will be the following:

- **Working Paper #1:** A comprehensive inventory of existing and planned transportation systems and current and planned technology uses, and identification of transportation related deficiencies and opportunities.

- **Working Paper #2:** A comprehensive analysis of the ITS Vision, User Services related to problems and opportunities of short, medium, and long term objectives.

- **Working Paper #3:** Establishment of performance criteria, and determines the appropriate market packages, and results of market package screening.

- **Report #1:** ITS Market Package Plan for the San Joaquin Valley, including Identification and analysis of needed functional areas.

- **Working Paper #4:** Identification of Functional Areas, Technology, and Procurement Options.

- **Working Paper #5:** Definitions of market package functional requirements, system architecture, and identification of available technology options.

- **Report #2:** Strategic Deployment Plan, Executive Summary, and Outreach Materials.

This Working Paper represents the results and findings of Task 10 (Identify and Screen Technology Options), which will be an appendix to the Strategic Deployment Plan.

1.3 Stakeholder Participants

Technical oversight for the San Joaquin Valley ITS Strategic Deployment Plan was provided by the ITS Technical Advisory Committee (TAC), composed of representatives of federal, state and local transportation organizations representing the Valley's transportation interests. The ITS Technical Advisory Committee consists of the following members:

- California Highway Patrol (CHP)
- California Trucking Association
- Caltrans – District 10

- Caltrans – District 6
- Caltrans New Technology and Research Program
- Council of Fresno County Governments (COFCG)
- Federal Highway Administration (FHWA)
- Kern Council of Governments (Kern COG)
- Kings County Association of Governments (KCAG)
- Madera County Transportation Commission (MCTC)
- Merced County Association of Governments (MCAG)
- San Joaquin Council of Governments (SJCOG)
- San Joaquin Valley Air Pollution Control District (SJVAPCD)
- Stanislaus Council of Governments (StanCOG)
- Tulare County Association of Governments (TCAG)

The San Joaquin Valley COG Directors are providing Policy Level oversight as in the role of a Steering Committee for this Plan.

Table 1.1 lists the agencies/organizations of approximately 400 key stakeholders, identified by the TAC and the Project Team, that provided input to the San Joaquin Valley ITS Strategic Deployment Plan and/or participated in the ITS Subcommittee. Input from the TAC, stakeholders, as well as others, were instrumental in the development of the information presented in this Working Paper. Much of this information was collected and assembled from existing documents and responses to the ITS inventory and user needs survey.

1.4 Reference Documents/Resources

The following documents were used to provide background information for this document.

- Caltrans ITMS Data for San Joaquin Valley, March 2000
- Caltrans, District 6 and District 10 Master Plans
- Caltrans/CHP Transportation Management Center Master Plan, December 1997
- Caltrans-CHP Central Valley TMC District 6 Fact Sheet, May 2000
- Congestion Management Programs (CMPs) and Regional Transportation Plans (RTPs) from each county
- City of Fresno ITS Implementation Design Engineering Report, August 1998
- City of Stockton Traffic Management System
- Fresno City-Wide Traffic Signal Master Plan, October 1995
- Fresno County ITS Strategic Deployment Plan, December 1999
- Golden Empire Transit District – Survey of Existing Radio Equipment and Systems, April 2000
- Golden Empire Transit District Five-Year Service Improvement Plan

- Kern County Intelligent Transportation Systems (ITS) Early Deployment Plan, June 12, 1997
- Kern County Traffic Census, 1998
- Kings County Transit Development Plan, August 1998
- Meadows Field Master Plan Summary, November 1988
- Metropolitan Bakersfield 2010 General Plan
- Modesto CCTV and Ceres ATMS, September 1996
- San Joaquin Valley Goods Movement Study, May 2000
- Stockton Citywide Traffic Signal System Upgrade Master Plan, October 1993
- Stockton Street Traffic Management
- Interviews, field visits, and user needs surveys with/from specific agencies, individuals and stakeholders
- Other ITS information and background documents

Table 1.1: San Joaquin Valley ITS Strategic Deployment Plan Stakeholders

Agricultural Interests	Automobile Club of California
California Highway Patrol	California Trucking Association
Caltrans – District 6	Caltrans – District 10
Caltrans Division of New Technology & Research	Council of Fresno County Governments
Emergency Service Providers	Farm Bureaus
Federal Highway Administration	Federal Railroad Administration
Federal Transit Administration	Fresno Area Express
Golden Empire Transit District	Kern Council of Governments
Kern Regional Transit	Kings County Association of Governments
Local Jurisdictions	Local Police Departments
Local Transit Operators	Madera County Transportation Commission
Meadows Field Airport	Merced County Association of Governments
Port of Stockton	San Joaquin Council of Governments
San Joaquin Valley Air Pollution Control District	San Joaquin Valley Railroad
Sheriff Departments	Stanislaus Council of Governments
Tourism Industry	Tulare County Association of Governments
Union Pacific Railroad	United Parcel Service

Source: BRW, Inc. June 2000

1.5 Relationship to Fresno and Kern County ITS Plans

As noted in Section 1.1, two ITS Strategic Plans have recently been completed for subregions within the San Joaquin Valley: Fresno County (1999) and Kern County (1997). Both of those efforts were comprehensive, in terms of both needs assessment and the development of recommendations, and aside from some selective updating, those efforts are not being repeated as part of the development of the San Joaquin Valley ITS Plan.

The overall approach to incorporating the Fresno and Kern County plans into this planning process is to coordinate at the project development and system architecture stages. Since those plans include recommendations responsive to the needs identified for those areas, the most effective juncture at which to reference and potentially integrate those plans with the broader San Joaquin Valley plan is at the stage where projects and project relationships are being developed. Given this approach, needs assessment and prioritization efforts for this plan have focused primarily on the other counties in the Valley, with the expectation that the relationship between those previous plans and the valley-wide plan will be established through projects and program recommendations.

1.6 Intended Influence of the San Joaquin Valley ITS Strategic Deployment Plan

The San Joaquin Valley ITS Strategic Deployment Plan is intended to establish the need for ITS investments in the Valley, identify relative priorities to direct ITS investment in the region, and to identify specific projects to be deployed to address identified needs. The phasing of the recommended projects reflects the relative priorities identified in the development of the plan.

In concept, the Strategic Deployment Plan is intended to guide all ITS investment in the region, in so much as every attempt has been made in the development of the plan to involve all interested agencies and to reflect their needs and priorities in the recommended ITS investment program. The Strategic Deployment Plan is expected to play a particularly significant role in directing ITS investments planned and programmed by the Regional Transportation Plan (RTP) and Transportation Improvement Plan (TIP) processes administered by the Metropolitan Planning Organizations (MPOs) within the region.

However, there will be some ITS investments made in the Valley based on priorities established at the state level, utilizing state funds (as opposed to utilizing funds dedicated to regionally prioritized investments). It should also be noted that despite the expressed priorities of the Strategic Deployment Plan, private companies will invest or withhold investment based on their own priorities, and therefore private sector involvement or lack of involvement may significantly influence the actual phasing of specific ITS investments in the Valley.

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SECTION 2.0

FUNCTIONAL AREAS

2.0 FUNCTIONAL AREAS

2.1 Introduction

Functional Areas is a concept taken from some of the early National ITS Architecture development efforts undertaken in the mid 1990's. They were introduced in the *National ITS Program Plan*; Volume II; First Edition, 1995. The original premise was the translation of intelligent transportation systems (ITS) functions and technologies into the emerging National ITS Architecture concepts and nomenclature.

The Functional Areas topic was a specific step taken in the Early Deployment Planning process. However, because of the emergence of the National ITS Architecture, and its corresponding maturation, the Functional Areas topic has diminished somewhat in its importance in today's ITS planning process. Even so, Functional Areas continues to be a useful tool in translating User Needs, User Services and Market Packages into a clear and logical plan for ITS deployment. This activity is considered more of an educational tool for the stakeholders group than an analytical exercise to better determine ITS planning or deployment strategy. This activity will also assist the consultant team and the stakeholders group in making sure that the project's scope is comprehensively covered. When ITS elements are mainstreamed into future projects in the San Joaquin Valley, the processes and technologies identified in this Working Paper will be useful in selecting appropriate technological solutions.

2.2 Approach

First, a listing of the 17 Functional Areas is shown, along with their definitions. Second, the list of High Priority Market Packages from Working Paper (WP) #3 is shown. Then those two lists are merged into one matrix by way of a mapping process correlating the Functional Areas to the High Priority Market Packages. This mapping is similar to the mapping exercises that took place in WP #2 regarding Needs and User Services, and in WP #3 regarding User Services and Market Packages. Finally, a statement about the coverage of the appropriate Functional Areas, as they relate to the San Joaquin Valley, is made.

2.3 Functional Areas

The Functional Areas were originally developed to provide a way to translate ITS functions and technologies into the emerging National ITS Architecture concepts and nomenclature. Each of the Functional Areas has a corresponding description of potential functionality and technologies to implement the functionality. Many of the terms have changed to varying degrees but the ideas and principles have not. **Table 2.1** lists the 17 Functional Areas and their corresponding descriptions. Several different Market Packages are defined in each major application area, which provide a palette of service options at various costs. Market Packages are also structured to segregate services that are likely to encounter technical or non-technical challenges from lower risk services. This approach allows the identification of a subset of the Market Packages that are likely early deployments. At the other end of the spectrum, several of the Market Packages represent advanced products or services that will not be available for some time. Many of the Market Packages are also incremental so that more advanced packages can be efficiently implemented by building on common elements that were deployed earlier with more basic packages. The complete list of market packages from The National ITS Architecture version 3.0 is identified later in the chapter.

Table 2.1: Functional Areas

Function	Brief Description of Related Technologies Within Each Function
Traffic Surveillance	Surveillance technologies that collect information about the status of the traffic stream. Possible technologies include loop detectors, infrared sensors, radar and microwave sensors, video detection, aerial surveillance, closed circuit television (CCTV), acoustic, and vehicle probes.
Vehicle Surveillance	Surveillance technologies that collect a variety of information about specific vehicles. These technologies include weigh-in-motion devices, vehicle identification, vehicle classification, vehicle operating parameters and vehicle location.
Inter-Agency Coordination	Technologies that connect travel-related facilities to other agencies such as police, emergency services providers, weather forecasters, Traffic Management Centers (TMCs), Transit Management Centers (TrMC), railroad operators, etc. The communications technologies that are most likely utilized between these agencies are listed under Stationary Communications.
1-Way Mobile Communications	Any communication technology that transmits information to potentially mobile reception sites but cannot receive information back from those sites. Possible technologies providing this function include highway advisory radio (HAR), AM/FM subcarrier, pager/cell phone text messaging and commercial radio/TV broadcasts.
2-Way Mobile Communications	Any communication technology that transmits information to potentially mobile reception sites and allows receipt of information back from those same sites. Possible technologies include cellular telephones, 2-way radio, 2-way pagers, microwave, infrared, and 2-way satellite.
Stationary Communications	Any communication technology that connects stationary sites for the purpose of transmitting/transferring voice and data. Technologies include wire line communications such as fiber optics, “copper wire”, leased lines, the Internet, and other land lines; microwave, 2-way radio, spread spectrum radio, cell phones, satellite, etc.
Individual Traveler Interface	Devices that provide information flow to a specific traveler. Technologies meeting this function include touch screens, keypads, graphics displays and computer voices at kiosks; automated stop-announcement systems and on-board display systems in vehicles; personal digital assistants (PDAs) carried with the traveler, audiotext from any phone, and TV in the office or home.

Table 2.1: Functional Areas

Function	Brief Description of Related Technologies Within Each Function
Payment Systems	Technologies that enable electronic fund transfer between the traveler and the service provider. The technology areas include Automated Vehicle Identification (AVI), electronic toll collection, other fare collection systems, smart cards, and "back-office" electronic funds management systems.
Variable Message Displays	Technologies that allow centrally controlled messages to be displayed and possibly announced audibly to multiple users at a common location, such as a roadside display (dynamic message sign-DMS), or a display board (arrivals/departures) in a transit terminal. These technologies would typically be applied to provide information on highway conditions, traffic restrictions, and transit status such as arrival and departure estimates.
Signalized Traffic	Technologies that allow for real-time control of traffic flow. Possible technologies include optimized traffic signals, centralized signal control systems, traffic responsive signal control, ramp metering, reversible lane designation, and ramp/lane closures.
Restrictions Traffic Control	Operational techniques that restrict the use of roadways according to regional goals. Techniques include HOV restrictions, parking restrictions (time of day, day of week, etc.), and road use (congestion) pricing.
Navigation	Technologies that determine vehicle position in real time. Technologies that provide this function include global positioning systems (GPS), dead reckoning, localized beacons, electronic signposting, map database matching, and cellular/radio triangulation.
Database Processing	Technologies that manipulate and configure or format transportation-related data for sharing on various platforms. General purpose database software such as Microsoft SQL, Oracle, object oriented databases, flat-file databases, etc. currently exist. These database tools are currently being adapted to transportation needs, such as data fusion, maps, and travel services.
Traffic Prediction Data Processing	Data processing relating to prediction of future or changing traffic situations. Algorithms under development include areas such as real-time traffic prediction, adaptive signal control and traffic assignment.
Traffic Control Data Processing	Data processing related to the real-time control of traffic. Algorithms under development include optimal control and incident detection, and the interaction of route selection and traffic control.
Routing Data Processing	Data processing related to routing of vehicles including the next generation of step-by-step driving instructions to a specified destination. Algorithms under development include the scheduling of drivers, vehicles, and cargo; multi-stop route generation, route selection, commercial vehicle scheduling; route guidance (Autonomous and Dynamic Route Guidance); and multi-modal dispatching.
In-Vehicle Sensors/Devices	Technologies providing a range of sensing functions to be located within vehicles. Functions addressed by these technologies include monitoring of vehicle performance and driver performance; automatically activated warning messages; determination of vehicle position relative to the roadway, other vehicles, and obstacles; assisted vision in adverse weather conditions; automated "mayday call" upon deployment of vehicle airbags (or other safety monitoring device indicators); and other types of on-board security monitoring.

2.4 High Priority Market Packages for the San Joaquin Valley

Table 2.2 is included to serve as a reminder of the High Priority Market Packages from the final priority ranking in Working Paper (WP) #3. Because the High Priority Market Packages are the most relevant in the short term, they are the only Market Packages that are mapped to the Functional Areas. Appendix A contains the High Priority Market Package descriptions and diagrams.

Table 2.2: High Priority Market Packages for the San Joaquin Valley

High Priority Market Packages			
ATMS1	Network Surveillance	ATIS1	Broadcast Traveler Information
ATMS2	Probe Surveillance	ATIS2	Interactive Traveler Information
ATMS3	Surface Street Control	ATIS3	Autonomous Route Guidance
ATMS4	Freeway Control	ATIS4	Dynamic Route Guidance
ATMS5	HOV Lane Management	ATIS5	ISP Based Route Guidance
ATMS6	Traffic Information Dissemination	ATIS7	Yellow Pages and Reservation
ATMS7	Regional Traffic Control	ATIS8	Dynamic Ridesharing
ATMS8	Incident Management System	AVSS1	Vehicle Safety Monitoring
ATMS9	Traffic Forecast and Demand Management	AVSS7	Driver Visibility Improvement
ATMS12	Virtual TMC and Smart Probe Data	CVO1	Fleet Administration
ATMS18	Road Weather Information System	EM1	Emergency Response
APTS1	Transit Vehicle Tracking	EM2	Emergency Routing
APTS2	Transit Fixed-Route Operations	EM3	Mayday Support
APTS3	Demand Response Transit Operations	AD1	ITS Data Mart
APTS4	Transit Passenger and Fare Management	AD2	ITS Data Warehouse
APTS7	Multi-modal Coordination	AD3	ITS Virtual Data Warehouse
APTS8	Transit Traveler Information	New	Emergency Vehicle Maintenance
		New	Dynamic Warning System
		New	Safe Speed Advisory

2.5 Mapping the Functional Areas to the High Priority Market Packages

Table 2.3 maps the High Priority Market Packages for the San Joaquin Valley to the 17 Functional Areas. When a bullet appears in a cell in the table, it represents the presence of a correlation or relationship between the specific Market Package and the specific Functional Area. For this exercise, a correlation means that deployment of the specific Market Package could or would implement the Functional Area and its accompanying technologies.

In many cases the correlation is strong and well established. For example, the correlation between the Network Surveillance Market Package and the Traffic Surveillance Functional Area is strong. The Network Surveillance Market Package deals specifically with traffic flow information and sensor and surveillance control, between the Traffic Management Subsystem and the Roadway Subsystem. The Traffic Surveillance Functional Area deals specifically with "Surveillance technologies that collect information about the status of the traffic stream. Possible technologies include loop detectors, …" etc. The correlation is fairly obvious.

In other cases, the correlation may not be so obvious; for example, the correlation between the Multi-modal Coordination Market Package and the Signalized Traffic Functional Area. The Multi-modal Coordination Market Package deals mostly with coordination between different transit operators, and/or between transit operators and traffic managers. However, one additional component of the Multi-modal Coordination Market Package deals with signal priority. This would be one important component of a robust, complete Signalized Traffic Functional Area, and therefore the table identifies the existence of this relationship.

Table 2.3: Mapping High Priority Market Packages to Functional Areas

	High Priority Market Packages / Functional Areas	Traffic Surveillance	Vehicle Surveillance	Inter-Agency Coordination	1-Way Mobile Communications	2-Way Mobile Communications	Stationary Communications	Individual Traveler Interface	Payment Systems	Variable Message Displays	Signalized Traffic	Restrictions Traffic Control	Navigation	Database Processing	Traffic Prediction Data Processing	Traffic Control Data Processing	Routing Data Processing	In-vehicle Sensors/Devices
ATMS1	Network Surveillance	●					●									●		
ATMS2	Probe Surveillance	●	●			●							●			●		●
ATMS3	Surface Street Control	●		●			●			●	●	●		●	●	●	●	
ATMS4	Freeway Control	●		●			●			●	●	●		●	●	●	●	
ATMS5	HOV Lane Management			●			●			●	●	●		●	●	●	●	
ATMS6	Traffic Information Dissemination	●		●	●	●	●	●		●				●			●	
ATMS7	Regional Traffic Control	●		●			●			●	●	●		●	●	●	●	
ATMS8	Incident Management System	●		●	●	●	●			●	●	●		●	●			
ATMS9	Traffic Forecast and Demand Management	●										●		●	●	●	●	
ATMS12	Virtual TMC and Smart Probe Data	●	●	●		●				●	●			●		●	●	●
ATMS18	Road Weather Information System			●		●	●											
APTS1	Transit Vehicle Tracking	●	●			●							●	●				●
APTS2	Transit Fixed-Route Operations			●						●				●			●	
APTS3	Demand Response Transit Operations			●		●							●	●			●	
APTS4	Transit Passenger and Fare Management								●					●				●
APTS7	Multi-modal Coordination	●		●		●	●				●	●				●	●	●
APTS8	Transit Traveler Information				●	●	●	●		●				●			●	
ATIS1	Broadcast Traveler Information	●			●		●	●				●		●			●	
ATIS2	Interactive Traveler Information	●	●			●	●	●				●		●			●	
ATIS3	Autonomous Route Guidance		●					●				●	●	●			●	●
ATIS4	Dynamic Route Guidance	●	●			●		●				●	●	●	●		●	●
ATIS5	ISP Based Route Guidance	●		●		●		●				●	●	●	●		●	●
ATIS7	Yellow Pages and Reservation			●		●		●						●				
ATIS8	Dynamic Ridesharing	●		●		●		●				●		●				
AVSS1	Vehicle Safety Monitoring		●					●										●
AVSS7	Driver Visibility Improvement							●										●
CVO1	Fleet Administration		●			●	●	●	●				●	●			●	●
EM1	Emergency Response	●		●		●		●								●	●	●
EM2	Emergency Routing	●	●	●		●		●			●		●		●	●	●	●
EM3	Mayday Support		●	●		●		●					●				●	●
AD1	ITS Data Mart	●		●			●		●			●		●	●	●	●	
AD2	ITS Data Warehouse	●		●			●		●			●		●	●	●	●	
AD3	ITS Virtual Data Warehouse	●		●			●		●			●		●	●	●	●	
New	Emergency Vehicle Maintenance		●											●				●
New	Dynamic Warning System	●			●					●								
New	Safe Speed Advisory	●			●					●								

Additionally, while some Functional Areas are addressed by relatively many Market Packages, others are addressed by relatively few. This disparity, in some cases, is a reflection of the maturity of certain technologies. For example, the Traffic Surveillance Functional Area is addressed by relatively many Market Packages, as a result of the relative maturity of most of the technologies that perform traffic surveillance. Conversely, the Navigation Functional Area is addressed by relatively few Market Packages due to the still-emerging nature of these Technologies, in general.

The number of Market Packages addressing a Functional Area may also be a reflection of the specialization of technologies. For example, the Stationary Communications Functional Area has relatively many technology options that are not very specialized. Therefore, there are many Market Packages that address that Functional Area. Payment Systems, however, is a relatively specialized Functional Area utilizing relatively specialized technologies. Even though many payment systems may utilize relatively mature technologies, the specialization of the payment systems reduces the number of Market Packages that address them.

2.6 Functional Areas Conclusion

In conclusion, the various High Priority Market Packages already identified for the San Joaquin Valley Region equate to a wide representation of virtually all of the Functional Areas. Due to the diverse nature of the Region (medium and small sized urban centers, surrounded by extensive rural areas), this comes as no surprise. The range of High Priority Market Packages reflects that diversity in the Region. This is, in turn, reflected in complete coverage of the Functional Areas.

In a less diverse region, one might observe less complete coverage of the Functional Areas. However, complete coverage of all the Functional Areas is not necessarily a goal, nor is it essential. The coverage of the Functional Areas is determined by the selection and prioritization of User Services and Market Packages, which in turn reflects the priorities of the Region.

SECTION 3.0

IDENTIFY AND SCREEN TECHNOLOGY OPTIONS

3.0 IDENTIFY AND SCREEN TECHNOLOGY OPTIONS

3.1 Approach

This section articulates a process to identify, screen and evaluate technology options for the San Joaquin Valley. First, a subset of Technologies identified in Table 2.1 (Functional Areas) is carried forward to perform a mapping of those Technologies to the High Priority Market Packages for the San Joaquin Valley. That mapping exercise result is shown in **Table 3.1**.

The next step further narrows the number of identified Technologies for which a high level cost evaluation will be presented, **Table 3.2**. The cost data presented is taken from the *ITS Unit Cost Database* (as of March 30, 2001). The *ITS Unit Cost Database* has been developed as part of a larger ITS benefit/cost evaluation tool for the United States Department of Transportation (USDOT).

3.2 Mapping Technologies to Market Packages

The Technologies shown in the column headers in Table 3.1 are a subset of technologies used to identify the Functional Areas in Table 2.1. The Technologies contained in Table 3.1 were perceived as the most relevant Technologies to the San Joaquin Valley, and therefore have a greater likelihood of deployment in that Region.

Refer to Table 2.2 for a reminder of the High Priority Market Packages from the final priority ranking in Working Paper (WP) #3; and Appendix A for the High Priority Market Package descriptions and diagrams. As with the mapping exercise in the Functional Areas, because the High Priority Market Packages are the most relevant in the short term, they are the only Market Packages for which Technologies will be identified, screened and evaluated.

The primary question asked when performing the mapping exercise was “would, or could, this Technology be used to implement this Market Package?” For instance, “would, or could, Loop Detectors be used to implement the Network Surveillance Market Package?” Or, “would, or could, Dynamic Message Signs be used to implement the Traffic Information Dissemination Market Package?” If the answer is “Yes”, a bullet point is inserted into the matrix to indicate a correlation or relationship between a Technology and a Market Package.

Table 3.1: Mapping the Technologies to the High Priority Market Packages

San Joaquin Valley
ITS Strategic Deployment Plan

Identification of Market Package Technologies

| | IDENTIFIED TECHNOLOGIES | TRAFFIC SURVEILLANCE | Loop Detectors | Video Detection | Acoustics | Radar/Microwave Sensors | VEHICLE SURVEILLANCE | Weigh-in-motion | Automatic Vehicle Identification (AVI) | Automatic Vehicle Location (AVL) | INTER-AGENCY COORDINATION | Traffic Management Centers (TMC) | Transit Management Centers (TMC) | 1-WAY MOBILE COMMUNICATIONS | Highway Advisory Radio (HAR) | AM/FM Subcarrier | 2-WAY MOBILE COMMUNICATIONS | Cellular Telephone (including CDPD) | 2-Way Radio | 2-Way Satellite | 2-Way Pagers | STATIONARY COMMUNICATIONS | Land Line - Fiber Optic | Land Line - "Copper Wire" | Land line - Leased Line(s) | 2-Way Radio | Spread Spectrum Radio | Microwave | INDIVIDUAL TRAVELER INTERFACE | Kiosks | Internet Website | In-vehicle Systems | Personal Digital Assistant (e.g. Palm Pilot, etc) | Highway Advisory Telephone Systems | PAYMENT SYSTEMS | Electronic Toll Collection Systems | Advanced Fare Collection Systems | Smart Card Systems | "Back Office" Management Systems | VARIABLE MESSAGE DISPLAYS | Dynamic Message Signs (DMS) | "Arrival/Departure" Display Systems | SIGNALIZED TRAFFIC | Centralized Signal Control Systems | Traffic Responsive Signal Control (includes priority/preemption) | Ramp Metering | RESTRICTIONS TRAFFIC CONTROL | HOV Restrictions | Congestion Pricing | Parking Management | NAVIGATION | Global Positioning System (GPS) | Dead Reckoning | Cellular/radio Triangulation | Map Database | Electronic Signposting | DATABASE PROCESSING | Database Integration | Data Fusion | Travel Services | TRAFFIC PREDICTION DATA PROCESSING | Real Time Traffic Prediction | Traffic Assignment | TRAFFIC CONTROL DATA PROCESSING | Integrated Routing/Traffic Control | Incident Detection Systems | Signal Synchronization/Optimization | Adaptive Signal Control | ROUTING DATA PROCESSING | Driver/Vehicle Scheduling Systems | Autonomous Route Guidance | Dynamic Route Guidance | Multi-modal Dispatching | IN-VEHICLE SENSORS/DEVICES | Vehicle Performance Monitoring Systems | Driver Performance Monitoring Systems | Automated Vehicle Operation Systems | Vision Enhancement Systems | In-vehicle Safety/Security Monitoring | Mayday Systems (On Star, etc.) |
|---|---|---

Table 3.2: ITS Unit Cost Database (as of March 30, 2001)

Identified Technologies	Subsystem/Unit Cost Element	Lifetime* (years)	Capital Cost ($K)		O&M Cost ($K/yr)		Notes (Notes in standard font are directly from the Unit Cost Database. Notes in *Italics* have been added by the BRW Team.)
			Low	High	Low	High	
TRAFFIC SURVEILLANCE							
Loop Detectors	**Roadside Detection (RS-D)**						
	Inductive Loop Surveillance on Corridor	5	3	8	0.5	0.8	Double set (4 loops) with controller, power, etc.
	Inductive Loop Surveillance at Intersection	5	9	16	1	1.6	Four legs, 2 lanes/approach.
Video Detection	Machine Vision Sensor *(Video Detection)* on Corridor		21.7	29	0.2	0.4	One sensor both directions of travel.
	Machine Vision Sensor *(Video Detection)* at Intersection		20	25.7		0.2	Four-way intersection, one camera per approach.
Acoustics	Passive Acoustic Sensor on Corridor		4.4	10	0.2	0.4	Two sensors both directions of travel.
	Passive Acoustic Sensor at Intersection			15	0.2	0.4	Four sensors, 4-leg intersection.
Radar/Microwave	Remote Traffic Microwave Sensor on Corridor			6	0.2	0.4	One sensor both directions of travel.
	Remote Traffic Microwave Sensor at Intersection			18	0.2	0.4	Four sensors, 4-leg intersection.
VEHICLE SURVEILLANCE							
Weigh-in-motion	**Commercial Vehicle Check Station (CC)**						
	Weigh-In-Motion Facility	10	14	21	1.4	2.1	Includes WIM fixed load cell and interface to roadside facility. Software is COTS.
	Wireline to Weigh-In-Motion Facility	10	1	2	0.1	0.2	Wireline communication (local line).
Automatic Vehicle Location (AVL)	**Transit Management Center (TR)**						
	Vehicle Location Interface	20	10	15			Vehicle location interface.
	Vehicle Location Equipment			275		16.5	
	Transit Vehicle On-Board (TV)						
	Driver Interface and Schedule Processor	10	0.3	0.5	0.006	0.01	On-board schedule processor and database.
	Cell Based Communication Equipment	10	0.15	0.25	0.0075	0.0125	Cell-based radio with data capacity.
	GPS/DGPS for Vehicle Location	10	0.5	0.8	0.01	0.016	AVL GPS/DGPS.
INTER-AGENCY COORDINATION							
Transportation Management Center (TMC)	**Transportation Management Center (TM)**						
	The following represents a "Basic" TMC. Not shown is the cost of the physical facility and the cost of the communications infrastructure necessary to communicate with the TMC field elements.						

Table 3.2: ITS Unit Cost Database (as of March 30, 2001)

Identified Technologies	Subsystem/Unit Cost Element	Lifetime* (years)	Capital Cost ($K)		O&M Cost ($K/yr)		Notes (Notes in standard font are directly from the Unit Cost Database. Notes in *Italics* have been added by the BRW Team.)
			Low	High	Low	High	
"Basic" TMC	Hardware for Signal Control	5	15	30			Includes 3 workstations.
	Software, Integration for Signal Control	5	180	220			Software and integration, installation and 1 year maintenance. Software is COTS.
	Labor for Signal Control				486	594	Costs include labor for operations (2 @ 50% of the time, at 100K), transportation engineer (1 at 50% of the time, at 100K), update timing plans (2K per system per month for every 10 systems), and signal maintenance technician (2 @ 75K). Salary cost are f
	Hardware, Software for Traffic Surveillance	20	135	165	6.75	8.25	Processor and software.
	Integration for Traffic Surveillance	20	225	275	11.25	13.75	Integration with other systems.
	Hardware for Freeway Control	5	15	30			Includes 3 workstations.
	Software, Integration for Freeway Control	5	180	220			Software and integration, installation and 1 year maintenance. Software is off-the-shelf technology and unit price does not reflect product development.
	Labor for Freeway Control				225	275	Labor for operations (2 @ 50% of 100K) and maintenance technicians (2 @ 75K). Salary cost are fully loaded prices including base salary, overtime, overhead, benefits, etc.
"Upgraded" TMC	*In addition to the above "Basic" TMC elements, the following represents an "Upgraded" TMC. Again, not shown, is the cost of the physical facility and the cost of the communications infrastructure necessary to communicate with the TMC field elements.*						
	Hardware for Lane Control	5	5.4	6.6	0.27	0.33	Includes 1 workstation and 19" monitor.
	Software, Integration for Lane Control	10	225	275	11.25	13.75	Software development and integration and software upgrade for controllers. Software development is fine tune adjustments for local installations. Otherwise, software is COTS.
	Labor for Lane Control				90	110	Labor for 2 operators @ 50% of 100K.
	Software, Integration for Regional Control	10	300	440			Software and integration, installation and 1 year maintenance. Integration with other TMC's. Software is COTS.
	Real-time, Traffic Adaptive Signal Control System	10	120	150	20		The costs range is based on commercially available packages, which run on a centralized computer. The high capital cost includes software packages for graphical user interface and incident management.

Table 3.2: ITS Unit Cost Database (as of March 30, 2001)

Identified Technologies	Subsystem/Unit Cost Element	Lifetime* (years)	Capital Cost ($K)		O&M Cost ($K/yr)		Notes (Notes in standard font are directly from the Unit Cost Database. Notes in *Italics* have been added by the BRW Team.)
			Low	High	Low	High	
"Upgraded" TMC	Labor for Regional Control				180	220	Labor for operators (2 @ 50% of 100K), transportation engineer (1 @ 50% of 100K), and maintenance contract. Salary costs are fully loaded prices including base salary, overtime, overhead, benefits, etc.
	Video Monitors, Wall for Incident Detection	5	40.5	49.5	2.025	2.475	Includes 5 19" video monitors and video wall monitors (3x3=9 monitors w/switch).
	Hardware for Incident Detection	5	81.7	119.3	4.085	5.965	Includes 4 servers, 5 workstations, and 2 laser printers.
	Integration for Incident Detection	20	90	110	4.5	5.5	Integration with other systems.
	Software for Incident Detection	5	90	110	4.5	5.5	Software is COTS and includes development cost
	Labor for Incident Detection				630	770	Labor for operators (4 @ 100K and 1 manager @ 150K) and 2 maintenance techs @ 75K.
	Video Monitor for Incident Response	5	2.7	3.3	0.135	0.165	Includes 1 19" monitor.
	Hardware for Incident Response	5	2.7	3.3	0.135	0.165	Includes 1 workstation.
	Integration for Incident Response	20	180	220			Integration with other systems.
	Software for Incident Response	2	13.5	16.5	0.675	0.825	Software is COTS.
	Labor for Incident Response				90	110	Labor for incident management coordinator (1 @ 100K).
	Automated Incident Investigation System	5		15			Includes workstation, tripod, monopole antenna, Auto Integration, and AutoCAD software.
	Hardware for Traffic Information Dissemination	5	5	10	0.25	0.5	Includes 1 workstation.
	Software for Traffic Information Dissemination	5	18	22	0.9	1.1	Software is COTS.
	Integration for Traffic Information Dissemination	20	90	110	4.5	5.5	Integration with other systems.
	Labor for Traffic Information Dissemination				90	110	Labor for 1 operator @ 100K. Salary costs are fully loaded and include base salary, overtime, overhead, benefits, etc.
	Hardware for Probe Information Collection	3	5	10	0.5	1	Includes 1 workstation.
	Software for Probe Information Collection	5	18	22	1.8	2.2	Includes software installation and 1 year maintenance. Software is COTS.
	Integration for Probe Information Collection	20	135	165	13.5	16.5	Integration with other systems.
	Labor for Probe Information Collection				45	55	Labor for 1 operator (4 hours per day @ 100K/year). Salary costs are fully loaded prices and include base salary, overtime, overhead, benefits, etc.

Table 3.2: ITS Unit Cost Database (as of March 30, 2001)

Identified Technologies	Subsystem/Unit Cost Element	Lifetime* (years)	Capital Cost ($K)		O&M Cost ($K/yr)		Notes (Notes in standard font are directly from the Unit Cost Database. Notes in *Italics* have been added by the BRW Team.)
			Low	High	Low	High	
"Upgraded" TMC	Road Weather Information System (RWIS)	25		25	0.4	2.5	RWIS contains an environmental sensing station (ESS) (see Roadside Detection subsystem for costs of ESS), CPU, workstation with RWIS software, and communications equipment. CPU replaced every 5 years at cost of $4K. O&M costs range includes communication
Transit Management Center (TrMC)	**Transit Management Center (TR)**						
	The following represents a "Basic" TrMC. Not shown is the cost of the physical facility and the cost of the communications infrastructure necessary to communicate with the TrMC field elements.						
"Basic" TrMC	Transit Center Hardware	10	15	30			Includes 3 workstations.
	Transit Center Software, Integration	20	815	1720	6	12	Includes vehicle tracking & scheduling, database & information storage, schedule adjustment software, real time travel information software, and integration. Software is COTS.
	Transit Center Additional Building Space				6	9	Additional space required for ITS technology - $12-$18 / sq.ft., 500 sq.ft.
	Transit Center Labor				50	250	Labor for 3 staff @ 75K. Salary cost are fully loaded prices including base salary, overtime, overhead, benefits, etc.
	In addition to the above "Basic" TrMC elements, the following represents an "Upgraded" TrMC. Again, not shown, is the cost of the physical facility and the cost of the communications infrastructure necessary to communicate with the TrMC field elements.						
"Upgraded" TrMC	Upgrade for Auto. Scheduling, Run Cutting, or Fare Payment	20	20	40	0.4	0.8	Processor/software upgrade, installation and 1 yr. maintenance (for processor). Software is COTS.
	Integration for Auto. Scheduling, Run Cutting, or Fare Payment	20	225	500			Integration with other systems.
	Further Software Upgrade for E-Fare Payment	20	40	60	0.8	1.2	Software upgrade. Software is COTS.
	Vehicle Location Interface	20	10	15			Vehicle location interface.
	Vehicle Location Equipment			275		16.5	
1-WAY MOBILE COMMUNICATION							
Highway Advisory Radio (HAR)	**Roadside Information (RS-I)**						
	Highway Advisory Radio	20	16	32	0.6	1	HAR

Table 3.2: ITS Unit Cost Database (as of March 30, 2001)

Identified Technologies	Subsystem/Unit Cost Element	Lifetime* (years)	Capital Cost ($K)		O&M Cost ($K/yr)		Notes (Notes in standard font are directly from the Unit Cost Database. Notes in *Italics* have been added by the BRW Team.)
			Low	High	Low	High	
	Information Service Provider (ISP)						
AM/FM Subcarrier	FM Subcarrier Lease				120	240	Cost is per year.
2-WAY MOBILE COMMUNICATION							
	Roadside Telecommunications (RS-TC)						
Cellular Telephone	Cellular Communication			0.5	0.3	0.4	Cost is for one unit.
CDPD (or similar)	Wireless Communications, Low Usage				0.18	0.2	125 Kbytes/month available usage.
	Wireless Communications, Medium Usage				0.6	0.7	1,000 Kbytes/month available usage.
	Wireless Communications, High Usage	20	0.5	1	1.2	1.8	3,000 Kbytes/month available usage.
	Emergency Response Center (ER)						
2-Way Radio	800 MHz. 2-way Radio	5		1.7		0.09	Cost is per radio. *Costs do not include basic wide area infrastructure such as: transmitter sites, repeater sites and any comm links between dispatch center and main transmitter site(s).*
STATIONARY COMMUNICATION							
	Roadside Telecommunications (RS-TC)						
Land Line - Fiber Optic	Direct Bury Armor Encased Fiber Cable			60		0.02	Cost is per km.
	Conduit Design and Installation - Corridor			65		0.02	Cost is per km.
	Fiber Optic Cable Installation			20		0.02	Cost is per km.
Land Line - "Copper Wire"	Conduit Design and Installation - Corridor			65		0.02	Cost is per km.
	Direct Bury Armor Encased Fiber Cable			12		0.02	Cost is per km.
Land Line – Leased Line(s)	Telephone Drop		1	3	0.2	0.3	Cost is per drop.
	DS0 Communication Line	20	0.5	1	0.6	1.2	56Kbps capacity. Leased with typical distance from terminus to terminus is 8-15 miles, but most of the cost is not distance sensitive.
	DS1 Communication Line	20	0.5	1	4.8	8.4	1.544Mbps capacity (T1 line). Leased with typical distance from terminus to terminus is 8-15 miles, but most of the cost is not distance sensitive.
	DS3 Communication Line	20	3	5	24	72	44.736 Mbps capacity (T3 line). Leased with typical distance from terminus to terminus is 8-15 miles, but most of the cost is not distance sensitive.
	ISP Service Fee				0.12	0.18	Monthly service fee ($10 to $15 per month).

Table 3.2: ITS Unit Cost Database (as of March 30, 2001)

Identified Technologies	Subsystem/Unit Cost Element	Lifetime* (years)	Capital Cost ($K)		O&M Cost ($K/yr)		Notes (Notes in standard font are directly from the Unit Cost Database. Notes in *Italics* have been added by the BRW Team.)
			Low	High	Low	High	
Spread Spectrum Radio	900 MHz Spread Spectrum Radio			9	0.15	0.4	Cost is per link.
Microwave	Microwave Communication			15	0.3	0.7	Cost is per link.
INDIVIDUAL TRAVELER INTERFACE							
Kiosks	**Remote Location (RM)**						
	Informational Kiosk	7	9.55	50	0.955	5	Includes hardware, enclosure, installation, modem server, and map software for indoor and outdoor.
	Integration of Kiosk with Existing Systems	7	2.2	27.4			Software costs are for COTS (low) and developed/outdoor (high).
	Kiosk Upgrade for Interactive Usage	5	5	8	0.5	0.8	Interactive information display interface (upgrade from existing interface).
	Kiosk Software Upgrade for Interactive Usage	5	10	12			Software is COTS.
In-vehicle Systems	**Vehicle On-Board (VS)**						
	Communication Equipment	7	0.2	0.4	0.004	0.008	Wireless data transceiver.
	In-Vehicle Display	7	0.05	0.1	0.001	0.002	In-vehicle display/warning interface. Software is COTS.
	In-Vehicle Signing System	7	0.16	0.4	0.0032	0.008	Interface to active tag reader, processor for active tag decode, and display device for messages.
	GPS/DGPS	7	0.25	0.5	0.005	0.01	Global Positioning System/Differential Global Positioning Systems.
	GIS Software	7	0.2	0.3			Geographical Information System (GIS) software for performing route planning.
	Route Guidance Processor	7	0.1	0.15	0.002	0.003	Limited processor for route guidance functionality.
	In-Vehicle Navigation System	7		2.8			COTS product that includes in-vehicle display and supporting software.
Personal Digital Assistant (e.g. Palm Pilot, etc.)	**Personal Devices (PD)**						
	Basic PDA	7	0.25	0.4	0.005	0.008	Personal digital assistant.
	Advanced PDA for Route Guidance, Interactive Information	7	0.5	0.75	0.01	0.015	Personal digital assistant with advanced capabilities (route guidance, interactive).
	Modem Interface, Antenna for PDA	7	0.18	0.25	0.0036	0.005	Modem interface and separate antenna for wireless capability.
	PDA with Wireless Modem	5		1.33			Personal digital assistant with wireless modem.
	Software Upgrade for Interactive Information	7	0.1	0.2	0.002	0.004	Software is COTS.

Table 3.2: ITS Unit Cost Database (as of March 30, 2001)

Identified Technologies	Subsystem/Unit Cost Element	Lifetime* (years)	Capital Cost ($K)		O&M Cost ($K/yr)		Notes (Notes in standard font are directly from the Unit Cost Database. Notes in *Italics* have been added by the BRW Team.)
			Low	High	Low	High	
Personal Digital Assistant (e.g. Palm Pilot, etc.)	GPS/DGPS	7	0.5	0.8	0.025	0.04	GPS/DGPS.
	GIS Software	7	0.1	0.15	0.005	0.0075	Additional GIS/GUI capability.
PAYMENT SYSTEMS							
Electronic Toll Collection Systems	**Toll Plaza (TP)**						
	Electronic Toll Reader	10	2	5	0.2	0.5	Readers (per lane).
	High-Speed Camera	10	5	10	0.5	1	Cost includes 1 camera/2 lanes.
	Electronic Toll Collection Software	10	5	10			Includes COTS software and database.
	Electronic Toll Collection Structure	20	10	15			Mainline structure.
	Vehicle On-Board (VS)						
	Electronic Toll Equipment	7	0.04	0.1			Active tag interface and debit/credit card interface.
"Back Office" Management Systems	**Toll Administration (TA)**						
	Toll Administration Hardware	5	10	15	1	1.5	Includes Pentium PC with 1G hard drive, 2 workstations, printer, and modem. *Doesn't take into account communications between roadside toll collection sites and the Toll Administration site.*
	Toll Administration Software	10	40	80	4	8	Includes local database and national database coordination. Software is COTS.
VARIABLE MESSAGE DISPLAYS							
Dynamic Message Signs (DMS)	**Roadside Information (RS-I)**						
	Variable Message Sign - Full Matrix and Controller	20	48	120	2.4	6	Includes cost for small and large VMS. *Doesn't take into account communications between roadside DMS site and the Transportation Management Center (TMC).*
	Variable Message Sign Tower	20	100	150		5	Tower structures for VMS.
	Variable Message Sign - Portable	14	21.5	25.5	1.2	2	Trailer mounted VMS (3-line, 8" character display); includes trailer, solar or diesel powered
	Remote Location (RM)						
	Transit Status Information Sign	10		5.5			A LED display installed at transit terminal that provides status information on transit arrival. *Doesn't take into account communications between transit terminal site and the Transit Management Center (TrMC).*

Table 3.2: ITS Unit Cost Database (as of March 30, 2001)

Identified Technologies	Subsystem/Unit Cost Element	Lifetime* (years)	Capital Cost ($K)		O&M Cost ($K/yr)		Notes (Notes in standard font are directly from the Unit Cost Database. Notes in *Italics* have been added by the BRW Team.)
			Low	High	Low	High	
RESTRICTIONS TRAFFIC CONTROL							
	Parking Management (PM)						
Parking Management	Entrance/Exit Ramp Meters	10	2	5	0.2	0.5	Ramp meters are used to detect and count vehicles entering/existing the parking facility. O&M costs based on annual service contract.
	Tag Readers	10	2	5	0.2	0.5	Readers support electronic payment scheme. O&M costs based on annual service contract.
	Database and Software for Billing & Pricing	10	10	15	1	2	Database system contains parking pricing structure and availability. O&M costs based on annual service contract.
	Parking Monitoring System	10	14	46			Includes installation, detectors, and controllers.
	Hardware	5	2	11.5	0.2	1.15	Hardware is the central computer system. O&M costs based on annual service contract.
IN-VEHICLE SENSORS/ DEVICES							
	Vehicle On-Board (VS)						
Vehicle/Driver Performance Monitoring Systems	Driver and Vehicle Safety Monitoring System	7	0.66	1.25	0.033	0.0625	Safety collection processor and software, driver condition sensors, six vehicle condition sensors (@ $50 each), and vehicle data storage. Software is COTS.
Automated Vehicle Operation Systems	Sensors for Lateral Control	7	0.8	1.1	0.016	0.022	Includes lane sensors in vehicle and lateral sensors MMW radar.
	Sensors for Longitudinal Control	7	0.3	0.5	0.006	0.01	Longitudinal sensors MMW radar.
	Advanced Steering Control	7	0.5	0.6	0.01	0.012	Advanced steering control ("hands off" driving). Software is COTS.
	Advanced Cruise Control	7	0.15	0.3	0.003	0.006	Adaptive cruise control (automatic breaking and accelerating)
Vision Enhancement Systems	Vision Enhancement System	7	1.2	2.2	0.06	0.11	In-vehicle camera, software & processor, heads-up display, and infra-red sensors (local sensor system). Software is COTS.
In-vehicle Safety/Security Monitoring	Intersection Collision Avoidance Processor, Software	7	0.28	0.55	0.0056	0.011	Software/processor for infrastructure transmitted information, interface to in-vehicle signing and audio system, software and processor to link to longitudinal and lateral vehicle control modules based on input signal from vehicle intersection collision w

Table 3.2: ITS Unit Cost Database (as of March 30, 2001)

Identified Technologies	Subsystem/Unit Cost Element	Lifetime* (years)	Capital Cost ($K)		O&M Cost ($K/yr)		Notes (Notes in standard font are directly from the Unit Cost Database. Notes in *Italics* have been added by the BRW Team.)
			Low	High	Low	High	
In-vehicle Safety/Security Monitoring	Pre-Crash Safety System	7	1.1	2.15	0.037	0.067	Vehicle condition sensors, vehicle performance sensors, software/processor, interface, pre-crash safety systems deployment actuators. Software is COTS.
Mayday Systems (e.g. On-Star, etc.)	Mayday Sensor and Processor	7	0.15	0.65	0.003	0.013	Collision detector sensor and interface for Mayday processor. Software is COTS.

Notes:
* - Not available for all technologies/systems/subsystems

COTS - Commercial off-the-shelf

In many cases, more than one Technology is used to implement a given Market Package. And in most cases more than one Technology "could" be used to implement a given Market Package. As an example, because communications are so important to ITS deployments and applications, most of the Market Packages have multiple bullet points in the communications Technologies categories. Each project has it's own unique set of circumstances that may dictate selection of one communication technology over another. This mapping exercise points out that there may be more than one option to accommodate such a project need.

As with most mapping exercises, including the mapping of the Functional Areas to the High Priority Market Packages performed in Table 2.3 above, some of the correlations may be somewhat subjective. Most of the correlations are based largely on comparing the Market Package description and diagrams with the known Technology functions and applications. Many of the correlations are based on best engineering judgment and past project experience.

The results of this exercise are intended to give the ITS stakeholders of the San Joaquin Valley the tools to identify and select the various technologies that may be available to best fit their needs. This exercise is not intended to be a technology prescription or recommendation, nor is it intended to be an impediment to implementation.

3.3 Technologies Cost Evaluation

The cost evaluation that follows in Table 3.2 is based on the *ITS Unit Cost Database* (as of March 30, 2001). The *ITS Unit Cost Database* found on the USDOT website at http://www.benefitcost.its.dot.gov/ is a tremendous resource that all ITS-procuring agencies should know about and consult. The *Database* is updated periodically (currently every 6 months) as new unit costs are acquired from federal projects nationwide. The next update of the *Database* is expected for September 30, 2001.

The *Database* contains a listing of various ITS subsystems/technologies. The following information is contained in the *Database* relating to the ITS subsystems/technologies:

- an expected approximate product Lifetime
- an approximate Capital Cost, expressed as a range, from Low to High, in thousands of dollars
- the approximate annual operations and maintenance (O&M) cost expressed as a range, from Low to High, in thousands of dollars
- a "Notes" column that, in most cases, gives some very basic information on assumptions such as the number of workstations that may come with a given system, or the per unit of measure (miles, kilometers) or the number of system operators assumed in the O&M costs and
- an IDAS identification number. IDAS (ITS Deployment Analysis System) is an ITS cost/benefit tool that works in conjunction with a regional traffic model. The IDAS identification number is a standardized way to insert ITS infrastructure elements into a regional model.

Table 3.2 is a reformulation of the *ITS Unit Cost Database* spreadsheet, to fit the steps taken and terminology used to get to this point in the Technology evaluation; mainly the Functional Areas descriptions, the mapping of the Functional Areas to the High Priority Market Packages and the mapping of Technologies to the High Priority Market Packages. The reformulation is also an attempt to

group together system elements from various *Database* categories into the Functional Areas technology groupings.

Table 3.2 adds a column (the left-most column) to the *Database* that identifies the Functional Areas technology groupings; to follow the groupings presented in previous tables in this Working Paper. Since the IDAS identification number is not needed for this exercise it has been left out of Table 3.2. Also, some Notes have been added to the baseline *Database* Notes (and elsewhere in Table 3.2). The added Notes appear in italics to differentiate between baseline *Database* Notes and information and those added for this Working Paper. None of the cost data in Table 3.2 has been changed from the baseline *Database*.

3.4 ITS Unit Cost Database Limitations

The *ITS Unit Cost Database* is a solid, comprehensive source of cost information for ITS deployment. It does, however, have some limitations that should be understood prior to referencing any facts and figures from it.

First and foremost, the *Database* is assembled using cost data from across the United States. This effectively makes the database a "national average" of ITS unit costs. For high level planning purposes, the national averages are probably sufficient. The readers of this Working Paper should use the data with caution when applying the *Database* values to specific deployments in specific areas.

Secondly, the *Database* gives what one might refer to as "modular" costs. In other words, many of the unit costs are assigned to "modules" of ITS. For example, in the Transportation Management Center (TMC) section hardware and software for Lane Control is segregated from the basic TMC costs. This makes sense from a project phasing perspective, however, from a pricing and cost perspective an "economies of integration" savings may be realized if the Lane Control system is deployed as a phased portion of the larger TMC development. This is not necessarily a weakness, per se, it merely needs to be understood when looking at the cost data contained in the *Database*.

Other factors that may affect costs that may not necessarily be reflected in the database include economies of scale, project timing (time of year/seasons) and product/vendor availability and backlog. An agency deploying 100 units of a particular ITS element may realize a per unit cost savings over an agency deploying only 25 of the same ITS element. Project timing (time of year/seasons) can greatly affect product costs also. A vendor may be able to sell a product or service at a higher price in the summer, when demand may be greatest, than in the middle of winter, when demand may be lowest. Similarly, product and vendor availability can greatly influence costs. If supply is generally high and demand generally low, an agency may be able to negotiate a more favorable unit cost than when supplies are low and demand is high. If all or most vendors in a given marketplace have a large backlog of orders and work to perform, costs will be relatively inelastic as compared to when those same vendors are not as busy.

One final factor that may affect the costs cited in the *Database* is the sampling sizes and methodologies. It is assumed that the samples were collected on a "survey" basis. Several surveys were distributed, and a certain number were returned. In terms of sample sizes, not all of the cost elements were assembled using the same or similar sample size nor was there any normalization applied to the responses to

smooth varying response rates. The survey methodologies and response rates are sufficient to assemble valid data for high level planning purposes but not for detailed project level cost analysis.

In general, the *Database* is a good tool and a good source of information; however, it should be recognized that there need to be certain limitations in its application. It is best used to perform high level, "back of an envelope" planning. It can be used to give "order of magnitude" costs but not project level detailed budget planning. In fact, the website itself actually states "… the user is encouraged to find local/regional data sources and current vendor data in order to perform a more detailed cost estimate."

In this Working Paper, the *Database* is presented as precisely that kind of tool for the project stakeholders. It is meant to be used as an initial tool to evaluate and select the best technology for a particular project.

3.5 Follow-up Commentary on Specific Items and Issues in the Database

In many instances the *Database* may not necessarily reflect all of the elements of a complete system. For example, under Dynamic Message Signs, the database doesn't include costs for communications between the "center" that would control the DMS and the DMS itself. This is a very important item to consider.

Cost information regarding Advanced Fare Collection Systems and Smart Card Systems have been excluded from Table 3.2. A few elements of these Systems appear in the *Database*, however, it is felt that not enough is known about the cost data to give a clear and accurate picture of the costs for a complete system.

Cost information pertaining to Centralized Signal Control Systems has also been excluded from Table 3.2. primarily because of the variability of factors involved in implementing a Centralized Signal Control System. Among them are the degree of intersection interconnection, the amount of detection deployed at each intersection, the manner in which the field devices are in communication with the central system and the type and level of sophistication of the signal operating system deployed (e.g. adaptive control vs. time of day coordinated operation).

Similarly, Ramp Metering was excluded because of a lack of information regarding the level of sophistication and extent of coverage of the few Ramp Metering elements contained in the database.

3.6 The California Experience

As earlier explained, the data contained in Table 3.2 shows a national average of many ITS unit costs. And to reiterate section 3.4, the ITS Unit Cost Database is an excellent tool for high level planning level analysis but should be supported by local costs, where applicable, for detailed project level budgeting. Upon review of the draft version of the document, Working Paper #4, the project stakeholder group commented that they would like to see cost data that may be more relevant to their California experience and expectations.

To that end, the Consultant Team has pulled together some representative regional (i.e. California) project cost data on a select subset of the identified technologies from Table 3.2 to develop Table 3.3. Table 3.3 represents data culled from three primary sources: 1) other projects that the Consultant Team is working on currently or has completed in the past 6 to 18 months 2) requested input from project stakeholders, primarily Caltrans and 3) other publicly available information sources. Due to confidentiality matters, none of the projects on which the Consultant Team has worked and from which cost data is gathered will be specifically identified by either project name or client name. We will only identify a region of the state in which the project was (is) located – such as Southern California/Los Angeles area, or Northern California/Rural North, etc.

One of the challenges in gathering this data on the wide array of technologies is standardizing quantities and assumptions. Some project elements and costs are easily quantifiable in terms of a number of units or some lineal measure such as linear feet/kilometers/miles; others are not as easily quantifiable. The cost data for some projects are based on a lump sum, including design and communications costs. On some projects, the cost data only includes acquisition and installation of equipment, but does not include design and communications. This makes the cost data more open to fluctuations in assumptions. In other words a fair comparison of "apples to apples" is not entirely possible and this results in the sometimes wide range of estimated costs shown in Table 3.3. Even though Table 3.3 gives some more "California-ized" cost data than Table 3.2, it is still subject to some of the limitations mentioned in sections 3.4 and 3.5. For the preceding reasons, the "Comments" column of Table 3.3 needs to be read to understand the basic assumptions of each cost estimate.

Finally, no attempt is made to estimate or give cost data for custom software developments. This is one of the less mature and more widely variable fields for transportation related applications. Some of the technologies that appear in Table 3.3 contain a software element that is figured into the cost of the system. For the most part, this software would be considered "commercial off the shelf" (COTS) software.

Table 3.3: California Cost Examples

Technology	Approximate Capital Cost	Per Unit	Comments	Region	# of Sample Projects
CCTV Camera	$21,000 to $30,000	Each	Includes: installation, camera, zoom lens, bullet resistant enclosure, pan/tilt unit, pole and foundation, camera control receiver and fiber optic transceiver. DOES NOT include: additional cabling, connections to controller cabinets, central command and control system and training.	Southern California/L.A. Metro Area and Northern California/ Sacramento Metro Area	2
Fiber Optic Communications System					
Construction	$800,000 to $1,000,000	Lump Sum	Estimate based on approximately 5 mile fiber optic communications system. Includes: installation, conduit, 48 strand single mode fiber, pull boxes, splice vaults, splice closures, fiber distribution units, 400' of fiber run into TMC, test equipment, fiber optic tool kit, training and documentation. Fiber run into building may increase costs based on building code requirements. DOES NOT include design.	Southern California/Los Angeles Metro Area	2
Design	12% - 15% of construction cost	Lump Sum	Design cost depends on the size and complexity of the project. Approximately 12% to 15% is a good rule of thumb for estimating design costs for fiber optic communications projects. For the "5 mile system" example, assume design costs of approximately $96,000 to $150,000.	Southern California/L.A. Metro Area	2
Traffic Detection					

Table 3.3: California Cost Examples

Technology	Approximate Capital Cost	Per Unit	Comments	Region	# of Sample Projects
Inductive Loops	$30,000	Per inter-section	Assumes typical 4 legged intersection with 2 through lanes and 1 left turn lane per approach. Each through lane has 2 approach loops and 1 advance loop. Each left turn lane has 3 loops. DOES NOT include design.	Southern California/L.A. Metro Area	1
Video	$32,000	Per inter-section	Includes purchase and installation of fixed monochrome camera, cabinet, conductors, conduit, power cabling, pull box and monitor in cabinet. DOES NOT include design.	Southern California/L.A. Metro Area and Northern California/San Francisco Bay Area	2
Dynamic Message Sign (DMS)					
Fixed Location	$20,000 to $40,000	Each	All examples are from Caltrans. Costs reflect the sign (no structure) and installation only. DOES NOT include design, comm. or centralized control capabilities. These items will vary greatly with location. Actual range of costs go up to $120k to $160k, which likely includes structure, comm. and remote control capabilities, but not design costs.	Several Regions/ Statewide	9

Table 3.3: California Cost Examples

Technology	Approximate Capital Cost	Per Unit	Comments	Region	# of Sample Projects
Portable	$8,000 to $17,000	Each	Cost differences likely based on display technology and power supply, though most new DMS (portable and stationary) use LED matrix display technology. Power supply options include gas/diesel powered electric generator or solar electric power supply, both mounted on DMS trailer. Other considerations that add to cost include trailer security and weather enclosure of sign equipment on trailer. Actual costs ranged from approximately $4k to approximately $17k. Some remote control capabilities may be possible with higher cost signs.	Several Regions/ Statewide	11
Highway Advisory Radio (HAR)	$47,000 to $66,000	Each	One system in rural north ranged up to $125,000. All other researched figures are in a fairly close range. Assumptions vary based on transmitter type and strength and remote command and control capabilities. Cost includes frequency search but DOES NOT include design.	Northern California/Rural North and Sacramento Metro Area	5
Weigh In Motion (WIM)					
WIM System	$293,000	Lump Sum	Assumed to be a low to medium speed roadside system in an existing truck scale facility. Equipment and installation only. DOES NOT include any design or engineering costs.	Southern California/ Inland Empire Area	1

Table 3.3: California Cost Examples

Technology	Approximate Capital Cost	Per Unit	Comments	Region	# of Sample Projects
High Speed WIM	$55,000 to $235,000	Lump Sum	Assumed to be a high speed mainline system. Equipment and installation only. DOES NOT include design or engineering costs. NOTE: pavement must be in excellent condition for proper operation of WIM, pavement rehab (which may contribute to project cost) may be necessary to ensure proper operation.	Several Regions/ Statewide	6
Weigh Station Bypass System	$260,000 to $352,000	Lump Sum	Assumes implementation of a PrePass system. PrePass typically includes: mainline WIM, advance (upstream) transponder readers, roadside equipment cabinets, power and comm. between transponder readers and scale house. PrePass contractor typically supplies the PrePass computer in the scale house that connects to the national PrePass database. DOES NOT include design or engineering costs. NOTE: pavement must be in excellent condition for proper operation of WIM, pavement rehab (which may contribute to project cost) may be necessary to ensure proper operation.	Southern California/Los Angeles Metro Area and Northern California/San Francisco Bay Area	2
Emergency Vehicle Preemption	$5,000 to $8,000	2 Main-line Receivers and 1 Emitter	Cost includes 2 mainline arterial receivers, wiring to cabinet and phase selector. Cost per emitter unit is $1,500-$2,000 per installed unit.	Northern California/ Sacramento Metro Area	1

Table 3.3: California Cost Examples

Technology	Approximate Capital Cost	Per Unit	Comments	Region	# of Sample Projects
Fixed Microwave Link(s) (pairs)					
24GHz (short range - ½ mile to 1 ¼ miles)	$18,000	Per Link	Assumes the following equipment per link: parabola antenna at each end, transceiver at each end, mounting brackets, data cable from antenna, power supply cable. Assumes antennas to be mounted to pre-existing structure (pole, cabinet or building). Lower end costs reflect data only, higher end costs reflect data and video capabilities. DOES NOT include any design or engineering costs.	vendor estimate	1
23GHz (longer range - 5 to 10 miles)	23,000	Per Link	Assumes the following equipment per link: parabola antenna at each end, transceiver at each end, mounting brackets, data cable from antenna, power supply cable. Assumes antennas to be mounted to pre-existing structure (pole, cabinet or building). Most equipment in this category will handle video. DOES NOT include any design or engineering costs.	vendor estimate	1
Road Weather Information Stations	$10,000 to $25,000	Each	Range of cost depends on range of capabilities – wind speed/direction, visibility, rain measurement, etc. Assume an additional $7k to $10k for design and installation. DOES NOT include comm. from station to Center.	vendor estimate	1

Table 3.3: California Cost Examples

Technology	Approximate Capital Cost	Per Unit	Comments	Region	# of Sample Projects
NICE TO HAVE					
Smart Call Boxes					
Curve Warning Systems					

SECTION 4.0

PROCUREMENT OPTIONS

4.0 PROCUREMENT OPTIONS

Unlike traditional brick-and-mortar projects which nearly always follow a Design/Low Bid/Build process, procuring ITS elements and/or whole projects may be less straightforward. Advanced technology sometimes lends itself to alternative procurement strategies that depend less on having a completely designed, fully-specified, engineering design prior to selection of a vendor and/or technology solution.

Among the wide range of strategies available, three basic procurement options are available to agencies deploying intelligent transportation systems:

- Engineering (Consultant)/Contractor,
- Systems Manager, and
- Design/Build.

For the first two approaches, the following principles must be satisfied:

- Specifications must be developed by an organization separate from that supplying the hardware, bidding on the project, or installing the system, and

- Competitive bid requirements must be followed in the procurement of all hardware and software items.

Likewise, the process of integrating a variety of disparate technologies and/or project elements may be best undertaken by an independent firm who has expertise in various technology applications, rather than a product specific vendor. The selection of such a firm to perform integration services should be based upon qualifications rather than bid price.

4.1 Engineering (Consultant)/Contractor Approach

The engineer (consultant)/contractor approach represents the traditional procedure for contracting within the highway agency community. On the basis of requirements and preliminary studies, the engineer (consultant) prepares the final study or the design plans, specifications, and estimates (PS&E) for the proposed system. An agency employee or a consultant can serve as the engineer. The agency then

issues the study results or the completed PS&E to the contractor community, and receives bids in accordance with established practice.

In this approach, for projects involving construction, the contractor bids on a single set of plans and specifications and agrees to provide a complete system, composed of hardware and software, procured, installed, and integrated by the contractor's organization. Hardware items may be manufactured by the contractor's firm or subcontracted within the conditions imposed by the contract. The contractor is also responsible for all system integration tasks, documentation, and training. He may also be responsible for system startup assistance and, in the case of traffic control systems, the development and implementation of timing plans and other database elements.

The engineer or consultant is responsible for witnessing testing activities and final acceptance of components and the completed system. An agency employee, or its selected consultant, can perform all or part of the engineer's duties.

4.2 Systems Manager Approach

The systems manager approach requires the selection of a single firm or consulting team (as systems manager) to be responsible under an engineering services contract for system design, PS&E preparation, systems integration, documentation, and training.

Selecting a systems manager generally follows the typical procedures for selection of an engineering consultant. Negotiated cost-plus-fixed-fee contracts are frequently used for system manager services.

The system manager prepares the PS&E. The agency's normal bidding processes then procure the individual subsystems or services, and the systems manger subsequently oversees testing and installation of the equipment. The systems manager may also provide the integration of all hardware elements and the software to provide a total operating system.

4.3 Design/Build Approach

In the design/build approach, a single responsible entity is selected to perform all work associated with the deployment of the system and its components. The public agency's role is in monitoring the activity of the design/builder. The design/builder performs all design work, contracts and/or constructs system elements, and commissions the system and turns it over to the operating agency. A detailed set of system requirements usually forms the basis for the design/build approach.

A key attribute of the design/build approach is the complete assumption of responsibility by the design/builder. This generally allows more rapid completion because of streamlined procurement procedures and quicker resolution of problems. Also, the design/builder has an incentive to reduce its costs and risks by completing all work quickly and turning the system over to the agency. Assuming a qualified design/build team, all skills rest within the team leading to closer coordination and cooperation between team members and the public agency.

The approach does place a burden of supervision on the deploying agency to maintain quality. The design/builder moves at full speed and may prove reluctant to change direction, if required, due to technology changes. It also may force the agency into making hasty decisions.

4.4 Choice of Procurement Approach

All the approaches, and variations of them, can result in the successful implementation of ITS deployments within the San Joaquin Valley region. For the most successful operational system, a knowledgeable agency staff needs to participate in all phases of the implementation process regardless of the selected procurement approach.

Table 4.1 summarizes the primary differences between the three procurement approaches.

Table 4.1: Procurement Approaches

Approach	Comments
Engineer (Consultant)/ Contractor	• Costs less then systems manager approach because of competitive bidding for total installation. • May result in lower design cost because less detail required for certain elements • Minimizes potential conflicts of interest • Complicates system integration among variety of systems
Systems Manager	• Provides greater expertise in contract monitoring, equipment acceptance and testing than many agencies can provide • Can easily modify functional requirements and provide additional features during implementation • Has greatest value for very large systems or systems having unique characteristics
Design/Build	• Assures project cost limit prior to starting detailed design • Eliminates time between project phases, thus leading to more rapid project completion • Requires sufficient level of technical definition prior to award to assure that all functional requirements, operating features and quality standards are satisfied

The choice of the procurement approach impacts the preparation of plans and specifications. Specifications developed under the engineer (consultant)/contractor approach generally emphasize the functional characteristics of the equipment and impose operational and design constraints. They will describe *what* must be done, but leave to the contractor, within constraints, *how* it must be done.

By contrast, the systems manager or design/builder must develop detailed specifications that describe data such as interface requirements, voltage levels, data rates, connector types, etc. to assure their proper integration into a total system. In certain cases, it may also become necessary to procure major subsystems sequentially to assure compatibility.

The manner in which ITS Technologies are procured in the San Joaquin Valley will be reflective of the various needs of the agencies, and the procurement methods which will be most efficient for that agency. When ITS is mainstreamed into other traditional projects, the procurement will most likely be by the Engineering (Consultant)/Contractor method. If, however, ITS deployments stand alone, many other procurement options become possible. Each deployment will need to be evaluated at the time, in order to select the most appropriate method.

The baseline relationships between User Services and Market Packages as identified in the National ITS Architecture version 3.0 is presented in Table 4.1. As shown in the table, the identified Market Packages support all required User Services.

Not shown in Table 4.1 are several secondary relationships between the User Services and Market Packages. Some of these secondary relationships are direct technical connections and others are more by analogy than technology. For example, there is no baseline relationship identified between the Route Guidance User Service and any of the ATMS Market packages. However, a secondary relationship could be established that could be of a technical nature that would directly link that User Service with one or more of the ATMS Market Packages.

Similarly, only one baseline relationship is identified between the Incident Management User Service and the ATIS Market Packages (ATIS4 – Dynamic Route Guidance). Emergency Services or Public Safety agencies involved in incident management often depend on the same traveler information outlets as the general public. However, those Emergency Services providers could subscribe to a Dynamic Route Guidance service provided by a private sector company to improve incident response times. Therefore, by analogy, implementation of any or all of the other ATIS Market Packages could create a relationship between the Incident Management User Service and the other ATIS Market Packages.

Job Number: 45098-001
San Joaquin Valley ITS Strategic Deployment Plan
Working Paper #4 – Functional Areas and Technology Options
Z:\Projects\45098-001 (San Joaquin Valley ITS Plan)\Working Papers\Working Paper #4 - Technologies\wp#4_06-25-01.doc

San Joaquin Valley Intelligent Transportation System (ITS) Strategic Deployment Plan Working Paper #5

Regional Architecture

FINAL

Prepared for:

San Joaquin Valley ITS Technical Advisory Committee
San Joaquin Council of Governments (SJCOG)
California Department of Transportation (Caltrans)

Prepared by:

URS
BRW

In Association with:

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SECTION 1.0

INTRODUCTION

1.0 INTRODUCTION

The San Joaquin Valley Regional ITS Architecture provides a framework for the deployment of ITS applications. The Regional ITS Architecture incorporates the existing and planned ITS projects and provides a roadmap for future deployment. Additional planning efforts will be required in the future as highway and transit applications within and around the Valley are considered. While the SJV Regional ITS Architecture is contained as a document, it must be considered a process, which will be maintained, revised, and validated as needed. A coordinated effort among the stakeholders involved now will ensure that this effort continues and ITS is mainstreamed into future projects

1.1 Purpose

The purpose of this Working Paper is to describe the recommended system architecture on which future ITS projects in the San Joaquin Valley will be based. This Working Paper follows the organization outlined in the US DOT Final Rule, Section 940.9 on Regional Architecture development dated Monday, January 8, 2001.

1.2 Organization

This Working Paper contains the following Sections:

Section 1 – Introduction

Section 2 – Regional Description

Section 3 – Regional Stakeholders

Section 4 – Operational Concept

Section 5 – Operations Agreements

Section 6 – Functional Descriptions

Section 7 – Information Flows and Interface Requirements

Section 8 – Standards

Section 9 – Project Phasing

1.3 Architecture Overview

This Working Paper contains the regional system architecture for the San Joaquin Valley Region. A system architecture is meant to act as a blueprint within which the regional deployment of ITS can occur. This architecture supports the National Architecture and the statewide architecture. It does not replace these two documents.

The San Joaquin Valley Region has the advantage of developing its system architecture following the development of several other system architectures in neighboring regions including the Bay Area, Sacramento, Kern County, Fresno County, Central Coast and Southern California. Where feasible, the San Joaquin Valley Region should maximize the effectiveness of its system integration efforts and minimize costs by drawing on integration efforts from these other regions. The California Alliance for Advanced Transportation Systems (CAATS) has completed the statewide ITS architecture, with an emphasis on the integration of statewide Advanced Traveler Information Systems. The recommended San Joaquin Valley architecture recognizes this effort and is flexible enough to fit within the guidelines of the statewide effort. In fact, the San Joaquin Valley Region will depend heavily upon statewide ATIS integration for fulfillment of traveler information needs in this Plan.

The details contained in a system architecture vary from situation to situation. The architecture contained in this Section outlines potential paths/methods for the connection and integration of systems. It also provides guidelines on the relationships between the various ITS project elements discussed in Section 9.0 and national ITS standardization efforts currently underway. This architecture uses National Architecture Market Packages, suitably customized for the San Joaquin Valley Region, as a baseline for intermodal system connectivity. The San Joaquin Valley Region architecture also recognizes the US DOT Critical Standards currently in development as the key standards for regional project development. These standards are discussed in detail in Section 8.0.

1.3.1 BASIC ARCHITECTURE OVERVIEW

What is an architecture, and why is it important to know about architectures? In its most basic form, an architecture is a set of rules that facilitate the building of systems and that allow these systems to communicate and interoperate after being built. An ITS architect is to an ITS system as a building architect is to a building. A building architect could not build a structure without a set of plans. Neither could an ITS architect build a complex regional ITS system without a set of plans. These plans are the *system architecture*. It is important to distinguish between an architecture built for planning and implementation guidance and an architecture used to build actual working systems. In our discussions regarding this Plan, the former context is most appropriate. We are using best practice in architecture development within California to fit the San Joaquin Valley Region operational and institutional environment.

To put the concept of an ITS architecture into the real world, consider the following. The San Joaquin Valley Region desires to build a multi-jurisdictional “Smart Corridor” system consisting of integrated freeway and arterial traffic management elements in a relatively localized area. These elements include:

- A Regional Transportation Management Center that controls a set of freeway management devices within the defined corridor boundaries;

- One or more local Transportation Management Centers that control arterial traffic signals for one or more connected cities in the defined corridor (most "practical" smart corridor projects typically are limited to one or two cities);
- The freeway management devices (ramp meters, Dynamic Message Signs (DMS), CCTVs and Highway Advisory Radio (HAR)) and arterial traffic control signals;
- The vehicles that drive the freeways and arterials; and
- The local and/or regional communications systems that allow these elements to communicate.

The architecture describes how these elements will interoperate by detailing element locations, physical communications links, and most importantly what kinds of information must be transferred among the different elements. The architecture also tells us what "functions" are performed by each of the "Smart Corridor" elements. Later in this Working Paper we will see how an architecture can be gradually built up using the market packages.

An architecture is important in the development of complex systems because it provides detailed guidance on how to design the systems and because it provides a vehicle to decompose larger systems into more understandable subsystems. An architecture is particularly important if more than one system is to be built and these systems must talk to each other or if multiple systems will be expanded over a period of time. In the San Joaquin Valley Region both of these elements are clearly present.

A complex systems development process includes concept development, needs assessment, functional requirements definition and architecture development. To develop the architecture we first need to know about the system vision (concept) and what proposed system users need, in other words, what are their requirements? What do they want the system to do? At this point the details of physical elements such as communications links and traffic signals and TMC's are not important. The next step is to take the user needs and develop functional requirements. Here the emphasis is on what the proposed *system* must do to meet the users' needs. In the process of developing functional requirements, we determine what functions must be performed by the system and what data must flow between the functions. For example, if a function of ACTIVATE VIDEO is defined, we need to know what data is input to the function, what data is output from the function and the source and destination of these data flows. The final step in the system development process is to allocate the functional requirements to hardware, software or humans (operators). Part of this last process includes the development of an architecture for the system. This is referred to as High Level Design, or in some circles Preliminary Design. The major difference between these steps in a long range planning process (i.e. ITS Strategic Deployment Plan) versus a specific system development process is the degree of precision needed as the steps are performed.

1.3.2 ARCHITECTURE DEFINITIONS

When we speak of an **architecture**, we mean the **logical** and **physical** relationship of certain defined **subsystems** within a **system**. A **system** can be thought of in many ways: the Internet is a system. The highway network within the San Joaquin Valley Region is a system. The Caltrans Transportation Management Center in Fresno is a system. For purpose of our representation in this Plan, we define a **system** as the collection of **subsystems** including **communications networks**, **operations centers**, **roadside devices** and **multimodal vehicles** that control or operate on the region's transportation network in its broadest sense: roads, railroads and airports. Subsystems can be directly related to the National ITS Architecture through what is commonly referred to as the "Sausage Diagram".

Communications network subsystems range from underground fiber optic networks to commercial broadcast stations and paging networks. **Operations Center** subsystems are as diverse as the CHP communications center in Fresno, a local Traffic Management Center in the city of Bakersfield, a private information provider or a private truck dispatch facility desiring information about travel conditions in San Joaquin County. **Roadside** subsystems include railroad warning signals, motorist aid call boxes, traffic signals, changeable message signs, vehicle detection loops in the pavement and closed circuit TV monitors. **Vehicle** subsystems include cars, buses, commercial vehicles, emergency vehicles, trains (passenger and freight) and aircraft.

What is the difference between the physical and logical elements of an architecture? The **physical architecture** largely represents the communications links and the components that we can touch and feel that are connected by these links: operations centers, traffic lights, railroad crossing signals, loops in the pavement. The **logical architecture** is harder to define and to visualize, but it includes the **functions** (actions to be performed), and the **flow of information** between the functions that the system is supposed to accomplish.

For example, one of the Market Packages chosen for the transportation system in the San Joaquin Valley Region is **Emergency Vehicle Routing**. To perform this routing, the *Emergency Management* function needs to have real-time traffic conditions for the roadway links that emergency vehicles will travel to their destination. Conversely, the *Information Service Provider* function providing real-time traffic information needs to have the real-time location of the vehicle so it can intelligently select the routes for which traffic data is needed. If traffic signal preemption is required, additional functions and data flows are needed. These functions, and the data flows between them, represent a piece of the logical architecture of the transportation system. **Figure 1.1** illustrates the separation of logical and physical architectures. The diagram shows the appropriate functions and data flows, therefore it represents a logical architecture needed to implement this Market Package. The physical architecture would include the *CHP communications center*, the *Caltrans TMC* (which we will assume includes the Information Service Provider function), the *patrol car*, and in the case illustrated, *traffic signals* along the route that will be preempted. The physical architecture would also include the *communications links* necessary to support these data flows. These would include leased lines or other wireline networks and short-range wireless radios.

Figure 1.1 also illustrates another important point about the separation of logical and physical architectures: a physical implementation may include any combination of logical functions. As shown, the functions of *Traffic Management* and *Information Service Provider* are combined in a single center, in this case, the Caltrans TMC. The **architecture design** process consists of developing a logical architecture based on user needs and functional requirements as previously discussed, and then allocating the logical functions to physical entities to build a physical architecture. Once the physical architecture is completed, the **system design** process can start, and specific centers or other system elements can be designed and developed. In the context of this Plan, the architectural design process will continue during development of the Plan. The system design process is an activity that occurs during individual project deployments. *There will be, however, a continuous refinement process for the architecture as project requirements, technology options and institutional relationships change over time.*

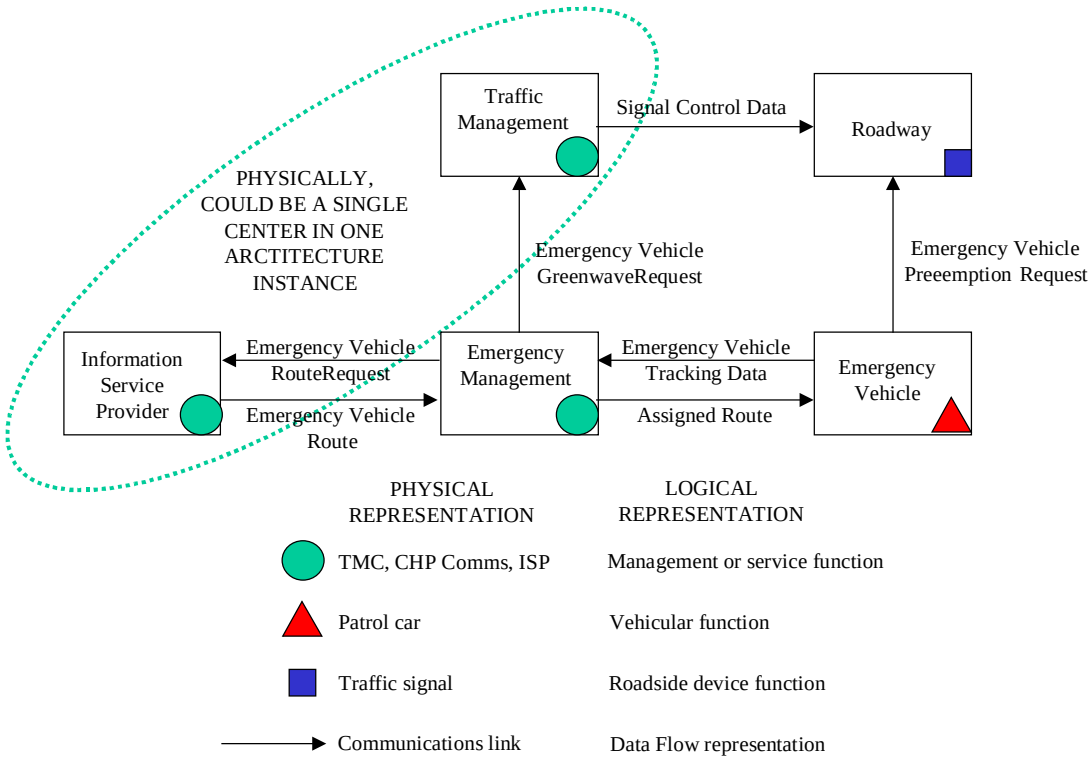

Figure 1.1: Example of Logical and Physical Architecture for Emergency Vehicle Routing Market Package.

1.3.3 LOGICAL ARCHITECTURE

The logical architecture for the San Joaquin Valley Region is depicted in some detail by the consolidation and tailoring of those high priority Market Packages that were summarized in the Market Package Report, Working Paper #3. This amalgamation is provided in Section 7 of this report. The illustration in **Figure 1.2** is used as an overview and introduction to the region's logical architecture. This illustration also serves to highlight some basic architectural design guidelines for the region as derived from Market Package priorities as discussed in Working Paper #3:

- There is an implied hierarchical relationship between the regional TMC's (Caltrans Districts 6 and 10) and local TMC's (examples: the Cities of Fresno, Stockton and Bakersfield TMC's) in the Figure. At least one level of local TMC's will be accommodated in the San Joaquin Valley Region's ITS architecture.

- The District 6 and 10 TMC's will be connected to the TMC's in Los Angeles, the Bay Area and Sacramento on the statewide Asynchronous Transfer Method (ATM) fiber optic network.

- Traveler information will be coordinated through a publicly or privately-operated Independent Service Provider which will generally follow the TravelTIP and TravInfo models being developed in Orange County and the Bay Area respectively. Multiple Independent Service Providers will be encouraged to participate in the region's Advanced Traveler Information System deployment;

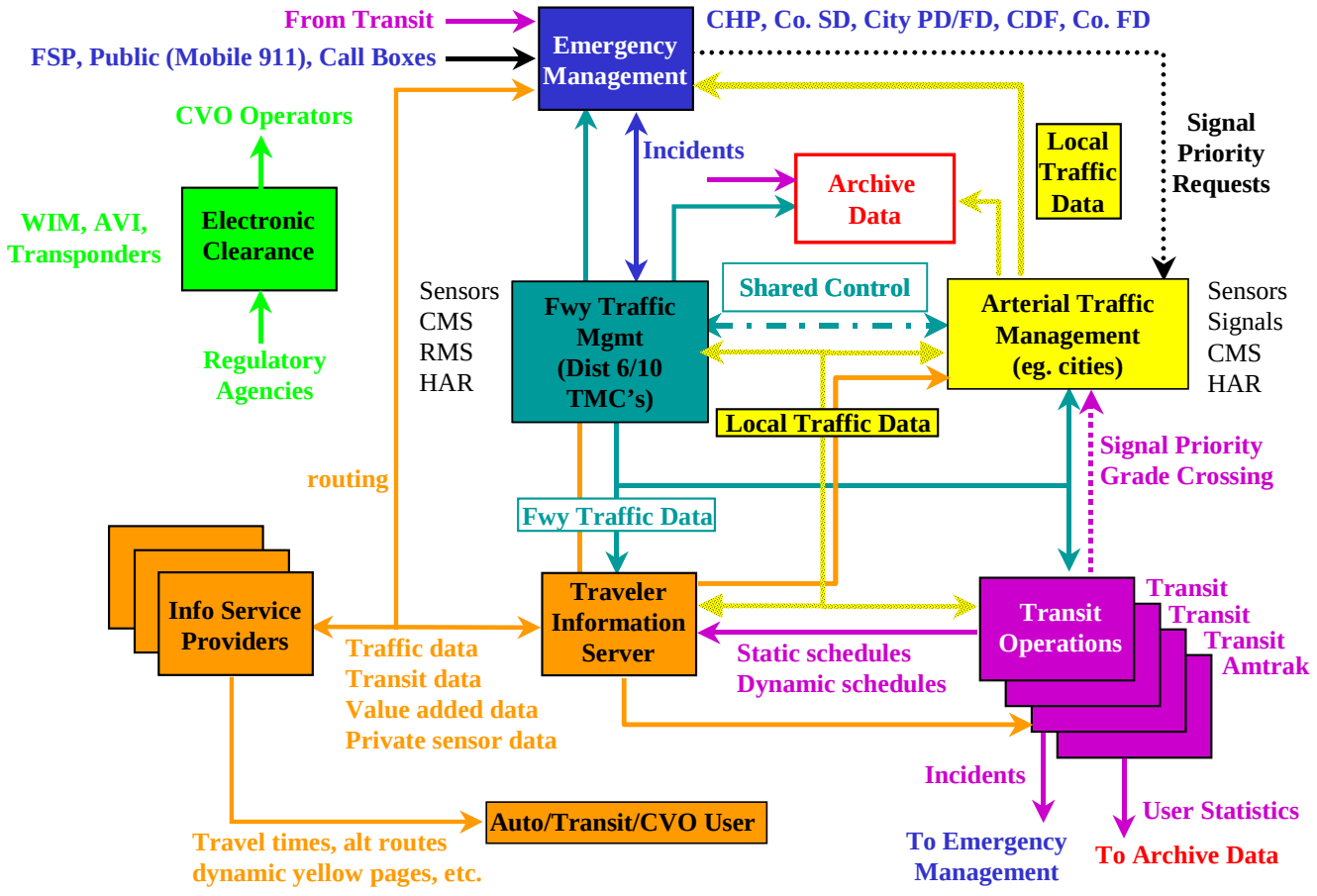

Figure 1.2: Summary of San Joaquin Valley Region Logical Architecture

- The Internet will be exploited to its full advantage for the dissemination of travel and incident information. The CHP is already accomplishing this for its communications centers' incident logs statewide;

- It may not be necessary to have centralized Transit Management Centers within subregions, but instead each major transit property (FAX, FCRTA and Clovis Transit) could operate independent centers. These centers could also be remoted from a central database. In either case, the architecture goal is that these centers would be interoperable with each other and would send and receive information to other modal management centers (e.g. freeway, public safety) in the same manner;

- Private shuttle operators will be integrated into the ITS system as their business interests dictate;

- Although the Archive Data function was not specifically identified in the Project List, ITS provides a sufficient quantity and quality of data to support this process, therefore we show it in the logical architecture;

- The Emergency Management function should link all public safety centers in the region among themselves and with key traffic management centers. Several models exist around the U.S. that provide guidance on how to achieve this goal;

- Freeway Service Patrols (in the Fresno area) and Cellular 9-1-1 will continue to be the primary sources of incident detection from the traveling public. Call boxes may be considered as another source of incident reporting. These systems will be considered complementary;

- Tailored traveler information services will be provided to commercial fleet operators through one or more Independent Service Providers as well as through the Internet; and

- Regional and local TMC's will be integrated into at least one major "Smart Corridor" which will encompass the SR 41/SR 168/SR 180 routes in Fresno County. This corridor will be considered a prototype for other corridors in the region.

1.3.4 PHYSICAL ARCHITECTURE

As previously noted, the physical architecture consists of recognizable subsystems such as communications links, traffic signal systems, vehicles, TMC's and emergency dispatch centers. **Figure 1.3** is the generally accepted way to view the physical aspects of the region's architecture and has been tailored from the National ITS Architecture.

Figure 1.3 shows the major elements in the physical architecture: centers, roadside devices, vehicles, remote access and communications links. The San Joaquin Valley Region entities consist of the items listed below (not necessarily all-inclusive, with ITS National Architecture Subsystem abbreviated notation in parenthesis).

1.3.4.1 Centers

- District 6 and 10 TMC's (TMS)

- CHP Communications Centers in Stockton, Merced, Fresno and Bakersfield (EM)

- Local TMC's (cities with traffic signal control systems) (TMS)

- Independent Service Provider (dependent on ATIS business model) (ISP)

- Other Information Service Providers (none identified in projects) (ISP)

- Transit Management Centers (FAX, FCRTA,) (TRMS)

- Private freight company dispatch centers (external user of CVO ATIS data)

- Planning agencies (COG's, CAG's, Caltrans Districts 6 and 10) (PS)

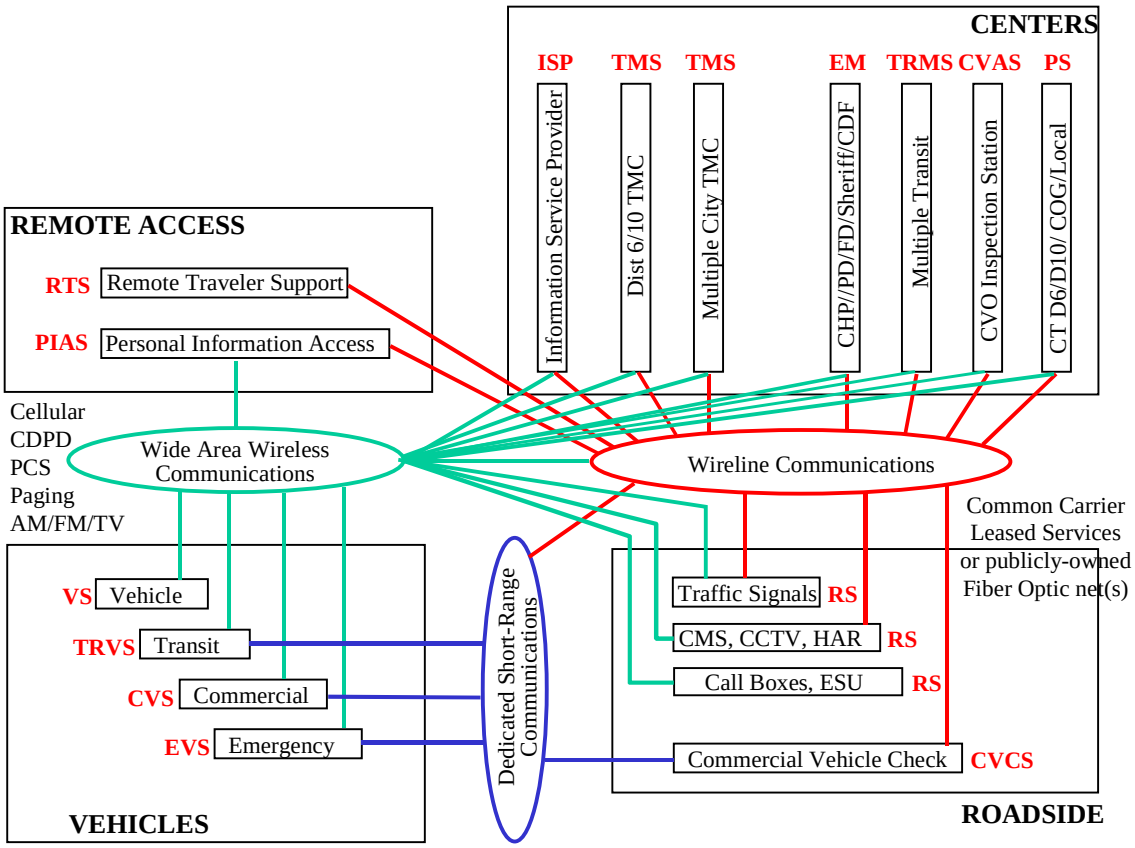

Figure 1.3: Generic Physical Architecture from the National ITS Architecture

1.3.4.2 Roadway

- Arterial traffic systems (cities, Caltrans, counties)
- Arterial management system elements (CCTV, CMS, HAR)
- Freeway management system elements (CCTV, loop detectors, CMS, ramp meters, HAR)
- Motorist aid call boxes (existing and future)
- Smart Call Boxes (future)
- Environmental Sensing Units (Caltrans assets)
- Railroad grade crossings
- Commercial Vehicle Weigh Stations (CHP assets)

1.3.4.3 Vehicles

- Freeway Service Patrol

- Caltrans Traffic Management Team Vehicles
- Public Safety Units (CHP, Sheriff, PD, FD, EMS)
- Buses (including regional Amtrak service)
- Amtrak rail
- Commercial goods movement vehicles (trucks, rail, air)
- Autos (commuters, regional business travelers and visitors)

1.3.4.4 Communications Links

- Caltrans Fiber Optic plant (state-owned)
- Private Fiber Optic plants
- Common carrier leased services
- Cellular network (analog, digital, Cellular Data Packet Distribution - CDPD)
- Public and private fleet radio networks (public safety, transit, CVO, etc.)
- Personal Communications System (PCS) networks
- Nextel personal communications and fleet dispatch network

1.3.4.5 Remote Access

- Internet
- Public Switched Telephone Network
- Analog cellular

1.3.5 COMMUNICATIONS

Wireline network options include the use of private networks, common carrier networks, or a mixture of the two. Examples of private network technologies are twisted pair cables, Fiber Data Distribution Interface (FDDI) over fiber optic rings, Synchronous Optical Network (SONET) fiber optic networks, and Asynchronous Transfer Method (ATM) over SONET networks. Examples of public shared network options are the leasing of telephone company-offered services such as leased analog lines, frame relay, Integrated Switched Digital Network (ISDN), Switched Multimegabit Data Service (SMDS), and Internet. A third wireline network option is that of a mixed network, where existing communications infrastructure can be utilized to the greatest extent possible, and possibly upgraded to carry any increased data load. The addition of CCTV video exchange in particular can overload the backbone of an existing network.

The decision to specify a private network is probably not motivated by technological reasons because the desired data bandwidth can be supplied through the use of common carrier networks. Common

carrier networks have many other advantages such as cost sharing and risk reduction. It is virtually certain that within the time frame of this Plan one or more local common carriers can provide network connectivity to fulfill the architecture communications requirements.

The reasons for building a private network have more to do with requirements/preference for a network built to the exact specifications of the user, and matching the available funding policies. If one-time capital funding is more easily obtained than monthly lease fees, then a private network appears as the best choice. In any case, there will still be ongoing operations and maintenance costs.

The active participation of the owners of highway Right of Way (ROW) in partnership with one or more common carriers may be a means of having a private network built for the ITS infrastructure at little or no cost to the local agency. In exchange for the use of the rights of way, the carriers would provide a portion of the network capacity for ITS use, and much of the maintenance cost. Bartering of railroad right-of-way offers similarly attractive options to the railroad operator. At the current time, Caltrans has no highway ROW policy in force.

For the purposes of the communications analysis, the owner of the network is not an issue, nor is the exact carrier technology used on each link an issue. The major issues are the amount of bandwidth (capacity) needed and the standards that will be used to access the network and to exchange data in a meaningful way on the network. The ultimate choice of a network technology for the region's deployed network will be based on the specific details of the infrastructure assets deployed in the San Joaquin Valley.

SECTION 2.0

REGIONAL DESCRIPTION

2.0 REGIONAL DESCRIPTION

2.1 Overview of Transportation Facilities

This section provides an overview of the general demographic characteristics and existing transportation system of the San Joaquin Valley, which is important because it defines the environment into which ITS systems must be deployed and operated. No ITS architecture effort should be undertaken without a thorough knowledge of the region into which systems and projects will be deployed. The general characteristics of the San Joaquin Valley are identified below and will be used as a frame of reference throughout the ITS architecture and project development efforts. Appendix A contains the associated Turbo Architecture Inventory Report.

2.2 ITS Region

The eight-county ITS region in the San Joaquin Valley includes the counties of San Joaquin, Stanislaus, Merced, Madera, Fresno, Tulare, Kings, and Kern. Federal legislation, specifically the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA) directs that transportation planning efforts be coordinated in geographically defined air basins. The eight counties share an air basin and have many attributes in common.

In September 1992, the Transportation Planning Agencies from the eight counties entered into a Memorandum of Understanding (MOU) to assure a coordinated regional approach to transportation and air quality planning efforts. The eight counties are completing this ITS Strategic Deployment Plan, a freight study, and a Valley-wide traffic/emissions modeling plan, with support from Caltrans, the California Air Resources Board, the State Office of Planning and Research, the San Joaquin Valley Unified Air Pollution Control District, and the Federal Highway Administration.

Key issues that are common to the eight counties include the following:

- A rapidly expanding population;
- Economies based in large part on agricultural production;
- Major north-south freeways, Interstate 5 (I-5) and State Route 99 (SR-99) that serve local, regional, and inter-regional commodity movements;
- Limited east/west access on the existing highway network between SR-99 and I-5, as well as to US 101 and east over the Sierras;
- Inclement weather (i.e., fog) during certain times of the year;

- Air quality deficiencies;
- San Joaquin Passenger Rail Service and future high speed rail access;
- Two major mainline rail freight providers;
- A large proportion of residents who commute to job centers in other counties, some of which are outside the region; and
- High volumes of truck traffic on major freeways and other State Routes.

Existing and future population statistics are presented by county in **Table 2.1**.

Table 2.1: County Population Estimates

County	Population		Average Annual Growth	1998-2020 Percent Growth
	1998 Estimate	2020 Forecast		
Fresno County	786,779	1,185,000	1.88%	50.6%
Kern County	639,798	1,220,300	2.98%	90.7%
Kings County	122,848	202,800	2.30%	65.1%
Madera County	114,349	203,200	2.65%	77.7%
Merced County	204,422	380,100	2.86%	85.9%
San Joaquin County	545,249	920,900	2.41%	68.9%
Stanislaus County [1]	427,642	826,123	2.47%	93.2%
Tulare County	360,352	612,000	2.44%	69.8%
TOTAL	**3,201,439**	**5,870,923**	**2.79%**	**83.4%**

Note:
[1] Population data are for January 1998 and July 2020 except for Stanislaus County, for which a future date of 2025 is used.

Source: CCS Planning & Engineering, Inc. June 2000

2.3 Major Study Area Roadways

The major north-south facilities are I-5 and SR-99. I-5 runs through the western portion of six of the eight counties and currently carries average daily volumes ranging from 14,800 to 109,000 vehicles per day (vpd). SR-99 runs near the geographic center of the eight counties approximately 20 to 40 miles east of I-5. The separation gradually decreases through Tulare and Kern Counties until the two roads join in the southern part of Kern County. SR-99 was constructed long before I-5, serves a higher concentration of cities and populated areas, and is adjacent to the major railroad freight lines in the region.

I-5 can be divided into three distinct sections. North of I-205, the road is the main north-south route with a high volume of 109,000 vpd and a low of 47,000 vpd at the northern San Joaquin County border. To the south through six counties to the SR 99 junction, the volumes are relatively consistent, ranging from a low of 21,400 vpd to a high of 27,500. This pattern suggests that the road in this area mostly serves through traffic. South of the junction, the volumes almost double to approximately 52,000 vpd.

SR-99 has considerable variations throughout its length, generally with highs on either side of major cities with lows at midpoints between these cities. The three distinct lows are immediately north of the I-5/SR-99 intersection, between Bakersfield and Visalia, and between Merced and Madera. These lows are only slightly above the maximum volume for the mid-section of I-5. High volume locations occur at Bakersfield (114,000 vpd), Fresno (96,000 vpd), Modesto (91,000 vpd), and at Stockton (86,000 vpd).

Several east-west highways or freeways cross the counties. However, there's limited access across the east-west facilities between SR-99 and I-5, as well as, to US 101 and east over the Sierras. **Table 2.2** gives a summary of these routes and their current average daily traffic volumes. SR-41, although a north-south route, has been included because it provides a connection between I-5 and SR-99. As with SR-99, the maximum volumes occur near major urban areas. Except for I-205, which is a major inter-regional connection, the routes generally do not serve through traffic, as indicated by the minimums in Table 2.2. In most cases, traffic falls below 5,000 vpd.

Table 2.2: Summary of San Joaquin Valley East-West Routes

Route	Minimum Volume	Maximum Volume
SR-12	13,900	27,000
SR-4	3,100	74,000
SR-41	5,100	118,000
SR-120	10,500	49,000
I-205	68,000	80,000
SR-132	13,700	28,000
SR-140	1,000	16,000
SR-152	8,800	27,500
SR-168	1,350	62,000
SR-180	500	46,000
SR-198	1,100	44,000
SR-46	4,200	9,200
SR-178	1,300	5,000
SR-58	300	71,000

Source: 1998 volumes on California State Highways, Caltrans (on-line) June 2000

2.4 Transit Services

Each county is currently served by both fixed route and dial-a-ride transit service. Large systems, with over 100 vehicles, include the systems in Fresno (140 vehicles) and San Joaquin County (151 vehicles). Medium size systems, with 30-75 vehicles, include Bakersfield at the upper end and at the lower end systems in Corcoran, Modesto, and Visalia.

The two basic types of transit service are fixed route, where buses operate on fixed schedules on a fixed route and demand responsive, where these routes change based on individual trip requests usually made in advance. Fixed route service itself can be broken down into major urban service, which focuses on commuter patterns; rural service, which provides basic mobility to public services, especially health and education; and long-distance routes, which provide trips to and from a single destination and usually does not have intermediate stops. For demand-responsive services, those available to the general public are generally located in small communities while those for the elderly and handicapped are located in both large and small cities. In some counties, such as in San Joaquin County, one agency provides several of the services. In others, such as Stanislaus County, separate operators provide the services.

Regional commercial carriers also provide service throughout the San Joaquin Valley and connect the Valley to other regions. These carriers include Amtrak Bus Connectors, Amador Stage Lines, California Yosemite Tours, Desert Stage Lines, Green Tortoise, Green Belt Stages, Trailways, and Via Adventures. Amtrak bus schedules are coordinated with train schedules. Also, the San Joaquin County Regional Transit District (SMART) provides inter-regional subscription bus service to specific destinations in Alameda and Santa Clara Counties, including the Lawrence Livermore Labs and Lockheed. Additionally, the Yosemite Area Regional Transportation System (YARTS) has commenced summer seasonal service on a two-year demonstration basis in around Yosemite National Park, which serves tourists, commuters and students.

For the larger fixed route systems, ITS applications are multi-faceted that integrate two or more of the following functions: vehicle and equipment monitoring, customer information, signal pre-emption, and fare box summaries. For demand responsive systems, the primary ITS application is automated trip scheduling and can prove cost-effective when more than 15-20 vehicles are involved. For the smaller systems, the focus is on AVL systems.

2.5 Commercial Transportation Facilities and Services

This section is separated into the following sections: trucking, airports and seaports, passenger and freight rail, and intermodal facilities, which are discussed below.

2.5.1 TRUCKING

Commercial trucking plays an important role in the movement of goods to, from, within, and through San Joaquin Valley. Trucking is the most commonly used mode for transporting freight because of its flexibility and speed. It generally is cost-effective for both large and small shipments up to 600 miles in length, except for bulk cargo. Trucks currently carry over 85 percent of freight tonnage in the study area. Trucking companies operating in the area provide a variety of services, from long-haul shipments to moving produce to processing plants.

Long-haul truck travel along the major corridors in the San Joaquin Valley is mostly in a north-south direction. SR-99 and I-5 are the primary truck routes and are designated as Surface Transportation Assistance Act (STAA/super-truck) routes. The other two freeways, I-205 and I-580, are also STAA routes. The east-west routes summarized in Table 2.2 are designated as access truck routes providing connections between the STAA routes and terminals.

Weigh stations are operated by the California Highway Patrol. Responsibilities of weigh station staff include weighing, safety inspections, and operator checks. There are a total of six weigh stations in the eight-county area, at the following locations:

- I-5 near Los Banos (NB and SB)
- I-5 near the south Kern County line (SB at Grapevine)
- SR-99 in Chowchilla (NB)
- SR-58 on either side of Techachapi Pass (EB at Keene, east of the pass and WB at Cache Creek, west of the pass)

2.5.2 AIRPORTS AND SEAPORTS

Significant airport facilities are divided into three groups: hubs, commercial facilities, and general aviation or utility facilities. The only hub airport in the region is Fresno Yosemite International Airport, which serves jet aircraft from numerous major carriers, including United, Continental, and Delta. The commercial airports are those that are served by propeller-driven commercial aircraft that provide feeder service to and from hubs or between similar facilities. Other commercial airports are located in Bakersfield, Chowchilla, Madera, Mojave, Porterville, and Stockton. Numerous general aviation and utility airfields exist throughout the Valley that provide tie-downs for private aircraft, training, maintenance facilities, and airplane-related commercial activities such as crop dusting.

The sole seaport is the Port of Stockton and is accessible by small freighters via San Francisco Bay. This port is an important intermodal facility for Valley shipping and manufacturing. Cargo that passes through the Port includes dry bulk commodities, steel products, general cargo, and liquid bulk cargo items such as fertilizers, molasses, and petroleum products. Most cargo is foreign trade.

2.5.3 PASSENGER AND FREIGHT RAIL

Two major freight carriers, the Union Pacific Railroad (UP), which recently acquired the Southern Pacific Railroad, and the Burlington Northern Santa Fe Railroad (BNSF) serve the San Joaquin Valley. Most cargo items shipped by rail are bulk items such as grains and other farm products, containers, vehicles, and fuels. There are also short-line rail companies such as the Modesto and Empire Traction (M&ET) Railroad, the Stockton Terminal and Eastern Railroad, and the San Joaquin Valley Railroad that provide focused service. Rail service predominately serves shipments that travel more than 600 miles in length.

2.5.4 INTERMODAL FACILITIES

Intermodal facilities provide the efficient transfer of containers and/or trailers between railroad flatcars and trucks. Four are located in the SR 99 corridor, as follows from north to south: Lathrop (south of Stockton), Modesto (operated by M&ET), Fresno (a trailer on flat car, or TOFC, facility), and Bakersfield (a container on flat car, or COFC, facility). UP operates two regular intermodal terminals in Lathrop and Fresno, and two limited service facilities in Modesto and Fresno. BNSF operates intermodal facilities in Stockton, Modesto, and Fresno. However, BNSF is currently constructing a new facility at Mariposa Road, which will replace the undersized facility in the Stockton Yard.

2.6 Emergency Management Facilities

2.6.1 CALIFORNIA HIGHWAY PATROL

The California Highway Patrol (CHP) provides traffic patrols and response to incidents and emergencies for the majority of the study area. The CHP's area of responsibility includes all freeways, and all state routes and roadways in county unincorporated areas.

The Highway Patrol maintains a staff presence in the Caltrans Traffic Management Centers (TMC's) in the district offices. The District 10 office at 1976 East Charter Way in Stockton provides coordination and support to emergency response in San Joaquin, Stanislaus, and Merced counties. The District 6 TMC at 1352 West Olive in Fresno supports Fresno, Kings, Kern, Tulare, and Madera Counties. In each case, there is a separate CHP Communications Center.

Both CHP and Caltrans staff gather information at the TMC and disseminate it to field staff. Information gathered may include closed circuit television (CCTV) images, status reports from field crews, traffic flow data, weather data, CHP reports, or summaries of 911 calls. The field staff may include CHP officers, Caltrans maintenance, allied agencies that close down the entry and exit ramps such as local agency police or public works, the Forest Service, or private firms with contracts to clean up hazardous material spills.

The CHP operates area offices in 14 locations, including Bakersfield, Buttonwillow, Coalinga, Fort Tejon, Fresno, Hanford, Los Banos, Madera, Merced, Modesto, Porterville, Stockton, Tracy, and Visalia as well as dispatch centers in the four major urban areas (Stockton, Merced, Fresno, and Bakersfield).

2.6.2 CALIFORNIA DIVISION OF FORESTRY AND FIRE PROTECTION

The CDF has four administrative Units in the San Joaquin Valley region (Tuolumne-Calaveras, Madera-Mariposa-Merced, Fresno-Kings and Tulare) that provide fire protection for wildland and wildland-urban areas. In some cases, CDF provides contract fire protection services for counties, parts of counties and certain cities in the Valley. CDF fire apparatus and air resources are dispatched from centers in San Andreas (San Joaquin and Stanislaus counties), Mariposa (Madera and Merced counties), Fresno (Fresno and part of Kings County) and Visalia (Tulare County). Kern County is not covered by a CDF dispatch center but has its own facilities for regional dispatch. CDF air attack bases are located in Tuolumne, Fresno and Porterville and ground firestations are scattered throughout the entire Valley region. Some CDF communications facilities use an outdated CAD system called CalCAD, others have no CAD system at all. There is an expressed need to have a much improved resource management

capability, perhaps one that could handle resources in all four CDF Units. CDF communications facilities are considered secondary Public Safety Access Points (PSAPs).

2.6.3 COUNTY SHERIFFS AND FIRE DEPARTMENTS

Each of the eight counties in the Valley has County Sheriff and Fire Departments that provide law enforcement, fire protection and EMS services in unincorporated areas of the county as well as to certain urbanized areas under contract arrangements. These departments are dispatched through county 9-1-1 centers and in some cases, the closest CDF dispatch facility. Kern, Kings, Stanislaus and San Joaquin counties have combined Sheriff and Fire 9-1-1 centers. These centers are equipped with Computer Aided Dispatch (CAD) systems from various vendors.

2.6.4 CITY PUBLIC SAFETY AGENCIES

City Police and Fire Departments handle law enforcement, fire protection and EMS services for their jurisdictions. Dispatch arrangements vary widely throughout the Valley – in some cases, cities are dispatched by Regional County facilities (e.g. the City of Modesto dispatched by Stanislaus County 9-1-1 Center, the cities of Lemoore, Corcoran and Avenal dispatched by Kings County 9-1-1, etc.). Some cities have joint police/fire 9-1-1 centers such as Stockton, Lodi, Tracy, Manteca, Turlock and Oakdale. The larger systems are CAD equipped.

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SECTION 3.0

REGIONAL STAKEHOLDERS

3.0 REGIONAL STAKEHOLDERS

3.1 Identify Participating Agencies and Other Stakeholders

Table 3.1 identifies the San Joaquin Valley stakeholders that have been identified in earlier tasks in the Strategic Deployment Plan. Appendix B provides additional detail for the primary agency stakeholders in the San Joaquin Valley.

Table 3.1: San Joaquin Valley
ITS Strategic Deployment Plan Stakeholders

Agricultural Interests	Automobile Club of California
California Highway Patrol	California Trucking Association
Caltrans – District 6	Caltrans – District 10
Caltrans Division of New Technology & Research	Council of Fresno County Governments
Emergency Service Providers	Farm Bureaus
Federal Highway Administration	Federal Railroad Administration
Federal Transit Administration	Fresno Area Express
Golden Empire Transit District	Kern Council of Governments
Kern Regional Transit	Kings County Association of Governments
Local Jurisdictions	Local Police Departments
Local Transit Operators	Madera County Transportation Commission
Meadows Field Airport	Merced County Association of Governments
Port of Stockton	San Joaquin Council of Governments
San Joaquin Valley Air Pollution Control District	San Joaquin Valley Railroad
Sheriff Departments	Stanislaus Council of Governments
Tourism Industry	Tulare County Association of Governments
Union Pacific Railroad	United Parcel Service

SECTION 4.0

OPERATIONAL CONCEPT

4.0 OPERATIONAL CONCEPT

4.1 Introduction

From an ITS systems perspective, the San Joaquin Valley is characterized by few major urbanized areas and two major North-South arterials, I-5 and SR-99. These features lend themselves to a decentralized architecture, with regional nodes connected by a Valley-wide network and each regional node acting as a hub for local transportation system connectivity. Further, the San Joaquin Valley is largely rural in nature, so that ITS solutions must be economical and smaller scale than typically found in major metropolitan areas. This is not to say, however, that metropolitan-based solutions are not relevant to the Valley, but only that they must be applied with cost constraints in mind and with due regard for appropriate scaling.

In looking at current ITS deployment in the Valley region, the regional nodes suggested are Stockton, Fresno and Bakersfield. Only Fresno is scheduled for an Urban TMC installation in the Caltrans TMC Master Plan, but District 10 will have a small "TMC" in Stockton and Bakersfield is the home of a CHP Central Division Communications Center. It would also be feasible to remote a statewide ATMS Operator Workstation from Fresno to the Caltrans office in Bakersfield, or alternatively to the CHP Communications Center. A similar arrangement is being considered between the District 7 TMC in Los Angeles and the CHP Coastal Division Communications Center in Ventura.

Further discussion on the San Joaquin Valley Operational Concept will be focused in the areas of incident management, traffic management, transit management and advanced traveler information systems.

4.2 Incident Management

Incident Management is arguably the highest priority need for the San Joaquin Valley, particularly when reviewing the data in Figures 4-6 through 4-9 in Working Paper #1. Remote stretches of highway, frequent and severe restricted visibility conditions due to blowing dust and fog, a high concentration of commercial vehicles and winter weather conditions in the Sierras and foothills pose numerous challenges to the prevention of and response to major incidents. Historically, major incidents involving multiple vehicles and fatalities are all too common in the Region. One basic precept must be kept in mind when formulating a regional incident management strategy in the San Joaquin Valley: the Valley is not an isolated area and has natural and operational ties to the Bay Area and the Sacramento Delta to the North, and to Los Angeles County in the South. In other words, a Valley-wide architecture must be flexible enough to allow the exchange of information with areas outside the Valley proper.

Incident management focuses on five major phases of activity:

- Detection and Verification – this encompasses all activities up to the time of the initial dispatch action. Verification may not occur until Scene Management starts.
- Response (both emergency responders and transportation management assets) – activities from initial dispatch to the arrival of the last emergency responder.
- Scene Management – activities from the arrival of the first responder until the scene is cleared. This activity overlaps the Clearance phase.
- Clearance and Restoration of Highway Capacity – all activities necessary to open the affected roadway(s) to full capacity including dispatch of non-emergency and/or commercial clean-up resources.
- Traveler Information – activity that begins as soon as reliable information is known about the incident until the incident is cleared and traffic resumes normal flow. This activity overlaps all other activities in the incident management cycle.

The common requirement for all phases is the timely and accurate exchange of information between public safety and transportation agencies.

A typical incident scenario is depicted in **Figure 4.1**. Note that current communications to exchange information rely heavily upon the cellular and Public Switched Telephone Network shown in the figure. The evolving architecture must support a transition to a data network that supports automatic information exchange between management centers as shown in the figure. Wireless networks are also critical to support voice communications and certain types of data communications.

Notification (paths X-A, A-B, B-C and C-D in Figure 4.1). Over 90% of incidents are first reported to one of the CHP Communications Centers in the Valley (Stockton, Merced, Fresno, Bakersfield) through cellular 9-1-1 or call boxes (in San Joaquin and Kern counties only). At some point in the incident chain of events, Caltrans is made aware of the incident. On some occasions, Caltrans field personnel may report an incident for the first time and there is a need to get the initial data to the CHP for response. Most verification is done using on-scene resources since there are not enough CCTV installations in the Valley to rely on for incident verification on a routine basis.

Architecture requirement: ability to automatically pass initial incident data from CHP (or other public safety system) to the Caltrans ATMS.

Response (paths D-C, C-F, F-G, E-X and G-X in Figure 4.1). Once an incident is initially dispatched it is considered to be in the response phase. CHP will normally dispatch for freeway, state highway and in certain cases county roads – local police departments will dispatch for urban arterial incidents. For injury accidents, fire departments respond with an EMT-staffed engine and ambulance for transport. Fatalities require dispatching of the Coroner or County Medical Examiner's office. The CHP's Major Accident Investigation Team (MAIT) may be required for major incidents with multiple fatalities. These teams are strategically located throughout the state but may be some distance from a particular incident. Other responders will include HAZMAT Response Units for HAZMAT-related incidents, special equipment for commercial vehicle incidents to clear truck loads and/or move trucks out of the roadway and Caltrans maintenance units for cleanup activities. One of the major factors delaying a response is the presence of traffic congestion, either related to the incident itself or non-related, that impacts the transit

time of responding units. This situation makes essential the provision of real-time congestion data from transportation management centers to public safety communications centers.

Architecture requirement: Providing congestion data to emergency responders so that dispatch instructions can be tailored to the prevailing traffic conditions.

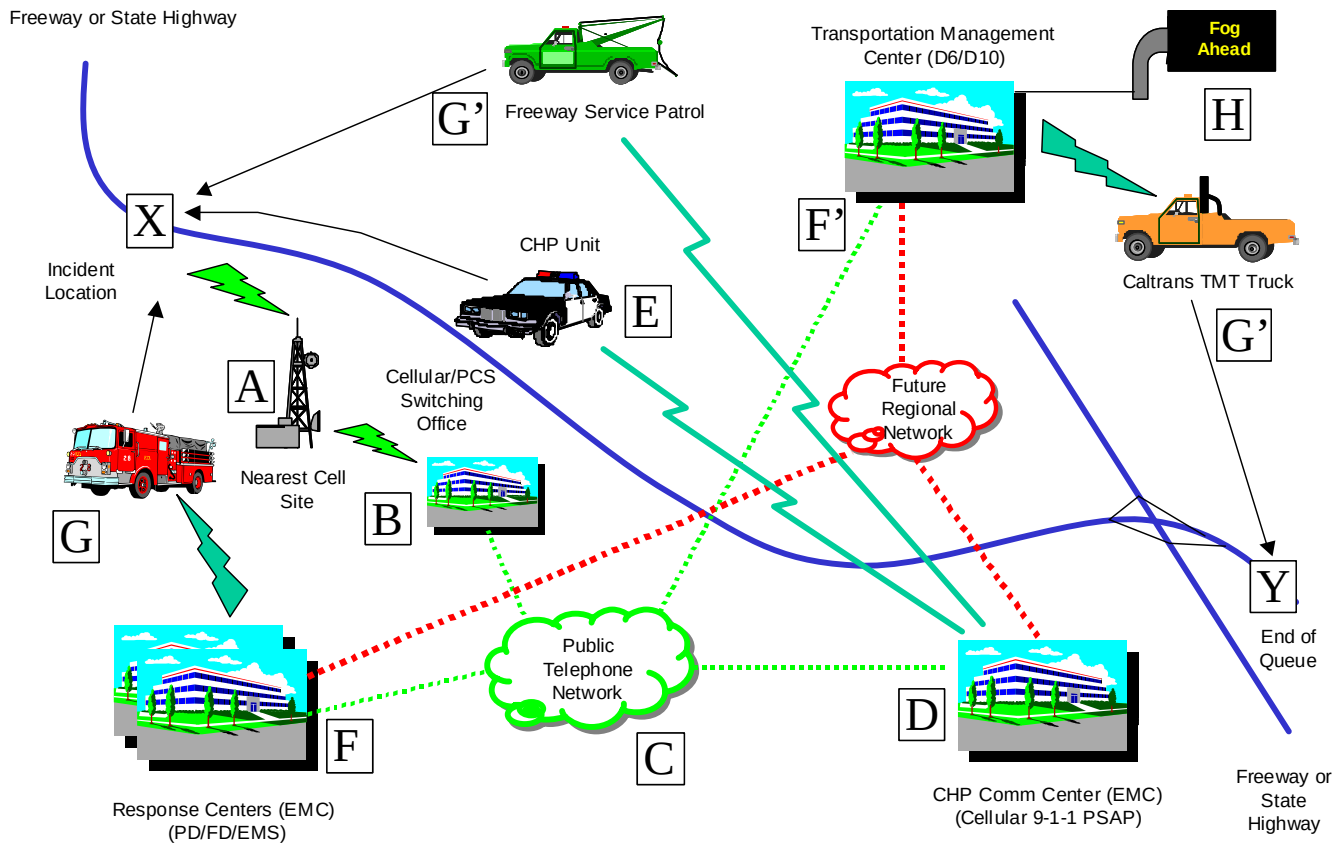

Figure 4.1: Depiction of Typical California Incident Scenario and Sequence

Scene Management (Immediate vicinity of X, F'-G', G'-Y in Figure 4.1). Scene Management includes the management of resources at the scene of the incident and generally encompasses multi-agency coordination during the incident. This coordination can be indirectly through communications centers or directly (on-scene) through multiple, usually non-interoperable voice communications systems. There are technical solutions that can be a part of the regional ITS project program that allow dissimilar voice communications systems to be patched together to facilitate on-scene coordination. Normally, responding units on scene update their respective communications centers with developing information through the use of organic radio facilities. This data needs to get passed to transportation agencies for more effective coordination. This is currently accomplished through informal telephonic notification, a process that is slow and error-prone. The desired goal is to have the essential data automatically entered into TMC ATMS systems to initiate or refine selected response plans. Response plans will include automatic selection of CMS's for activation and recommended messages for display.

Scene management also includes the deployment of Traffic Management Team trucks or other portable CMS equipment to strategic locations to reduce the probability of secondary incidents.

Architecture requirement: Periodically automatically update ATMS with on-scene incident updates (usually in the form of Computer Aided Dispatch log entries similar to what can be seen on the CHP incident web page – cad.chp.ca.gov). Log entries can come from any CAD system in the Valley. Another requirement that supports this scenario is automatic vehicle location equipment in TMT trucks to plot real-time locations on a regional map. This aids in assessing collateral impact on the transportation system due to incidents.

Clearance. Clearance phase involves tow trucks and various specialized equipment that may be required to clear vehicle, load and/or collateral property damage debris from the roadway. Much of this type of equipment may not be dispatched from centers that are part of the architecture. Caltrans maintenance equipment is generally dispatched from TMC's.

Architecture requirement: If responding units have Automatic Vehicle Location (AVL), vehicle location data should be displayed on Caltrans ATMS or local agency ATMS as appropriate.

Traveler Information (path F'-H in Figure 4.1). Traveler information during an incident can be disseminated through standard TMC-controlled roadside devices like CMS and HAR or through Independent Service Providers (ISP's). Some agencies may also have direct access to other media such as Cable TV and Internet web pages. The CHP maintains an incident web page for each of its communications centers in California. The data is filtered to eliminate extraneous or sensitive information.

Architecture requirement: Cross-control of any District 10 or 6 (or local agency) CMS and HAR from any TMC in the Valley. Selected ITS data connectivity (traffic congestion, incidents) from modal management centers to a central "gateway" or to a data consolidator.

4.3 Traffic Management

Working Paper #1 identified several areas of recurring traffic congestion in the San Joaquin Valley – these areas are expected to grow significantly over the next several years (Figures 4-4 and 4-5 Working Paper #1). Traffic management strategies in the San Joaquin Valley will be formed around the urban nodes in the Valley's architecture. In each urban node, ramp metering, centralized signal control, corridor management and multi-agency signal coordination are the principal strategies available for traffic management. Over time, coverage and complexity of traffic management systems and connectivity will grow, so that the architecture must support a graceful expansion of these capabilities. Traffic management will be implemented in a hierarchical fashion as shown in **Figure 4.2**. The major TMC's (Districts 10 and 6) will be connected on the Caltrans statewide Wide Area Network (WAN), provided by the Caltrans Information Services Support Center (ISSC). This provides high-level connectivity within the Valley and connectivity to the neighboring Districts shown on the map. CHP communications centers are already connected on the statewide Message Switch System (MSS) that connects CAD systems to each other and to law enforcement telecommunications networks such as California Law Enforcement Telecommunications System (CLETS) and the FBI's National Crime Information Center (NCIC). Within the major urbanized areas in the Valley (Stockton, Modesto, Merced, Fresno and Bakersfield), "Intertie" communications will be required to connect multiple

agencies wishing to exchange information and/or control of field elements within that area. Extensions from these urbanized areas will incorporate field elements from neighboring cities that have useful data to share. On the lowest level, individual cities desiring to implement centralized signal control systems and/or control their own ITS field devices such as changeable message signs, cameras and Highway Advisory Radios will require local interconnects from the field to their "TMC's" or signal control centers. These interconnects can be implemented using standard copper wire (leased circuits) or agency-owned fiber optic networks.

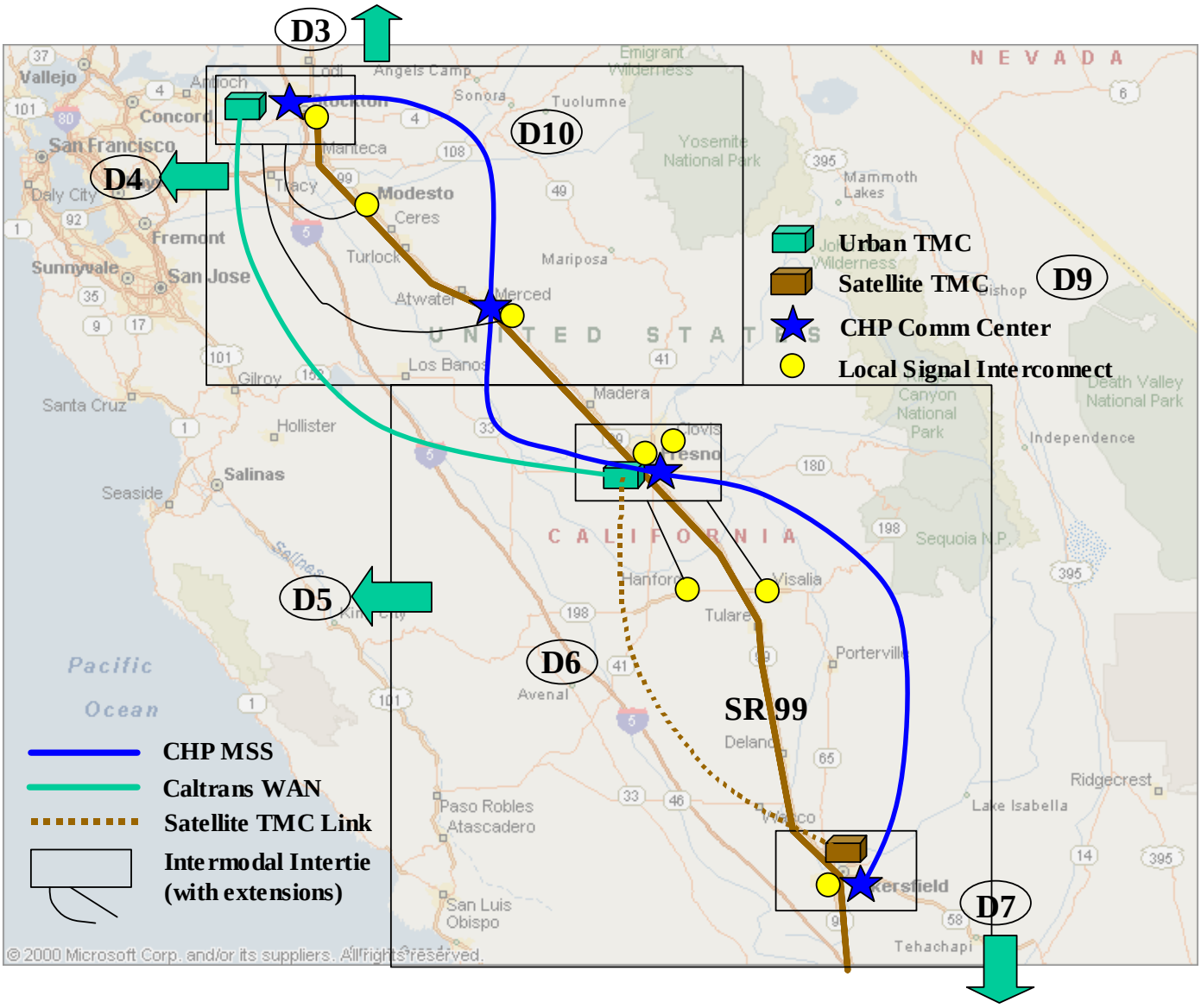

Figure 4.2: San Joaquin Valley Conceptual Traffic Management Architecture

Architecture requirement: Local interties shall be implemented where feasible to facilitate the sharing of traffic control device information and to allow shared control when and where local agreements permit such control. Local interties consist of appropriate communications connectivity and software enhancements to arterial and freeway management systems.

Examples of integrated traffic management that potentially can provide transportation network improvements include the following:

- Ramp metering (major metropolitan areas only)
- Centralized signal control (including incorporation of adjacent jurisdictions without centralized control where local agreements allow)
- Multi-jurisdictional signal control along major arterials that cross jurisdictional boundaries (see **Figure 4.3**)
- Integration of ramp metering and nearby intersection traffic signals
- Corridor management using freeway incident management combined with parallel arterial management

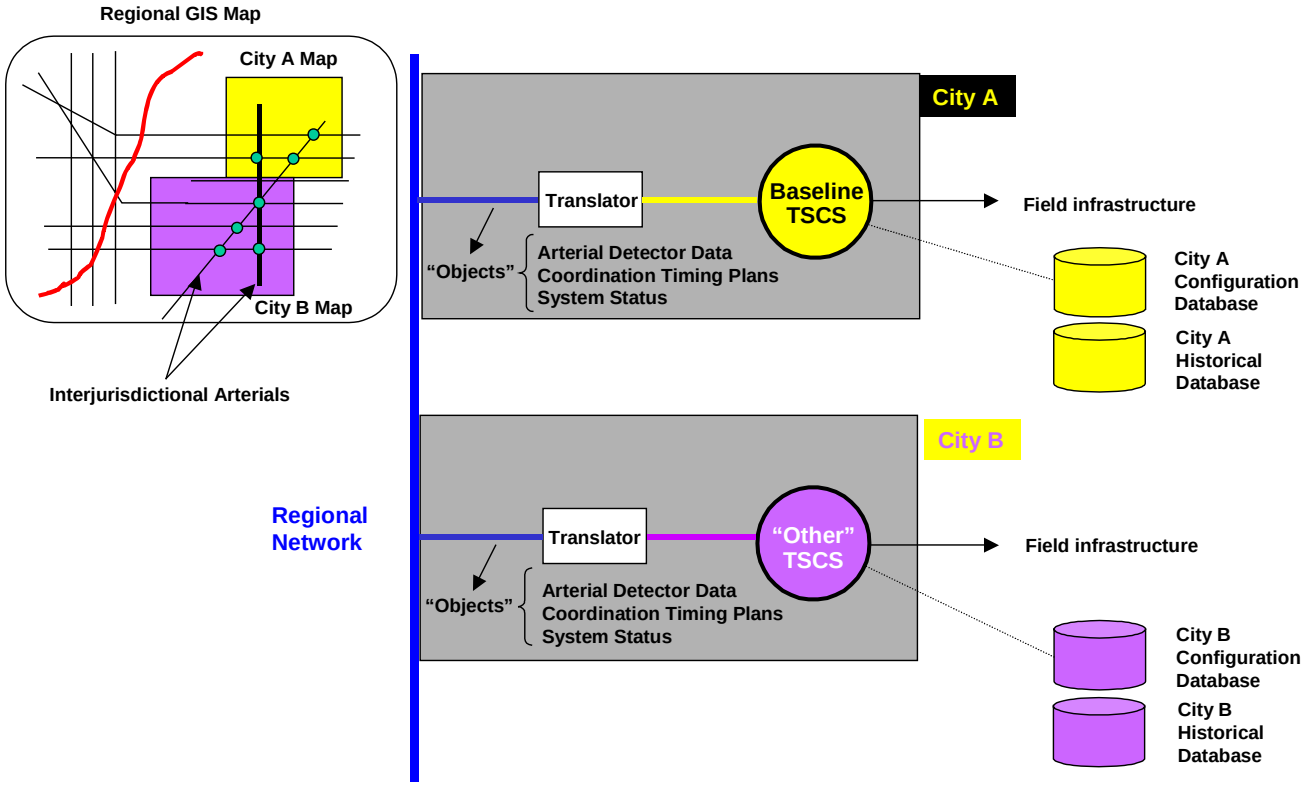

Figure 4.3: Typical Arterial Signal Coordination Architecture

Figure 4.3 illustrates a typical multi-jurisdictional signal coordination architecture. The end result of this architecture, the ability to provide a seamless signal progression along a designated arterial, can be achieved in one of three ways:

- Each City has its own signal system (but the same manufacturer) and the two systems are coordinated as shown in the Figure
- City B uses the central control system of City A through local coordination
- Each City has a different central control system and the "translators" shown in the Figure are required to provide a common signal control "vocabulary". In this situation, some ITS vocabulary standard is required: either (1) the Common Object Request Broker Architecture (CORBA) version of center-to-center communications and the corresponding Interface Definition Language for traffic signal objects; or (2) the National Transportation Communications Interface Protocol (NTCIP) Traffic Signal Control Object Definitions.

Architectural requirement: When the conditions are present for multi-jurisdictional traffic signal coordination, the architecture should provide the means to share traffic signal control data at the level of detail needed to affect such coordination.

Once the arterial progression is available through a single, or multiple jurisdictions, there is a potential for corridor management by integrating incident management along parallel (or approximately so) freeway/arterial corridors. In this situation, other elements of the strategies listed above can be brought into play. For example, if there is a freeway incident resulting in driver-selected route diversions onto a parallel arterial, the selection of a regionally-developed traffic signal timing plan along that arterial might be part of the response plan for that corridor. Other elements of the response plan might include the use of freeway CMS messages by the regional TMC, arterial CMS messages by a local agency, and a ramp meter activation plan to control traffic entrance to the affected area both downstream and upstream of the incident. The ramp meter activation plan in turn would (or might) result in some type of local traffic signal coordination in the immediate vicinity of the freeway on-ramp. These strategies are not unusual and have been employed in other areas of the country (Minneapolis-St. Paul, Milwaukee, Houston, Phoenix, for example).

Architectural requirement: The regional communications plan should accommodate the exchange of real-time traffic congestion information from freeway and arterial detectors. Regional workstations should have the capability of displaying own-system and remote-system real-time detector data.

To facilitate the above type of scenario, a regional working committee or other type of formal or informal organization consisting of CHP operations and communications personnel, Caltrans traffic management and TMC operator personnel, and local agency traffic engineers would be highly beneficial in establishing regional event management procedures using the architecture tools on hand or planned in the near future. Special event coordinators should participate in these planning sessions when appropriate.

Architecture requirement: The regional architecture should accommodate the coordination of event response plans between freeway managers and arterial managers.

In arterial management systems, the need to address the mitigation of arterial incidents frequently assumes that a local city TMC is staffed similarly to Caltrans TMC's and that the City Traffic Engineer will somehow initiate arterial incidents, much as a Caltrans TMC Operator would. This appears to be a

rare situation since City TMC's (usually just a segregated area with PC's running signal control software) may not be aware of an arterial incident unless they get notified by the City PD or FD. This communications link most often does not exist, therefore it may be prudent to investigate the need to put Regional Integrated Workstations in selected police/fire communications centers. These wortkstations provide emergency services personnel with real-time freeway congestion, incident and CCTV video information, while allowing dispatch personnel a means of inputting timely information concerning events that a traffic engineer may not be aware of.

Architecture requirement: The regional architecture should accommodate the placement of Integrated Workstations in non-traditional locations such as police, fire and other emergency services dispatch centers.

4.4 Transit Management

In many ways, transit management is similar to traffic management in that the architectural solution will be to concentrate transit-traffic management connectivity and transit-to-transit or transit-to-multimodal connectivity in urban or subregional nodes. On the other hand, the major Valley-wide transit data connectivity requirement is to share as many real-time bus schedules as available to better coordinate connections with interregional private transportation systems such as Amtrak, long-haul bus connections, airports, etc. This will become more important and interesting with the advent of high-speed rail service in the Valley. Local transit connectivity requirements include the need to better coordinate local transit services through the use of real-time schedule updates where available – this is likely to be possible and to make operational sense only in the major metropolitan areas. For all local transit services, the availability of real-time traffic and event data would be of operational value to most transit agencies. For purposes of cost efficiency, it may be valuable to consider consolidation of the dispatch of smaller transit services, even while the provider retains operating independence.

Interoperability of transit management systems is a major issue, since most transit management systems are proprietary in nature. Proprietary in this context means that the data models used by the transit dispatch software are not compatible. This is certainly the case with the major transit management systems currently installed or planned for the Valley. The way around this dilemma is to adopt a common language standard for sharing data. For example an incident report in two or more systems might seem different in its "look and feel" and even have different incident attributes, but there is almost always a situation where the dissimilar systems share some common data elements. Good examples of "generic" incident report data include <location> , <type>, <bus no.> , <route no., etc. This type of data lends itself well to defining a common vocabulary that can be shared among different transit properties. The challenge of common vocabularies has been taken up by the Transit Communications Interface Protocol (TCIP) which has defined incident, scheduling and runcutting, customer information and location referencing, among others, as standard areas for vocabulary development. This standardization effort will facilitate the future integration of dissimilar transit management systems.

Another area of potential improvements in transit operations is to provide transit operators with more timely information about ongoing highway incidents and congestion. This type of information would also include real-time video where available. Conversely, traffic agencies can benefit from certain types of information known within the transit management system, such as critical transit-related incident data, driver observations of traffic conditions, and in the more esoteric scenarios, the use of buses as probes to measure such operating characteristics as travel times and average speeds on arterials.

Architecture requirement: Support the availability of Valley-wide transit data to major private sector long-haul transportation providers.

Architectural requirement: Support the sharing of real-time schedule data among multiple transit providers, where available in major metropolitan areas, for schedule coordination and improved customer service.

Architectural requirement: Support the sharing of real-time traffic and event data between traffic management centers and transit dispatch centers in major metropolitan areas. Support the dissemination of real-time event data to all transit providers in the Valley, regardless of location.

Architectural requirement: Support the consolidation of smaller dispatch centers where appropriate and deemed financially and politically feasible by local providers.

4.5 Advanced Traveler Information

Public agency traveler information is currently provided through CMS signs and Highway Advisory Radios that are controlled from the owning TMC and via one or more Information Service Providers who provide traffic information to the media in exchange for advertising revenue. In some cases, the media may directly obtain real-time event and congestion data from CHP, Caltrans or local agencies.

Architecture requirement: The architecture must support the publishing of congestion and event-related information in various media and formats to a wide audience of retail consumers, from commercial fleet operators to private individuals on business or vacation travel or to ISP's in wholesale (bulk) format.

Congestion and event data can come from a wide variety of sources across the 8-county San Joaquin Valley region. In addition to CMS's and HAR's, information dissemination media may include broadcast media (radio, TV), Internet, Cable TV, kiosks, pagers and Personal Data Assistants (PDA's). The traffic-related data may be provided by the public sector directly to travelers or indirectly through ISP's who sell personal or fleet management subscriptions for premium information or contract with the media as described above. The architecture should support the establishment of an optional "data consolidator" who can proxy the delivery of traffic information to other ISP's, the media or directly to their own retail consumers. In this case, each "other" ISP can independently sell data to retail customers or the media since there is no exclusivity. In this case, however, the "other" ISP must take care not to directly resell data obtained from the data consolidator's proprietary data fusion efforts. In the San Joaquin Valley, the ATIS market may be limited in the short run, thus attracting private sector interest in acting as a data consolidator will likely require using consolidators from other regions in the state, possibly the Bay Area or Southern California. Data consolidators are currently in place in San Diego (Regional ATIS Project), Orange County (TravelTIP) and the Bay Area (TravInfo).

Architecture requirement: The architecture must support a means to provide a "data consolidator(s)" with a standard feed of traffic related information, preferably from a single collection point in the Valley. Because the Valley is seen as a limited market for more advanced ATIS services, there is an implied requirement to consolidate available information into as few points as possible to maximize the marketability of ATIS information to all types of traveler information consumers in the region.

SECTION 5.0

OPERATIONS AGREEMENTS

5.0 OPERATIONS AGREEMENTS (EXISTING OR NEW)

The only formal operating agreements in the region are the ones between Caltrans and the California Highway Patrol related to Incident Management and Alternate Routes for Freeway Detours. Formal operation agreements will need to be deployed Valleywide for interjurisdictional projects and the proposed Alternate Route Plans identified for each County.

SECTION 6.0

FUNCTIONAL REQUIREMENTS

6.0 FUNCTIONAL REQUIREMENTS

High-level Functional Requirements for the San Joaquin Valley Architecture are derived from the National ITS Architecture and its artifacts of Equipment Packages, the building blocks of the Physical Architecture subsystems. These subsystems are shown generically in **Figure 6.1**. Section 7 provides graphical representations of the San Joaquin Valley physical architecture subsystems, both Valleywide and by County. Equipment Packages group like processes (or functions) of a particular subsystem together into an "implementable" package of hardware and/or software. For purposes of the San Joaquin Valley architecture development, Equipment Packages will be considered equivalent to high-level functions. Since Equipment Packages represent the functionality needed to implement Market Packages (and are shown in Market Packages), they provide a link between the interface-oriented physical architecture definition and the deployment-oriented Market Packages.

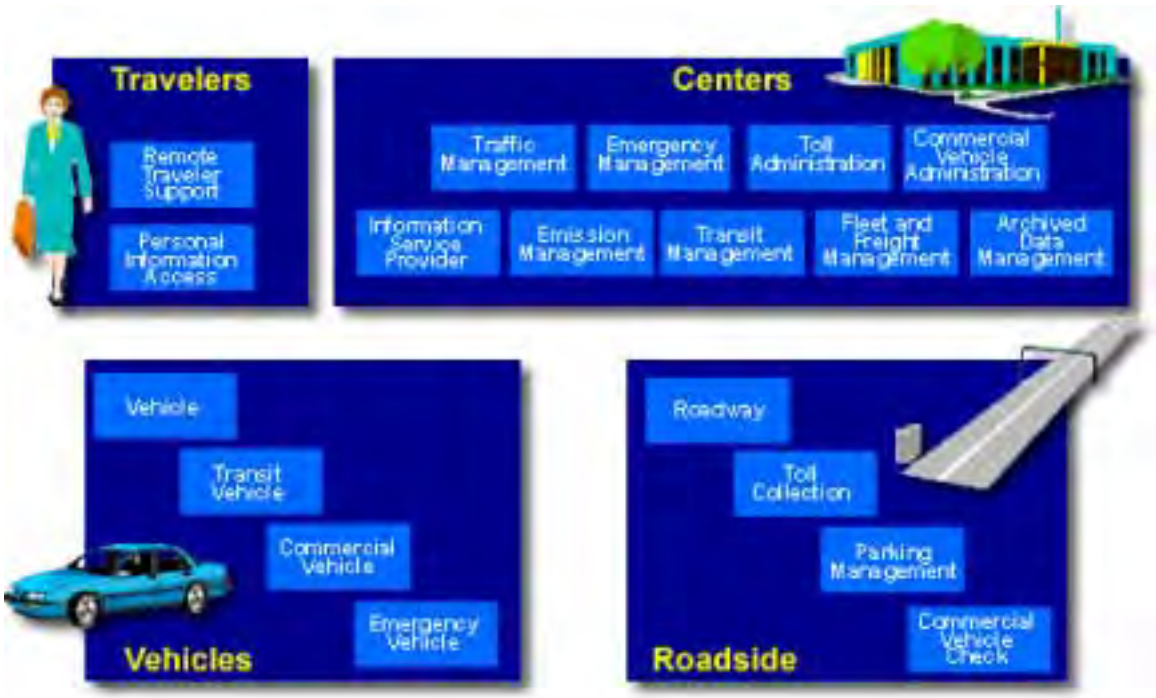

Figure 6.1: Overview of Physical Architecture Subsystems

Tailored Market Packages showing high-level data flows to support regional project development are also shown in Section 7 of this report. In the following paragraphs, each Subsystem from the National ITS Architecture that will be implemented within the scope of the San Joaquin Valley ITS Strategic Deployment Plan is briefly described, followed by a listing of high-level functions that already exist or are most likely to be implemented as described in SDP Section 6, Program Areas and Projects. Project Numbers that will implement new functions are listed for cross-referencing. New functions or parts of functions are bracketed and italicized in the Functional Description field – if no project number is listed, these sub-functions are not addressed in the architecture.

6.1 Emergency Management Subsystem

The San Joaquin Valley Emergency Management Subsystem is distributed among various public safety communications centers operated by the CHP Valley and Central Divisions, County Regional Communications Centers, City Communications Centers and California Division of Forestry and Fire Protection. This subsystem interfaces with other Emergency Management Subsystems to support coordinated emergency response involving multiple agencies. The subsystem tracks emergency response vehicle status to facilitate coordinated response. The subsystem tracks and manages emergency vehicle fleets using automated vehicle location technology (selected agencies only) and two-way radio communications with the vehicle fleet (all agencies). Real-time traffic information received from traffic management subsystems is used to further assist the emergency dispatcher in selecting the emergency vehicle(s) and routes that will provide the timeliest response. Interface with the Traffic Management Subsystem allows strategic coordination in tailoring traffic control to support en-route emergency vehicles and to keep unnecessary traffic away from areas affected by the incident. Interface with the Transit Management Subsystem allows coordinated use of transit vehicles to facilitate response to major emergencies and timely notification of transit-related incidents requiring emergency management response. **Table 6.1** lists the functions for Emergency Management.

Table 6.1: Emergency Management Functional Descriptions

Function	Functional Description	Project X-Ref
Emergency Call Taking	This Function supports the emergency call-taker, collecting available information about the caller and the reported emergency, and forwarding this information to other functions that formulate and manage the emergency response. This function receives 9-1-1, 7-digit local access, [*and motorist call-box calls*] and interfaces to other agencies to assist in the verification and assessment of the emergency and to forward the emergency information to the appropriate response agency.	Partially existing in public safety communications centers *Project 2.3*
Emergency Data Collection	This function collects and stores emergency information that is collected in the course of operations by the Emergency Management Subsystem. This data can be used directly by operations personnel [*or it can be made available to other data users and archives in the region*].	Partially existing in public safety communications centers
Emergency Dispatch	This Function supports efficient dispatch of emergency vehicles. It tracks emergency vehicles, dispatches these vehicles to an incident, [*and provides safe and efficient routes based on real-time traffic information*].	Partially existing in public safety communications centers
Emergency Response Coordination	[*This Function develops and stores emergency response plans and manages overall coordinated response to emergencies. It tracks the availability of resources and assists*	*Project 3.1 (should be renumbered)*

Table 6.1: Emergency Management Functional Descriptions

Function	Functional Description	Project X-Ref
	in the appropriate allocation of these resources for a particular emergency response. This Function provides coordination between multiple allied agencies before and during emergencies to implement emergency response plans and track progress through the incident. It provides vital communications linkages that provide real-time information to emergency response personnel in the field].	*Projects 2.1, 2.2* *Project 2.3ST* *Project 2.1T*
Mayday Support	[*This Function receives Mayday messages, determines an appropriate response, and either uses internal resources or contacts a local agency to provide that response. The nature of the emergency is determined based on the information in the mayday message as well as other inputs. This package effectively serves as an interface between Telematics Service Providers (TSP's) and the local public safety answering point for messages that require a public safety response*].	Not implemented or planned (as this is a fait accompli with TSP's, may want to reconsider as a project)

6.2 Emergency Vehicle Subsystem

This subsystem resides in emergency vehicles operated within the San Joaquin Valley region and provides the sensory, processing, storage, and communications functions necessary to support safe and efficient emergency response. Emergency vehicles are taken to mean CHP units, Sheriff and City PD patrol vehicles, fire apparatus and EMS vehicles. FSP and Traffic Management Team vehicles are not considered to be part of the Emergency Vehicle Subsystem. The Emergency Vehicle Subsystem includes two-way communications to appropriate communications centers and other emergency vehicles. Some emergency vehicles (generally fire and EMS) are equipped with automated vehicle location capability for monitoring by vehicle tracking and fleet management functions in the Emergency Management Subsystem. Using these capabilities, the appropriate emergency vehicle to respond to each emergency is determined. Route guidance capabilities within the vehicle (GPS-based displays) enable safe and efficient routing to the emergency. In addition, the emergency vehicle may be equipped to support signal preemption through communications with the roadside subsystem. **Table 6.2** lists the functions for the Emergency Vehicle subsystem.

Table 6.2: Emergency Vehicle Functional Descriptions

Function	Functional Description	Project X-Ref
On-Board EV Enroute Support	This Function provides capabilities that support safe and expedient arrival on the incident scene. This package provides dispatch and routing information, tracks the vehicle, [*and preempts signals via short-range communication directly with traffic signal control equipment at the roadside*].	P/S agencies implement varying levels of this function *Project 2.2ST* *Project 1.6T* *Project 2.1ME* *Project 1.10F* *Project 1.1KE*
On-Board EV Incident Management Communications	[*This Function provides a direct interface between the emergency vehicle and incident management personnel*].	*Project 2.4ST*

6.3 Traffic Management Subsystem

The Traffic Management Subsystem operates within a Caltrans or local agency traffic management center or other fixed location. This subsystem communicates with the Roadway Subsystem to monitor and manage traffic flow. Incidents are detected and verified and incident information is provided to the Emergency Management Subsystem, travelers (through Roadway Subsystem Highway Advisory Radio and Dynamic Message Signs), and to third party information service providers. The subsystem supports HOV lane management and coordination, road pricing, and other demand management policies that can alleviate congestion and influence mode selection. The subsystem monitors and manages maintenance work and disseminates maintenance work schedules and road closures. The subsystem also manages reversible lane facilities, and processes probe vehicle information. Some of these capabilities will not be implemented as part of this SDP. The subsystem communicates with other Traffic Management Subsystems to coordinate traffic information and control strategies in neighboring jurisdictions. This can be Caltrans-to-local agency or local agency-to-local agency. It also coordinates with rail operations to support safer and more efficient highway traffic management at highway-rail intersections. **Table 6.3** lists the functions for Traffic Management.

Table 6.3: Traffic Management Functional Descriptions

Function	Functional Description	Project X-Ref
Collect Traffic Surveillance	This Function collects, stores, [*and provides electronic access to the traffic surveillance data*].	Some capability exists in the SJV *Project 1.5* *Project 1.1F* *Project 1.2F* *Project 1.5F*
Highway-Rail Interface Traffic Management	[*This function monitors highway-rail intersection (HRI) equipment at the roadside which manages highway traffic. Various levels of roadside equipment may be interfaced to, and supported by, this function to include standard speed active warning systems and high speed systems which provide additional information on approaching trains and detect and report on obstructions in the HRI. This function remotely monitors and reports the status of this roadside equipment. A two way interface supports explicitly status requests or remote control plan updates to be generated by this function. Status may also be received periodically in the absence of a request or asynchronously in the event of a detected failure or other unsafe condition at the intersection.]*	*Project 1.4F* *Project 1.2KI* *Project 1.1ME* *Project 1.1SJ* *Project 1.9SJ* *Project 1.4ST* *Project 1.8T*
TMC Freeway Management	[*Control system for efficient freeway management including integration of surveillance information with freeway road geometry and vehicle control such as ramp metering and CMS*.] Interface to ATIS-related subsystems such as CMS and HAR for information dissemination to the public.	TMC's in Dist 6 and 10 do not have ATMS *Project 1.5* *Project 1.1F* *Project 1.2KE* *Project 1.3SJ* *Project 1.6ST*

Table 6.3: Traffic Management Functional Descriptions

Function	Functional Description	Project X-Ref
TMC Incident Detection	This Function provides the capability to traffic managers to detect and verify incidents and includes detectors and ATMS algorithms. [*This capability includes analyzing and reducing the collected data from traffic surveillance equipment, including planned incidents, adverse weather and other hazardous conditions*].	SJV currently has some loop detectors, CCTV sites and RWIS sites. *Project 1.5* *Project 2.3* *Project 4.2* *Project 4.9* *Project 1.1F, 1.3F, 1.6F, 1.8F 2.3F, 1.4KE, 1.7KE, 1.2MA, 1.5ME, 1.2SJ, 1.3SJ, 1.5SJ, 1.11SJ, 1.1ST, 1.3ST, 1.7ST, 1.5T, 1.7T*
Incident Dispatch Coordination and Communications	[*This Function provides the capability for incident response planning to minimize secondary incidents and other adverse traffic impacts. This function recommends resources required for incident management including proposing and facilitating the dispatch of emergency response and service vehicles as well as coordinating response with all appropriate cooperating agencies*].	*Project 2.1* *Project 2.2* *Project 3.1 (renumber)* *Project 4.2* *Project 1.8F, 1.9F, 2.5F, 1.3KE, 1.4KE, 1.6KE, 2.1KE, 2.2KE, 1.5ME, 2.1ME, 2.2ME, 1.3SJ, 1.5SJ, 1.10SJ, 2.1SJ, 1.3ST, 2.1ST, 2.3ST, 1.5T, 1.7T, 2.1T, 2.2T*
TMC Multi-Modal Coordination	[*This Function provides the capability of signal control at the traffic management subsystem to provide signal priority for transit vehicles*].	No Projects planned

Table 6.3: Traffic Management Functional Descriptions

Function	Functional Description	Project X-Ref
TMC Regional Traffic Control	This Function provides capabilities in addition to those provided by the TMC Basic Signal Control Function for analyzing, controlling, and optimizing area-wide traffic flow. [*These capabilities provide for wide area optimization integrating control of a network signal system with control of freeway, considering current demand as well as expected demand with a goal of providing the capability for real-time traffic adaptive control while balancing inter-jurisdictional control issues to achieve regional solutions. These capabilities are best provided using a Traffic Management Center (TMC) to monitor and manage freeway ramp meters and intersection traffic signals and software to process traffic information and implement traffic management measures (e.g., ramp metering, signalization, and traffic coordination between both local and regional jurisdiction). The TMC shall be able to communicate with other TMCs in order to receive and transmit traffic information on other jurisdictions within the region*].	*Project 5.1* *Project 1.2F, 1.3F* *Project 1.5F* *Project 1.4KE* *Project 5.1KI* *Project 1.4ME* *Project 5.1ME* *Project 1.5SJ* *Project 1.6SJ* *Project 5.1SJ* *Project 1.1ST, 1.2ST, 1.3ST 1.8ST, 5.1ST* *Project 1.5T* *Project 5.1T*
TMC Road Weather Monitoring	This function assimilates current and forecast road conditions and weather information using a combination of weather service information and an array of environmental sensors deployed on and about the roadway. The collected road weather information is monitored and analyzed to detect and forecast environmental hazards such as icy road conditions and dense fog. This information can be used to more effectively deploy road maintenance resources, issue general traveler advisories, and support location specific warnings to drivers.	RWIS sites currently exist but no ATMS integration *Project 4.2, 4.9* *Project 1.8F* *Project 1.5KE* *Project 1.7KE*
TMC Signal Control	This Function provides the capability for traffic managers to monitor and manage the traffic flow at signalized intersections. This capability includes analyzing and reducing the collected data from traffic surveillance equipment and developing and implementing control plans for signalized intersections. Control plans may be developed and implemented that coordinate signals at many intersections under the domain of a single traffic management subsystem. [*In advanced implementations, this package collects route planning information and integrates and uses this information in predicting future traffic conditions and optimizing the traffic control strategy for these conditions. These capabilities are achieved through real-time communication of logged routes from an Information Service Provider. The planned control strategies can be passed back to the Information Service Provider so that the intended strategies can be reflected in future route planning.*]	*Project 1.2F, 1.5F, 1.11F* *Project 1.3KE* *Project 1.1KI* *Project 1.3KI* *Project 1.3ME, 1.6ME* *Project 1.2SJ, 1.7SJ* *Project 1.1ST, 1.2ST* *Project 1.1T, 1.2T, 1.3T, 1.4T*

Table 6.3: Traffic Management Functional Descriptions

Function	Functional Description	Project X-Ref
TMC Traffic Information Dissemination	This Function provides the capability to disseminate incident related information to travelers, potential travelers, and private information service providers. [*These capabilities shall be provided using a workstation type processor within a facility connected to traveler information providers by utilizing existing wireline links.]*	*Project 1.2, 1.3, 1.4, 1.5, 4.5, 4.7* *Project 1.9F, 2.1F* *Project 1.5KE* *Project 1.6KE* *Project 1.3MA* *Project 2.1ME* *Project 1.3SJ* *Project 1.8SJ* *Project 1.10SJ* *Project 2.3ST* *Project 4.1ST* *Project 1.7T*
TMC Traffic Network Performance Evaluation	[*This Function provides the capability to predict travel demand patterns to support traffic flow optimization, demand management, and incident management. This Function requires the data collected by surveillance Functions as well as input from other management subsystems including the ISP Subsystem, Transit Management Subsystem.*]	No projects planned
Traffic Data Collection	[*This function collects and stores traffic information that is collected in the course of traffic operations performed by the Traffic Management Subsystem. This data can be used directly by operations personnel or it can be made available to other data users and archives in the region.*]	No projects planned
Traffic Maintenance	[*This Function provides monitoring and remote diagnostics of field equipment to detect field equipment failures, issues problem reports, and tracks the repair or replacement of the failed equipment.]*	No projects planned
Rail Operations Coordination	*[This equipment package provides strategic coordination between rail operations and traffic management centers. It receives train schedules, maintenance schedules, and any other forecast events that will result in highway-rail intersection (HRI) closures from Rail Operations. The provided information is used to develop forecast HRI closure times and durations that may be applied in advanced traffic control strategies or delivered as enhanced traveler information. This equipment package includes the processing and algorithms necessary to derive HRI closure times and the communications capabilities necessary to communicate with rail operations and interface to the traffic control and information distribution capabilities included in other Traffic Management Subsystem equipment packages.]*	*Project 1.4F* *Project 1.2KI* *Project 1.1ME* *Project 1.1SJ* *Project 1.9SJ* *Project 1.4ST* *Project 1.8T*

6.4 Transit Management Subsystem

The transit management subsystem manages transit vehicle fleets and coordinates with other modes and transportation services. It provides operations, maintenance, customer information, planning and management functions for the transit property. It spans distinct central dispatch and garage management systems and supports the spectrum of fixed route, flexible route, and paratransit services. The subsystem's interfaces allow for communication between transit departments and with other operating entities such as emergency response services and traffic management systems. This subsystem receives

special event and real-time incident data from the traffic management subsystem. It provides current transit operations data to other center subsystems. The Transit Management Subsystem collects and stores accurate ridership levels and implements corresponding fare structures. It collects operational and maintenance data from transit vehicles, manages vehicle service histories, and assigns drivers and maintenance personnel to vehicles and routes. The Transit Management Subsystem also provides the capability for automated planning and scheduling of public transit operations. It furnishes travelers with real-time travel information, continuously updated schedules, schedule adherence information, transfer options, and transit routes and fares. In addition, the monitoring of key transit locations with both video and audio systems is provided with automatic alerting of operators and police of potential incidents including support for traveler activated alarms.

In the San Joaquin Valley, there are a handful of medium-to-large transit properties that will lead the way with the deployment of transit management systems. There are many smaller, rural-oriented properties that cannot afford the luxury of such systems, but there are always the opportunities to consolidate dispatch and management systems to reduce the cost to transit agencies while providing some of the benefits of advanced management systems. **Table 6.4** lists the functions for Transit Management.

Table 6.4: Transit Management Functional Descriptions

Function	Functional Description	Project X-Ref
Transit Center Fixed Route Operations	This Function enhances the planning and scheduling associated with fixed route transit services. The package allows fixed-route services to develop, print and disseminate schedules and automatically updates customer service operator systems with the most current schedule information. Current vehicle schedule adherence and optimum scenarios for schedule adjustment shall also be provided.	*Project 3.2* *Project 3.4F* *Project 3.3ME* *Project 3.2SJ* *Project 3.2ST* *Project 3.2T*
Transit Center Information Services	This function collects the latest available information for a transit service and makes it available to transit customers and to Information Service Providers for further distribution. Customers are provided information at transit stops and other public transportation areas before they embark and on-board the transit vehicle once they are enroute. Information provided can include the latest available information on transit routes, schedules, transfer options, fares, real-time schedule adherence, current incidents, weather conditions, and special events. In addition to general service information, tailored information (e.g, itineraries) are provided to individual transit users.	*Project 3.3* *Project 3.3F* *Project 3.2MA* *Project 3.3MA* *Project 3.1ME* *Project 3.4ME* *Project 3.3SJ* *Project 3.5SJ* *Project 3.5ST* *Project 3.4T* *Project 3.5T*
Transit Center Multi-Modal Coordination	This Function provides the transit management subsystem the capability to determine the need for transit priority on routes and at certain intersections and request transit vehicle priority at these locations. It also supports schedule coordination between transit properties and coordinates with other surface and air transportation modes.	*Project 3.1F*

Table 6.4: Transit Management Functional Descriptions

Function	Functional Description	Project X-Ref
Transit Center Paratransit Operations	This Function provides the capability to automate the planning and scheduling, allowing improvements in paratransit routes and services to develop, printing and disseminating schedules, and automatically updating customer service operator systems with the most current schedule. In addition, this Function provides the capability to assign drivers to routes in a fair manner while minimizing labor and overtime services, including driver preferences and qualifications, and automatically tracking and validating the number of work hours performed by each individual driver. These capabilities shall be provided through the utilization of dispatch and fleet management software running on a workstation type processor.	*Project 3.2F* *Project 3.1KE* *Project 3.1KI* *Project 3.2KI* *Project 3.1MA* *Project 3.4SJ* *Project 3.3ST*
Transit Center Security	This Function provides the capability to monitor key transit locations and transit vehicles with both video and audio systems automatically alerting operators and police of potential incidents and supporting traveler-activated alarms. The monitoring equipment shall also include capabilities to assist in responding to terrorist incidents.	*Project 3.4MA* *Project 3.2ME* *Project 3.1ST* *Project 3.1T*
Transit Center Tracking and Dispatch	This Function provides the capabilities for monitoring transit vehicle locations and determining vehicle schedule adherence. The Function shall also furnish users with real-time travel related information, continuously updated with real-time information from each transit system within the local area of jurisdiction, inclusive of all transportation modes, from all providers of transportation services, and provide users with the latest available information on transit routes, schedules, transfer options, fares, real-time schedule adherence, current incidents conditions, weather conditions, and special events. This Function also supports the capability for two-way voice communication between the transit vehicle driver and a facility, two-way data communication between the transit vehicles and a facility.	*Project 3.2* *Project 3.4F* *Project 3.1KI* *Project 3.2ME* *Project 3.3ME* *Project 3.2SJ* *Project 3.2ST* *Project 3.6ST* *Project 3.2T*
Transit Garage Operations	This Function automates and supports the assignment of transit vehicles and drivers to enhance the daily operation of a transit service. It provides the capability to assign drivers to routes or service areas in a fair manner while minimizing labor and overtime services, considering driver preferences and qualifications, and automatically tracking and validating the number of work hours performed by each individual driver.	Some Implementers of Project 3.2 *Project 3.2F* *Project 3.4F* *Project 3.2SJ*
Transit Data Collection	This function collects and stores transit information that is collected in the course of transit operations performed by the Transit Management Subsystem. This data can be used directly by operations personnel or it can be made available to other data users and archives in the region.	*Project 3.2* *Project 3.2F* *Project 3.4F* *Project 3.2SJ* *Project 3.2ST* *Project 3.2T*

Table 6.4: Transit Management Functional Descriptions

Function	Functional Description	Project X-Ref
Transit Load and Fare Management	[*This function provides the capability to accept collected data required to determine accurate ridership levels and implement variable and flexible fare structures. Support shall be provided for the traveler for use of a fare medium for all applicable surface transportation services, to pay without stopping, have payment media automatically identified as void and/or invalid and eligibility verified, and allow for third party payment. In addition, capability to provide expansion into other uses for payment medium such as retail and telephone and for off-line billing for fares paid by agencies shall be supported. This function also supports the capability for two-way voice communication between the transit vehicle driver and a facility, two-way data communication between the transit vehicles and a facility, sensor data to be transmitted from the transit vehicles to a facility, and data transmission from individual facilities to a central facility for processing/analysis if desired. These capabilities shall be provided through a workstation type processor with GUI, high capacity storage, ride share software housed in a building with dialup lines and wireline telephone and require integration with an existing Transit Center Tracking and Dispatch function.*]	*Project 3.4* *Project 3.5F* *Project 3.2KE* *Project 3.1SJ* *Project 3.4ST* *Project 3.3T*

6.5 Transit Vehicle Subsystem

This subsystem resides in a transit vehicle and provides the sensory, processing, storage, and communications functions necessary to support safe and efficient movement of passengers. The Transit Vehicle Subsystem collects accurate ridership levels and supports electronic fare collection. An optional traffic signal prioritization function communicates with the roadside subsystem to improve on-schedule performance. Automated vehicle location functions enhance the information available to the Transit Management Subsystem enabling more efficient operations. On-board sensors support transit vehicle maintenance. The Transit Vehicle Subsystem also furnishes travelers with real-time travel information, continuously updated schedules, transfer options, routes, and fares. **Table 6.5** lists the functions for the Transit Vehicle Subsystem.

Table 6.5: Transit Vehicle Functional Descriptions

Function	Functional Description	Project X-Ref
On-Board Fixed Route Schedule Management	This Function provides the capabilities for automated planning and scheduling, by collecting data for schedule generation. Capability shall also be provided to automatically determine optimum scenarios for schedule adjustment. This Function also supports the capability for two-way voice communication between the transit vehicle driver and a facility, two-way data communication between the transit vehicles and a facility, on-board safety sensor data to be transmitted from the transit vehicles to a facility, and data transmission from individual facilities to a central facility for processing/analysis if desired.	*Project 3.2* *Project 3.2F* *Project 3.4F* *Project 3.2SJ* *Project 3.2ST* *Project 3.2T*

Table 6.5: Transit Vehicle Functional Descriptions

Function	Functional Description	Project X-Ref
On-Board Maintenance	This Function provides the capability to use transit vehicle mileage data to automatically generate preventative maintenance schedules for each specific bus by utilizing vehicle tracking data and storing with a trip computer. It also provides the capability for real-time condition monitoring on board the vehicle, and transmission of this information via two-way communication to the management center.	*Project 3.2* *Project 3.2F* *Project 3.4F* *Project 3.2SJ* *Project 3.2ST* *Project 3.2T*
On-Board Paratransit Operations	This function forwards paratransit dispatch requests to the driver and forwards acknowledgements to the center. It coordinates with, and assists the driver in managing multi-stop runs associated with demand responsive, flexibly routed transit services.	*Project 3.2F* *Project 3.1KE* *Project 3.1KI* *Project 3.2KI* *Project 3.1MA* *Project 3.4SJ* *Project 3.3ST*
On-Board Transit Information Services	The Function furnishes enroute transit users with real-time travel-related information. Current information that can be provided to transit users includes transit routes, schedules, transfer options, fares, real-time schedule adherence, current incidents, weather conditions, and special events are provided. In addition to tailored information for individual transit users, this function also supports general annunciation and/or display of general schedule information, imminent arrival information, and other information of general interest to transit users.	*Project 3.3* *Project 3.3F* *Project 3.2MA* *Project 3.3MA* *Project 3.1ME* *Project 3.4ME* *Project 3.3SJ* *Project 3.5SJ* *Project 3.5ST* *Project 3.4T* *Project 3.5T*
On-Board Transit Security	This Function provides the capability to monitor the safety of transit vehicles using on-board safety sensors, processors and communications from the prerequisite On-board Trip Monitoring Function.	*Project 3.4MA* *Project 3.2ME* *Project 3.1ST* *Project 3.1T*
On-Board Transit Priority	This Function provides the capability for transit vehicles to request signal priority through short range communication directly with traffic control equipment at the roadside.	*Project 3.1F*
On-Board Transit Trip Monitoring	This Function provides the capabilities to support fleet management with automatic vehicle location and automated mileage and fuel reporting and auditing. This package may also record other special events resulting from communication with roadside equipment. This includes only the equipment on board the vehicle to support this function including the vehicle location devices such as GPS equipment, communication interfaces, a processor to record trip length, and the sensors/actuators/interfaces necessary to record mileage and fuel usage.	*Project 3.2* *Project 3.4F* *Project 3.1KI* *Project 3.2ME* *Project 3.3ME* *Project 3.2SJ* *Project 3.2ST* *Project 3.6ST* *Project 3.2T*

6.6 Information Service Provider Subsystem

This subsystem collects, processes, stores, and disseminates transportation information to system operators and the traveling public. The subsystem can play several different roles in an integrated ITS. In one role, the ISP provides a general data warehousing function, collecting information from transportation system operators and redistributing this information to other system operators in the region and other ISPs. In this information redistribution role, the ISP provides a bridge between the various transportation systems that produce the information and the other ISPs and their subscribers that

use the information. The second role of an ISP is focused on delivery of traveler information to subscribers and the public at large. Information provided includes basic advisories, real time traffic condition and transit schedule information, yellow pages information, ride matching information, and parking information. The subsystem also provides the capability to provide specific directions to travelers by receiving origin and destination requests from travelers, generating route plans, and returning the calculated plans to the users. In addition to general route planning for travelers, the ISP also supports specialized route planning for vehicle fleets. In this third role, the ISP function may be dedicated to, or even embedded within, the dispatch system. Reservation services are also provided in advanced implementations. The information is provided to the traveler through the Personal Information Access Subsystem, Remote Traveler Support Subsystem, and various Vehicle Subsystems through available communications links. Both basic one-way (broadcast) and personalized two-way information provision is supported. The subsystem provides the capability for an informational infrastructure to connect providers and consumers, and gather that market information needed to assist in the planning of service improvements and in maintenance of operations. **Table 6.6** lists the functions for the Information Service Provider.

Table 6.6: Information Service Provider Functional Descriptions

Function	Functional Description	Project X-Ref
Basic Information Broadcast	This Function provides the capabilities to collect, process, store, bill, and disseminate traveler information including traveler, transit, ride matching, traffic, and parking information. The traveler information shall include maintaining a database of local area services available to travelers with up-to-the-minute information and providing an interactive connectivity between sponsors and providers of services. The transit information shall include the latest available information on transit routes and schedules, transit transfer options, transit fares, and real-time schedule adherence. The traffic information shall include latest available information on traffic and highway conditions, and current situation information in real-time including incidents, road construction, recommended routes, current speeds on specific routes, current parking conditions in key areas, schedules for any current or soon to start events, and current weather situations. [*This Function shall also provide users with real-time travel related information while they are traveling, and disseminate to assist the travelers in making decisions about transfers and modification of trips. These capabilities shall be provided using equipment such as a fixed facility with a communications system such as a data Subcarrier multiplexing device.*]	*Project 4.1* *Project 4.1ME* *Project 4.1SJ* *Project 4.1ST*
ISP Data Collection	[*This function collects and stores traveler information that is collected in the course of operation of the ISP subsystem. This data can be used directly by operations personnel or it can be made available to other data users and archives in the region.*]	No project planned
Interactive Infrastructure Information	[*This Function shall have as prerequisite the capabilities of the Basic Information Broadcast Function. This Function augments the Basic Information Broadcast Function by providing the capabilities for interactive traveler information.*]	*Project 4.1* *Project 4.7* *Project 4.8* *Project 4.1ME* *Project 4.1SJ* *Project 4.1ST*

Table 6.6: Information Service Provider Functional Descriptions

Function	Functional Description	Project X-Ref
Infrastructure Provided Yellow Pages and Reservations	[*This Function shall have as prerequisite the capabilities of the Interactive Infrastructure Information Function. In addition, this Function provides the capability to provide specific traveler information, such as Yellow Pages information, with reservation capabilities*.]	*Project 4.4* *Project 4.1ME*
Infrastructure Provided Route Guidance	[*This Function shall have as prerequisite the capabilities of the Interactive Infrastructure Information Function. In addition, this Function provides the capability to provide specific directions to travelers by receiving origin and destination requests from travelers, generating route plans, returning the calculated plans to the users, and then potentially logging the route plans with Traffic Management Subsystem. This additional capability shall be provided using equipment such as a workstation type processor and software for route planning and traffic measurements along with additional communications capabilities including dialup lines, PCS telephones, and wireless data transceivers*.]	No project planned

6.7 Personal Information Access Subsystem

This subsystem provides the capability for travelers to receive formatted traffic advisories from their homes, place of work, major trip generation sites, personal portable devices, and over multiple types of electronic media. These capabilities shall also provide basic routing information and allow users to select those transportation modes that allow them to avoid congestion, or more advanced capabilities to allow users to specify those transportation parameters that are unique to their individual needs and receive travel information. This subsystem shall provide capabilities to receive route planning from the infrastructure at fixed locations such as in their homes, their place of work, and at mobile locations such as from personal portable devices and in the vehicle or perform the route planning process at a mobile information access location. This subsystem shall also provide the capability to initiate a distress signal and cancel a prior issued manual request for help. **Table 6.7** lists the functions for Personal Information Access.

Table 6.7: Personal Information Access Functional Descriptions

Function	Functional Description	Project X-Ref
Personal Basic Information Reception	This Function shall provide the capability for travelers to interface with the ISP Subsystem Basic Information Broadcast Function and receive formatted traffic advisories including accurate traveling information concerning available travel options and their availability, and congestion information from their Personal Information Access Subsystem to include their homes, place of work, major trip generation sites, personal portable devices, and over multiple types of electronic media such as facsimile machines, portable AM/FM radios, and a pager processor.	Private Sector Provided + *Project 4.1* *Project 4.4* *Project 4.6* *Project 4.7*
Personal Interactive Information Reception	This Function shall provide the capability for travelers to interface with the ISP Subsystem Infrastructure Functions including the Interactive Infrastructure Information Function, and the Infrastructure Provided Route Selection, Yellow Pages and Reservation, and Dynamic Ridesharing Functions. These	Private sector Provided + *Project 4.1* *Project 4.4* *Project 4.6*

Table 6.7: Personal Information Access Functional Descriptions

Function	Functional Description	Project X-Ref
	capabilities shall be provided using the Personal Information Access Subsystem equipment such as cellular telephone, interactive TV, Personal Computer, and pager with alpha display using communication medium and equipment such as two-way radio, CATV, and wireless data transceivers.	*Project 4.7*
Personal Location Determination	This function determines current location information and provides this information to other functions that use the location information to provide various ITS services.	Private Sector Provided
Personal Mayday Interface	This Function shall provide the capability to initiate a distress signal and cancel a prior issued manual request for help using the Personal Information Access Subsystem. This capability shall be provided using equipment such as a processor to automatically dial the Emergency Management Subsystem and provide location.	*Private Sector Provided (but interface to regional 9-1-1 centers not yet implemented)*
Personal provider-Based Route Guidance	[*This Function coordinates with an ISP-Based route planning service to select a suggested route plan that is tailored to the traveler's preferences. Coordination may continue during the trip so that the route plan can be modified to account for new information. Many equipment configurations are possible including systems that provide a basic route plan to the traveler as well as more sophisticated systems that can provide transition by transition guidance to the traveler along a multi-modal route plan*.]	*To be Private Sector Provided (Telematics Service Providers)*
Personal Autonomous Route Guidance	This Function provides multi-modal route planning and transition by route guidance. It provides autonomous route guidance in the absence of real-time information or factors information provided by the infrastructure into its route selection and guidance algorithms. The function also includes those truly autonomous systems that are not configured to receive or process any external data.	Private Sector Provided

6.8 Remote Traveler Support Subsystem

This subsystem provides access to traveler information at transit stations, transit stops, other fixed sites along travel routes, and at major trip generation locations such as special event centers, hotels, office complexes, amusement parks, and theaters. Traveler information access points include kiosks and informational displays supporting varied levels of interaction and information access. At transit stops, simple displays providing schedule information and imminent arrival signals can be provided. This basic information may be extended to include multi-modal information including traffic conditions and transit schedules along with yellow pages information to support mode and route selection at major trip generation sites. Personalized route planning and route guidance information can also be provided based on criteria supplied by the traveler. In addition to traveler information provision, this subsystem also supports public safety monitoring using CCTV cameras or other surveillance equipment and emergency notification within these public areas. Fare card maintenance, and other features which enhance traveler convenience may also be provided at the discretion of the deploying agency. **Table 6.8** lists the functions for Remote Traveler Support.

Table 6.8: Remote Traveler Support Functional Descriptions

Function	Functional Description	Project X-Ref
Remote Basic Information Reception	This Function shall provide the capability for travelers to interface with the ISP Subsystem Basic Information Broadcast Function and receive formatted traffic advisories including accurate traveling information concerning available travel options and their availability, and congestion information at the Remote Traveler Support Subsystem.	*Project 4.1* *Project 4.4* *Project 4.6* *Project 4.7*
Remote Interactive Information Reception	This Function shall provide the capability for travelers to interface with the ISP Subsystem Infrastructure Functions including the Interactive Infrastructure Information Function, the Infrastructure Provided Route Selection, Yellow Pages and Reservation, and Dynamic Ridesharing Functions. These capabilities shall be provided using the Remote Traveler Support Subsystem equipment such as interactive TV and kiosk using communication medium and equipment such as CATV and wireline and wireless data transceivers.	*Project 4.1* *Project 4.4* *Project 4.6* *Project 4.7*
Remote Mayday Interface	This Function provides the capability to report an emergency and summons assistance. The equipment includes a traveler interface that facilitates generation of a distress signal under duress and wireline communications that carries this distress signal and allows follow-up verification and determination of the nature of the emergency and the required response. This function notifies either the Emergency Management or Transit Management Subsystem depending on the implementation.	Private Sector Provided
Remote Transit Information Services	The Function furnishes transit users with real-time travel-related information at transit stops, multi-modal transfer points, and other public transportation areas. It provides transit users with the latest available information on transit routes, schedules, transfer options, fares, real-time schedule adherence, current incidents, weather conditions, and special events. In addition to tailored information for individual transit users, this function supports general annunciation and/or display of imminent arrival information and other information of general interest to transit users.	*Project 3.3*
Secure Area Monitoring	[*This Function provides the capability to monitor the safety of transit users at Remote Traveler Subsystem locations. It collects surveillance images and data and relays this information back to the Transit Management Subsystem*.]	No Project Planned

6.9 Roadway Subsystem

This subsystem includes the equipment distributed on and along the roadway which monitors and controls traffic. Equipment includes highway advisory radios, dynamic message signs, cellular call boxes, CCTV cameras and video image processing systems for incident detection and verification, vehicle detectors, traffic signals, grade crossing warning systems, and freeway ramp metering systems. This subsystem also provides the capability for emissions and environmental condition monitoring including weather sensors, pavement icing sensors, fog etc. HOV lane management and reversible lane management functions are also available. Intersection collision avoidance, curve warning and speed warning functions are provided by determining the onset or existence of hazardous conditions and

sending appropriate warnings and/or control actions to the approaching vehicles. **Table 6.9** lists the functions for the Roadway Subsystem.

Table 6.9: Roadway Functional Descriptions

Function	Functional Description	Project X-Ref
Roadside Data Collection	[*This function collects traffic, road, and environmental conditions information for use in transportation planning, research, and other off-line applications where data quality and completeness take precedence over real-time performance. This function includes the sensors, supporting roadside infrastructure, and communications equipment that collects and transfers information to a center for archival*.]	*Project 2.3*
Roadside Signal Priority	This Function shall provide the capability to receive vehicle signal priority requests and control roadside signals accordingly.	*Project 1.10F* *Project 1.1KE* *Project 2.1ME* *Project 2.2ST* *Project 1.6T*
Roadway Basic Surveillance	This Function provides the capabilities to monitor traffic flow in major intersections and on main highways for urban areas and to monitor road conditions using fixed equipment such as loop detectors and wireline communication.	*All ATMS Projects*
Roadway Environmental Monitoring	This Function measures environmental conditions and communicates the collected information back to a center where it can be monitored and analyzed. A broad array of general weather and road surface information may be collected. Weather conditions that may be measured include temperature, wind, humidity, precipitation, and visibility. Surface and sub-surface sensors can measure road surface temperature, moisture, icing, salinity, and other measures. Air quality monitoring can include point monitoring of individual vehicles as well as general monitoring of standard air quality measures.	*Project 4.2, 4.9* *Project 1.8F* *Project 1.5KE* *Project 1.7KE*
Roadway Freeway Control	Ramp meters, CMS and other freeway control devices that will control traffic on freeways.	*Project 4.2, 4.9* *Project 1.8F* *Project 1.5KE* *Project 1.7KE*
Roadway Incident Detection	[This Function provides incident detection capability to reside at the roadside. For example, advanced CCTV's with built-in incident detection algorithms would allow the actual detection function to be roadside rather than transmitting images to a center for visual or automated detection.]	No Project Planned
Roadway Intersection Collision Warning	This Function provides the capability to determine the probability of a collision in the intersection and send appropriate warnings and/or control actions to the approaching vehicles using a short-range interface. This Function also provides the capability that the traffic control signals provide signal indication information to the vehicles using a short-range interface and the vehicle performs the determination of the probability of collision in the intersection. This package covers intersections between vehicles and railroad at grade crossings.	*Project 1.4F* *Project 1.2KI* *Project 1.1ME* *Project 1.1SJ* *Project 1.9SJ* *Project 1.4ST* *Project 1.8T*

Table 6.9: Roadway Functional Descriptions

Function	Functional Description	Project X-Ref
Roadway Signal Control	This Function provides the capabilities to control traffic signals at major intersections and on main highways for urban areas. This Function is generally constrained to a single jurisdiction.	*Project 1.2F* *Project 1.11F* *Project 1.1KI* *Project 1.3KI* *Project 1.3ME* *Project 1.6ME* *Project 1.7SJ* *Project 1.2ST* *Project 1.1T* *Project 1.2T*
Roadway Hazard Warning System	[*This Function provides the capability to detect the existence or onset of a hazardous condition in the roadway or by vehicles traveling the roadway and sends appropriate signals to a static or dynamic sign to inform motorists of the hazardous condition in real-time*.]	*Project 1.1* *Project 2.1F* *Project 1.5KE* *Project 1.1MA* *Project 1.3MA*
Roadway Traffic Information Dissemination	This Function provides the roadside elements of traffic information dissemination including DMS and HAR.	*Project 1.2, 1.3, 1.4, 1.5, 4.5, 4.7* *Project 1.3F, 1.9F, 2.1F, 4.1F* *Project 1.4KE* *Project 1.6KE* *Project 1.2MA, 1.3MA* *Project 1.4ME, 1.5ME* *Project 2.1ME* *Project 1.3SJ* *Project 1.5SJ* *Project 1.8SJ* *Project 1.10SJ* *Project 1.3ST* *Project 2.3ST* *Project 4.1ST* *Project 1.7T*
Standard Rail Crossing	This Function manages highway traffic at highway-rail intersections (HRIs) where operational requirements do not dictate advanced features (e.g., where rail operational speeds are less than 80 miles per hour). Either passive (e.g., the crossbuck sign) or active warning systems (e.g., flashing lights and gates) are supported depending on the specific requirements for each intersection. These traditional HRI warning systems may also be augmented with other standard traffic management devices. The warning systems are activated on notification by interfaced wayside equipment of an approaching train. The equipment at the HRI may also be interconnected with adjacent signalized intersections so that local control can be adapted to highway-rail intersection activities. Health monitoring of the HRI equipment and interfaces is performed; detected abnormalities are reported through interfaces to the wayside interface equipment and the traffic management subsystem.	*Project 1.4F* *Project 1.2KI* *Project 1.1ME* *Project 1.1SJ* *Project 1.9SJ* *Project 1.4ST* *Project 1.8T*

Table 6.9: Roadway Functional Descriptions

Function	Functional Description	Project X-Ref
Advanced Rail Crossing	[*This function manages highway traffic at highway-rail intersections (HRIs) where operational requirements demand advanced features (e.g., where rail operational speeds are greater than 80 miles per hour). It includes all capabilities from the Standard Rail Crossing function and augments these with additional safety features. The active warning systems supported by this market package includes positive barrier systems that preclude entrance into the intersection when the barriers are activated. Like the Standard package, the HRI equipment is activated on notification by wayside interface equipment that detects, or communicates with the approaching train. In this function, the wayside interface equipment also provides additional information about the arriving train so that the train's direction of travel, its estimated time of arrival, and the estimated duration of closure may be derived. This enhanced information may be conveyed to the driver prior to, or in context with, warning system activation. This function also includes detection capabilities that enable it to detect an entrapped or otherwise immobilized vehicle within the HRI and provide an immediate notification to the wayside interface equipment and traffic management*.]	*Project 1.4F* *Project 1.2KI* *Project 1.1ME* *Project 1.1SJ* *Project 1.9SJ* *Project 1.4ST* *Project 1.8T*

6.10 Commercial Vehicle Check Subsystem

The Commercial Vehicle Check Subsystem supports automated vehicle identification at mainline speeds for credential checking, roadside safety inspections, and weigh-in-motion using two-way data exchange. These capabilities include providing warnings to the commercial vehicle drivers, their fleet managers, and proper authorities of any safety problems that have been identified, accessing and examining historical safety data, and automatically deciding whether to allow the vehicle to pass or require it to stop with operator manual override. The Commercial Vehicle Check Subsystem also provides supplemental inspection services to current capabilities by supporting expedited brake inspections, the use of operator hand-held devices, on-board safety database access, and the enrollment of vehicles and carriers in the electronic clearance program. Some commercial vehicle check functions exist in the San Joaquin Valley but as a matter of policy, no CVO projects have been identified in this SDP. **Table 6.10** lists the functions for the Commercial Vehicle Check Subsystem.

Table 6.10: Commercial Vehicle Check Functional Descriptions

Function	Functional Description	Project X-Ref
Citation and Accident Electronic Recording	The equipment package documents violations and forwards the information to the Commercial vehicle if available and to the CVAS for processing as part of the normal credentials processing package	Not included in SDP project list
Roadside Electronic Screening	This Equipment package provides the Commercial Vehicle Check Subsystem the capabilities for two-way communication with approaching properly equipped commercial vehicles at mainline speeds, reading tags for automated vehicle identification and credential checking. There will be a capability to appropriately screen all vehicles, not just those that are equipped. This Equipment package shall be able to process the data from the commercial vehicles along with accessed database information to determine whether a pull-in message is needed or to generate random pull-in messages with provisions for facility operators and enforcement officials to have manual override capabilities. Support shall be provided to both interstate and intrastate carriers.	Not included in SDP project list
Roadside Safety Inspection	This Equipment package provides the Commercial Vehicle Check Subsystem the capabilities for operators to automate the roadside safety inspection process including the support of use of hand held devices to rapidly inspect the vehicle and driver. In addition this Equipment package provides the Roadside Check Subsystem the capabilities for operators to automate the roadside safety inspection process including the support of automated mainline speed reading of on-board safety data to rapidly screen the vehicle and driver. This Equipment package shall also provide the capabilities to collect, store, maintain, and provide safety data and access historical safety data after receiving identification from vehicles at mainline speeds or while stopped at the roadside. Results of screening and summary safety inspection can be written back onto the tag. The capabilities to process safety data and issue pull-in messages or provide warnings to the driver, carrier, and enforcement agencies shall be provided. These capabilities have a prerequisite of the Roadside Electronic Screening Equipment package and shall be provided primarily through the utilization of an additional safety database. Since a vehicle may cross jurisdiction boundaries during a trip, this equipment package supports the concept of a last clearance event record (aka trip ticket) carried on the vehicle s tag. The last clearance event record reflects the results of the roadside verification action. For example, if the vehicle is pulled over in State A and undergoes credential, weight, and safety checks, the results of the clearance process are written to the vehicle s tag. If the vehicle continues the trip and passes a roadside station in State B, the State B station has access to the results of the previous pull-in because it can read the last clearance event record written by the State A roadside station.	Not included in SDP project list

Table 6.10: Commercial Vehicle Check Functional Descriptions

Function	Functional Description	Project X-Ref
Roadside WIM	This Equipment package allows for roadside high-speed weigh in motion. This package can be fixed to a location or mobile. It can include an interface to the credential check package and augment electronic credentials check with electronic weight check or it can be a stand alone package with display.	Not included in SDP project list

6.11 Archived Data Management Subsystem

The Archived Data Management Subsystem collects, archives, manages, and distributes data generated from ITS sources for use in transportation administration, policy evaluation, safety, planning, performance monitoring, program assessment, operations, and research applications. The data received is formatted, tagged with attributes that define the data source, conditions under which it was collected, data transformations, and other information (i.e. meta data) necessary to interpret the data. The subsystem can fuse ITS generated data with data from non-ITS sources and other archives to generate information products utilizing data from multiple functional areas, modes, and jurisdictions. The subsystem prepares data products that can serve as inputs to Federal, State, and local data reporting systems. This subsystem may be implemented in many different ways. It may reside within an operational center and provide focused access to a particular agency's data archives. Alternatively, it may operate as a distinct center that collects data from multiple agencies and sources and provides a general data warehouse service for a region. **Table 6.10** lists the functions for Archived Data Management.

Table 6.11: Archived Data Management Functional Descriptions

Function	Functional Description	Project X-Ref
ITS Data Repository	[*This equipment package collects data and data catalogs from one or more data sources and stores the data in a focused repository that is suited to a particular set of ITS data users. This equipment package includes capabilities for performing quality checks on the incoming data, error notification, and archive to archive coordination. This equipment package supports a broad range of implementations, ranging from simple data marts that collect a focused set of data and serve a particular user community to large-scale data warehouses that collect, integrate, and summarize transportation data from multiple sources and serve a broad array of users within a region*.]	No Project Planned
Traffic and Roadside Data Archival	[*This equipment package collects and archives traffic, roadway, and environmental information for use in off-line planning, research, and analysis. The equipment package controls and collects information directly from equipment at the roadside, reflecting the deployment of traffic detectors that are used primarily for traffic monitoring and planning purposes rather than for traffic management*.]	No Project Planned

Table 6.11: Archived Data Management Functional Descriptions

Function	Functional Description	Project X-Ref
Virtual Data Warehouse Services	[*This equipment package provides capabilities to access "in-place" data from geographically dispersed archives and coordinate information exchange with a local data warehouse. While many of the functions performed by this equipment package are similar to the functions inherent in other archived data management subsystem equipment packages (e.g. data management, fusion, analysis) this equipment package also provides the specialized publishing, directory services, and transaction management functions associated with coordinating remote archives. In addition, this equipment package performs functions on an as-needed basis, thereby negating the need to maintain the comprehensive set of data from the remote archives in the local data warehouse*.]	No Project Planned

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SECTION 7.0

INFORMATION FLOWS AND INTERFACE REQUIREMENTS

7.0 INFORMATION FLOWS AND INTERFACE REQUIREMENTS

In the context of the San Joaquin Valley ITS architecture, information flows will be interpreted as "architecture flows" as defined in the National ITS Architecture. These flows are high-level data exchange requirements between physical elements of the architecture, i.e. the architecture subsystems. As shown in the previous section, these subsystems include the major functional areas of Management Centers, Roadway Devices, Vehicles and Personal Access. The data in these flows is carried by the architecture interconnects, or communications networks supporting ITS. These have been established as:

- **Wireline networks** – networks supporting fixed elements of the architecture (centers and roadway devices). These networks include the Internet, public agency-owned fiber optic networks, signal interconnect networks, and the like.
- **Wide Area Wireless networks** – public and private networks that support both fixed and mobile elements of the architecture. These networks can support mobile access to the Internet. Wide area wireless networks also include "private" radio systems (as seen by the Federal Communications Commission) such as law enforcement trunked radio systems, transit fleet radio systems, etc.
- **Dedicated Short-Range Communications networks** – networks primarily serving communications between roadway devices and vehicles. These networks include, for example, emergency vehicle preemption and transit vehicle signal priority treatments through direct vehicle to signal controller communications.
- **Vehicle-to-Vehicle networks** – networks that support advanced vehicle control applications such as the Automated Highway System.

Other communications systems that support ITS applications include local area networks (LAN's) that are typically used within modal management centers, such as a freeway management system running in a Caltrans TMC. These internal networks typically support single systems like Advanced Traffic Management Systems (ATMS) that include components such as applications servers, database servers and operator workstations.

Connectivity between physical architecture subsystems is greatly facilitated by the use of standard interfaces, or means of connecting to a network on one side, and to physical components on the other side. One of the best known interface standards is the RS-232C standard for connecting low data rate computing elements to communications devices such as modems. The RS-232C standard includes such mundane details as the electrical signal format (how "1's" and "0's" are formed), pin-out definitions for standard 9-pin and 25-pin connectors, and the meaning of signals on each pin (communications protocol). Other standard interfaces run the gamut from the means to encode analog video signals into a digital signal to the means to exchange high level data between dissimilar transportation management

centers (e.g. a freeway management center and a transit management center). In Section 8, the subject of standards and their use in ITS applications is covered in detail.

7.1 Information Flows

Because information flows are equivalent to architecture flows in the National ITS Architecture, the artifact of Market Packages will be used to express the flows needed to support projected ITS applications in the San Joaquin Valley. As previously described in Working Paper #3, Market Packages are defined as deployable combinations of equipment, functions and communications interconnects that support ITS User Services. Market Packages consist of physical elements (subsystems) within the architecture, connected by high-level data flows. The physical elements contain Equipment Packages that we have previously defined in Section 6 as high-level functions. For the San Joaquin Valley architecture development, standard National ITS Architecture Market Packages have been adapted, tailored and combined to form templates for eight (8) major functional areas within this regional architecture. These 8 functional areas include the following:

- Incident Management
- Traffic Management
- Transit Management
- Transit Traveler Information and Basic Advanced Traveler Information
- Advanced ATIS (deployable over the long term)
- Emergency Management
- Archive Data Management
- Highway/Rail Interface

Figure 7.1 through **Figure 7.8** provide the SJV-tailored Market Package diagrams corresponding to the 8 major functional areas.

7.2 Interface Requirements

To address interface requirements, **Figure 7.9** through **Figure7.17** provide a tailored architecture interconnect diagram for Valley-wide ITS applications followed by an architecture interconnect diagram for each of the eight (8) counties in the San Joaquin Valley. As would be expected, the Valley-wide applications are more comprehensive in terms of interface requirements than the individual counties. Each of the counties has a differing degree of complexity depending on the extent of ITS applications already deployed or planned through project development. The fundamental requirement for virtually all of the projects under development in this Strategic Deployment Plan is increased reliance upon wide area wireline communications for implementing local signal interconnects, local “interties” (multi-jurisdictional shared viewing and/or control), “smart” corridors and connectivity between major transportation nodes in the Valley.

Figure 7.1: Incident Management Market Packages

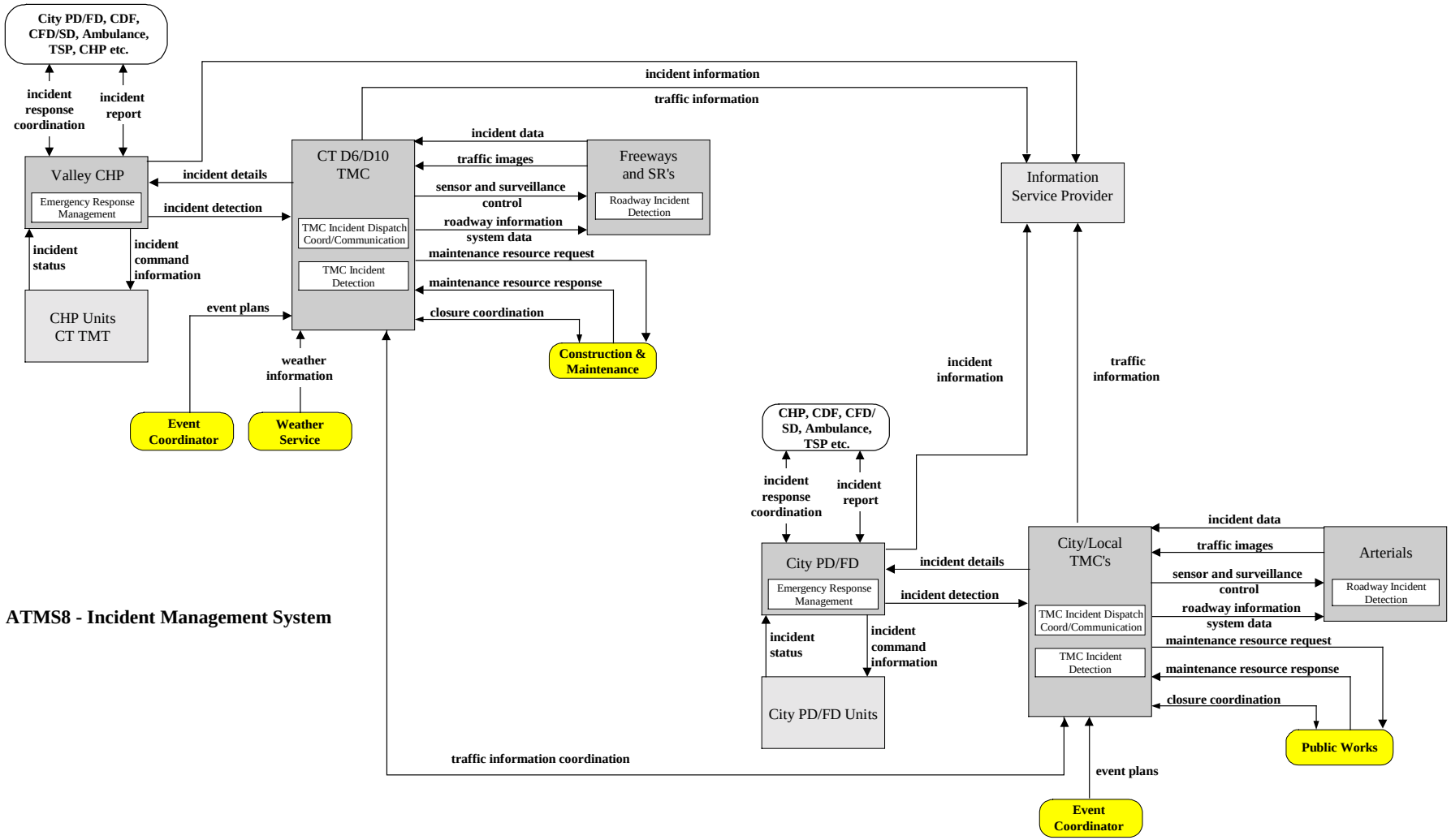


Figure 7.2: Integrated Traffic Management Market Packages

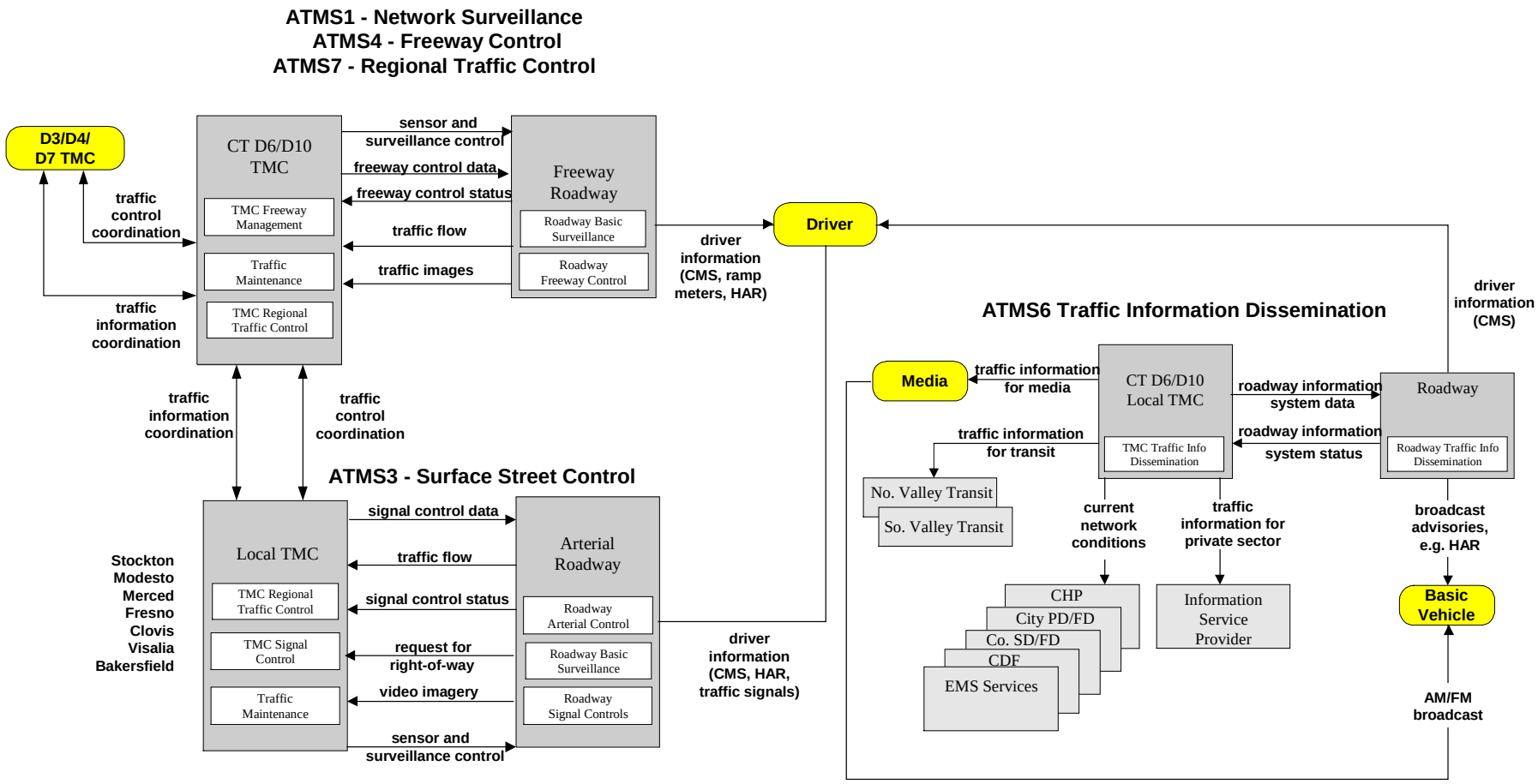


Figure 7.3: Transit Management Market Packages

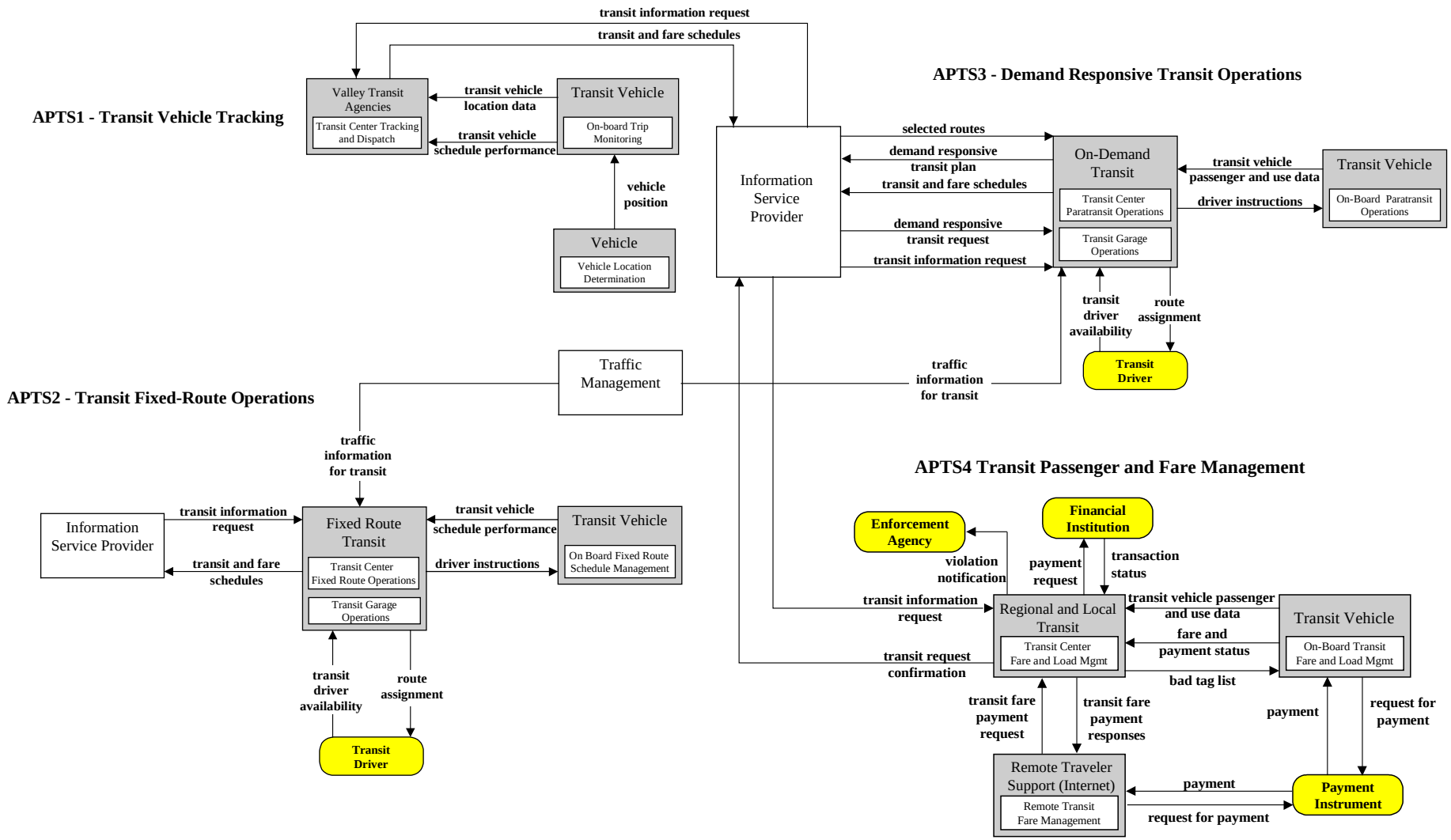


Figure 7.4: Transit Traveler Information and Basic ATIS Market Packages

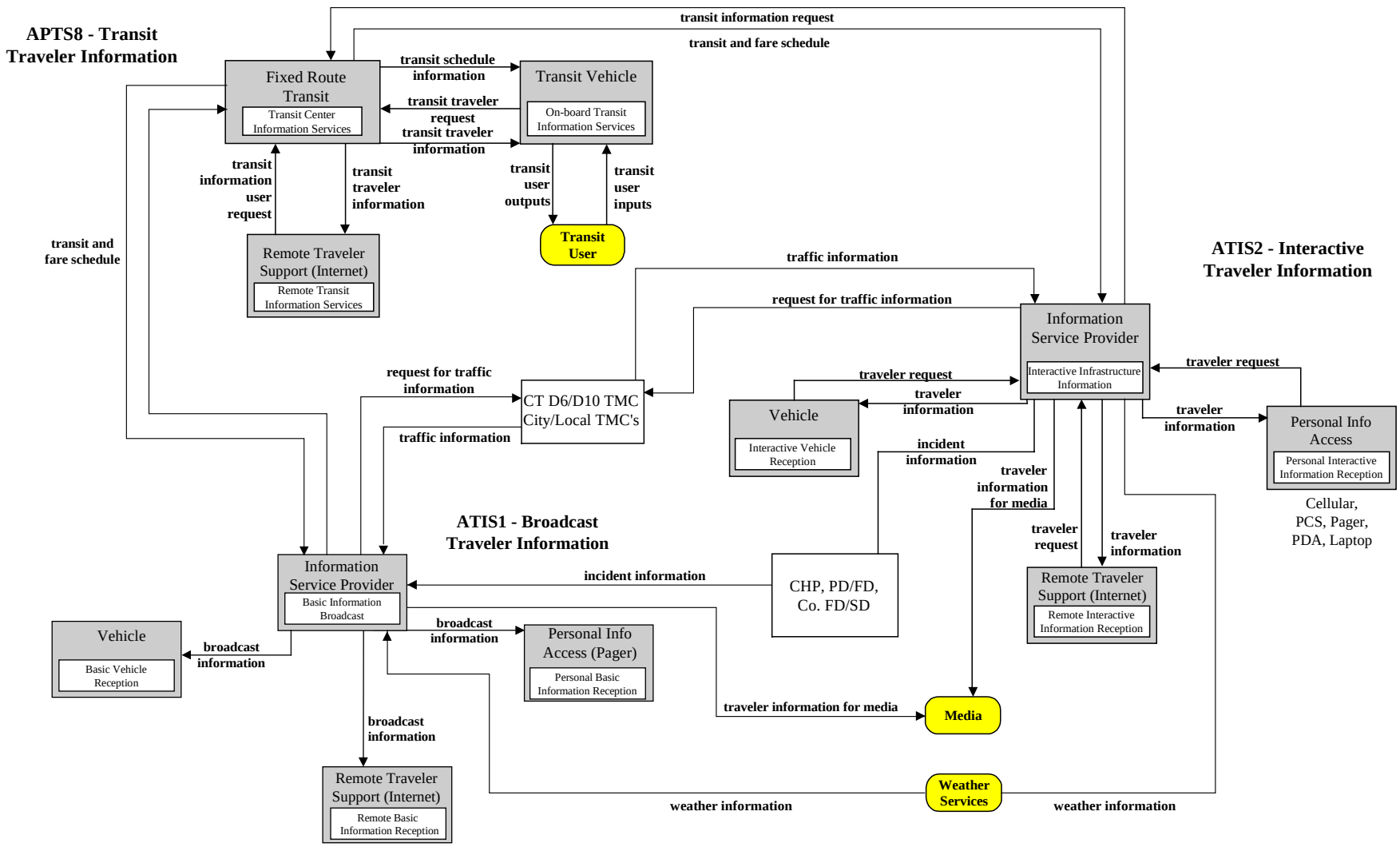
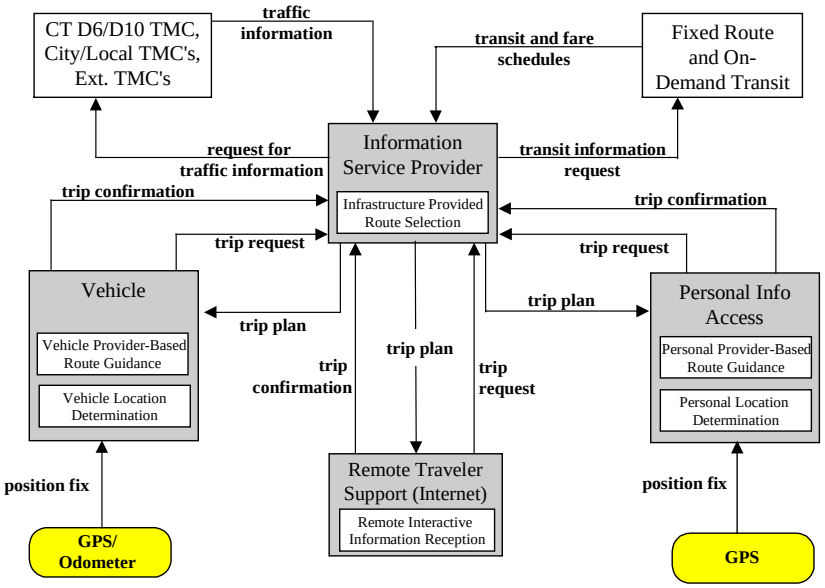


Figure 7.5: Longer Term ATIS Market Packages

ATIS5 - ISP Based Route Guidance



ATIS7 - Yellow Pages and Reservation

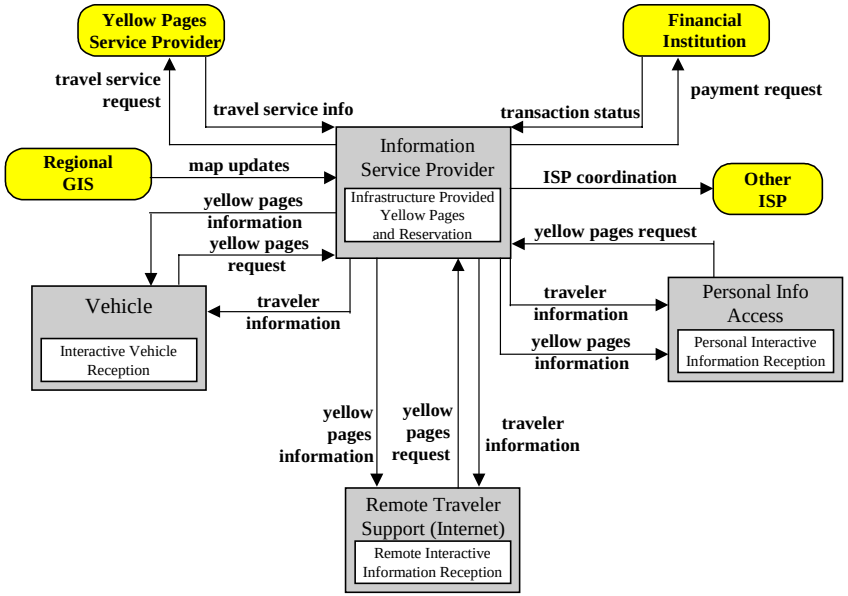


Figure 7.6: Emergency Management Market Packages

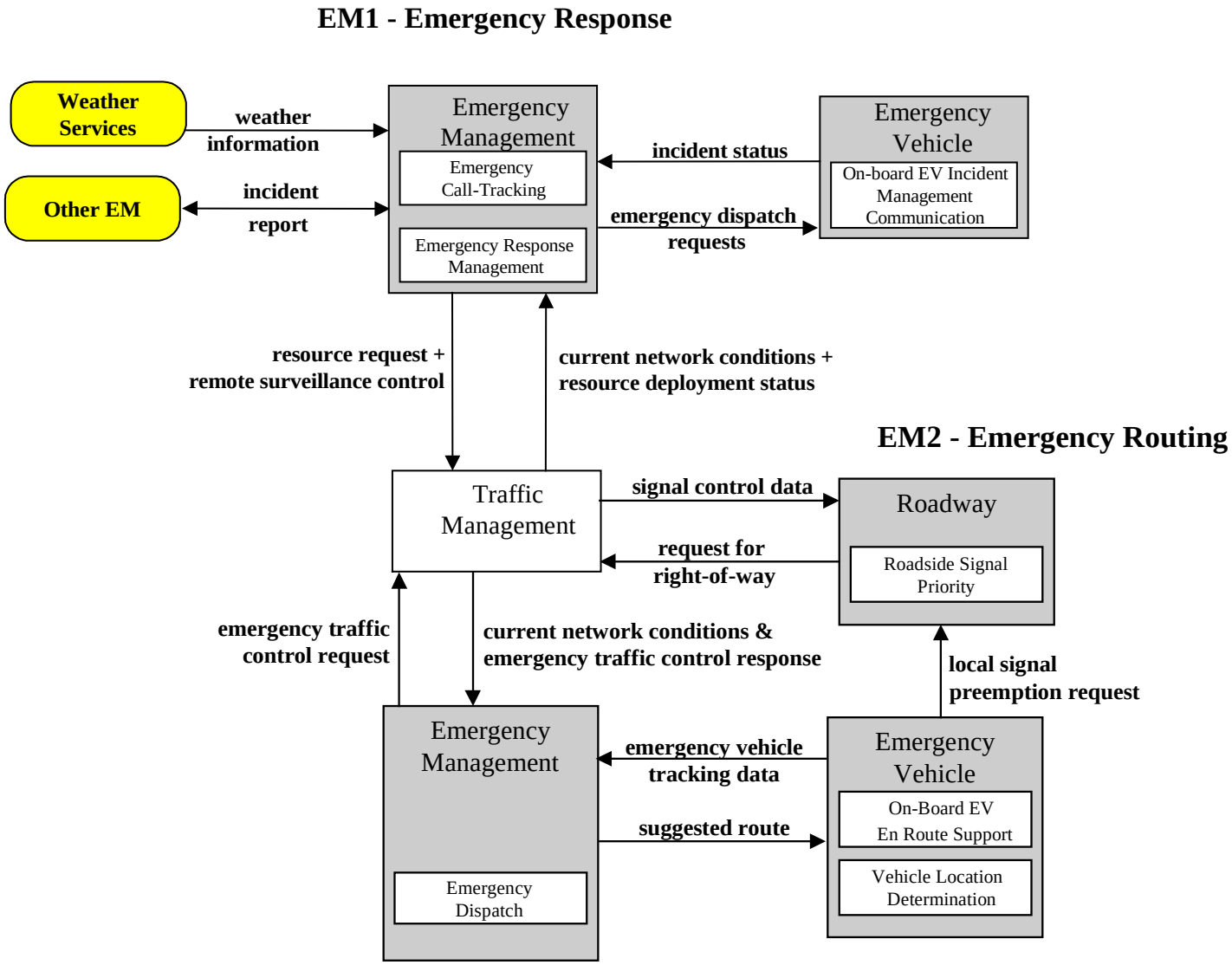


Figure 7.7: Archived Data Market Packages

AD1- ITS Data Mart

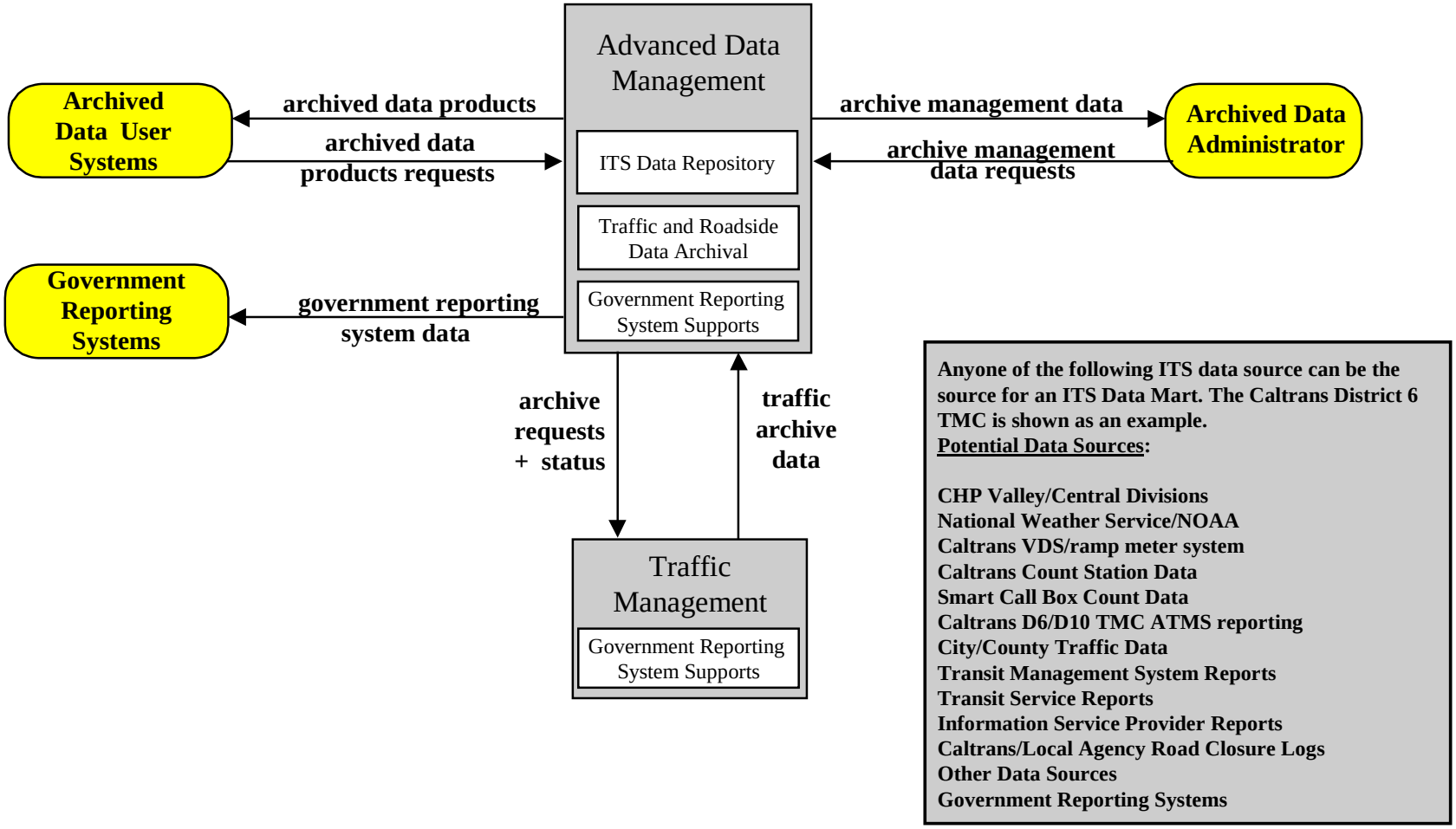


Figure 7.8: Highway/Rail Interface Market Packages

ATMS14 - Advanced Railroad Grade Crossing
ATMS15 - Railroad Operations Coordination

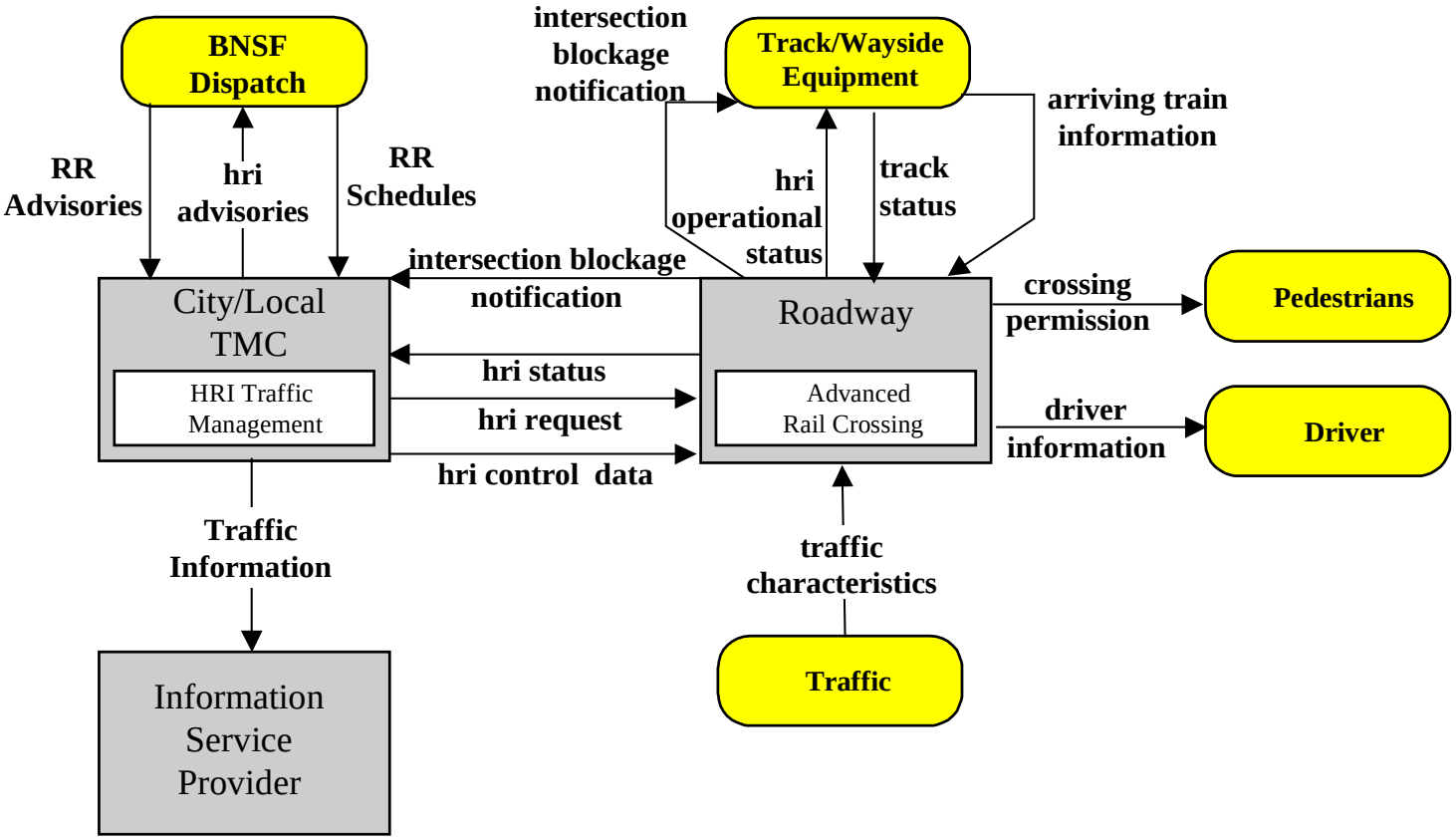


Figure 7.9: San Joaquin Valley Region Physical ITS Architecture

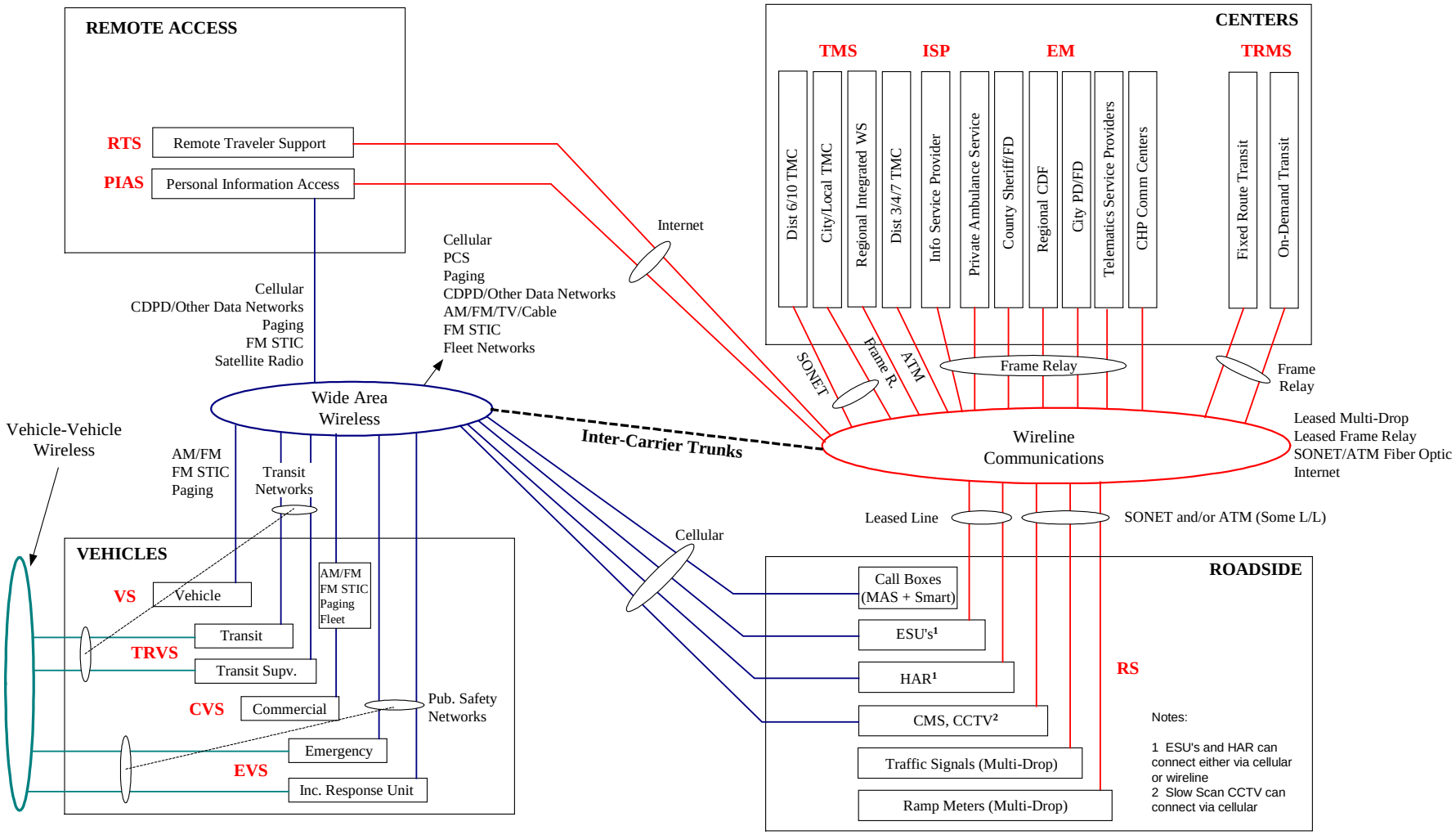


Figure 7.10: Fresno County Physical Architecture

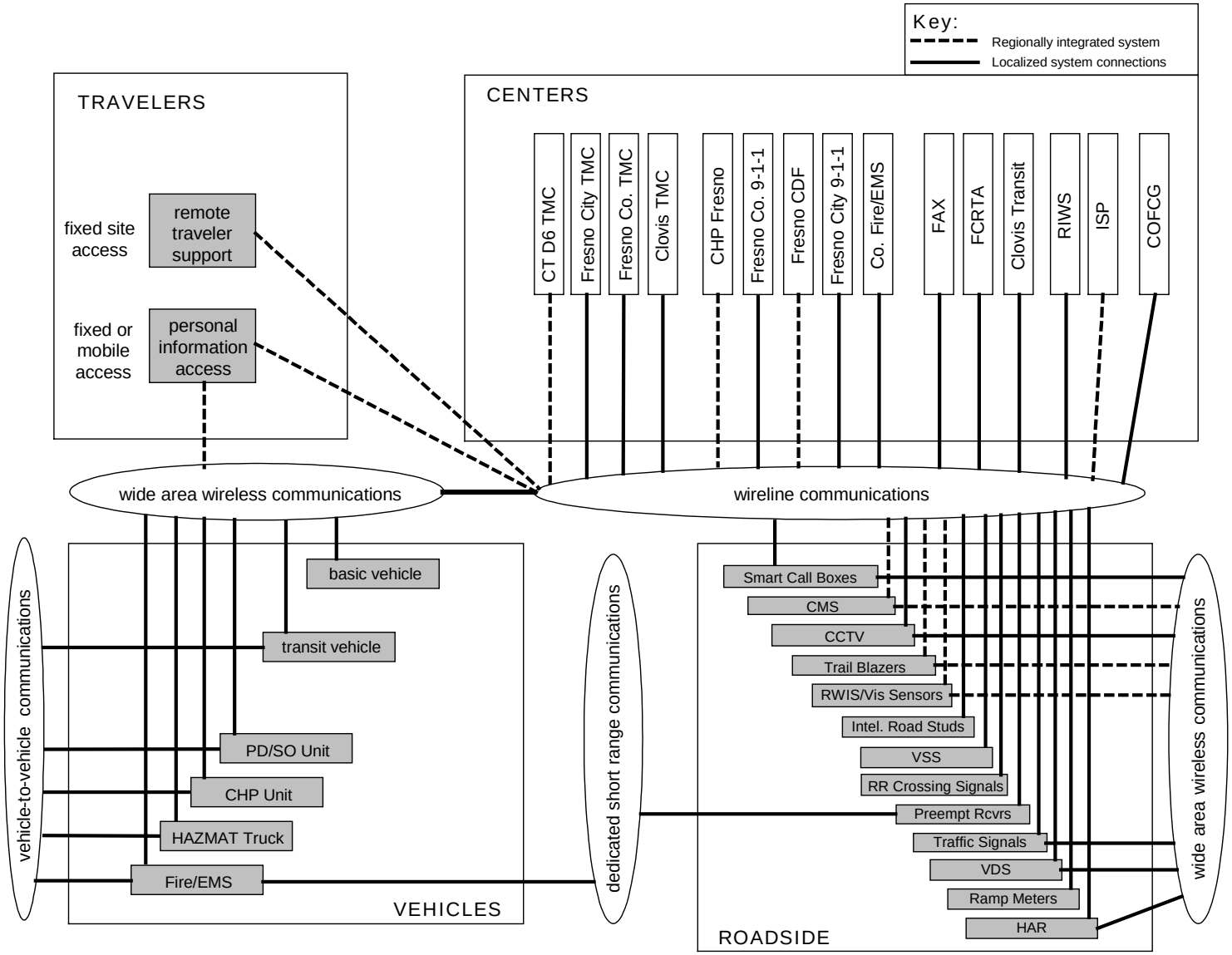


Figure 7.11: Kern County Physical Architecture

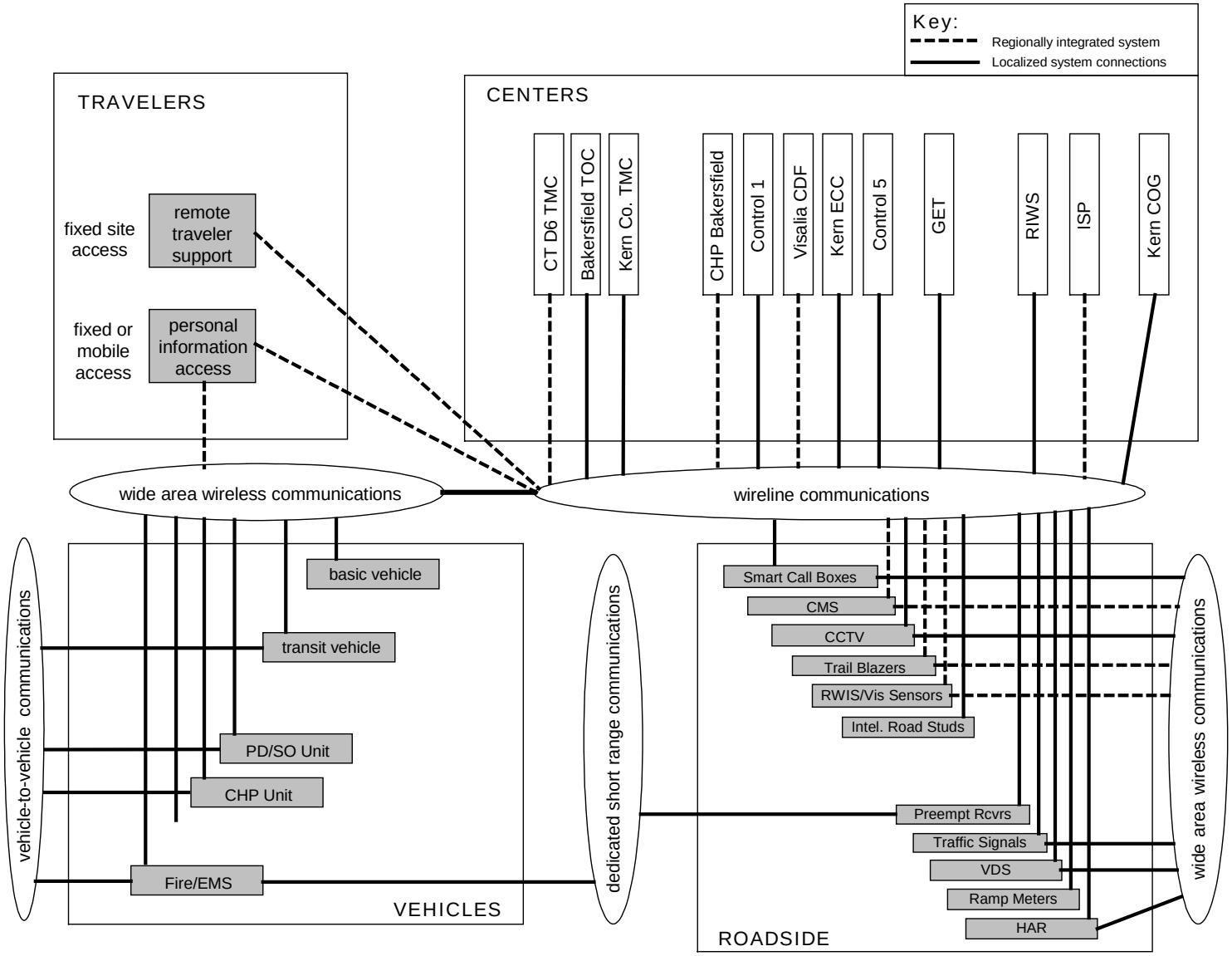


Figure 7.12: San Joaquin County Physical Architecture

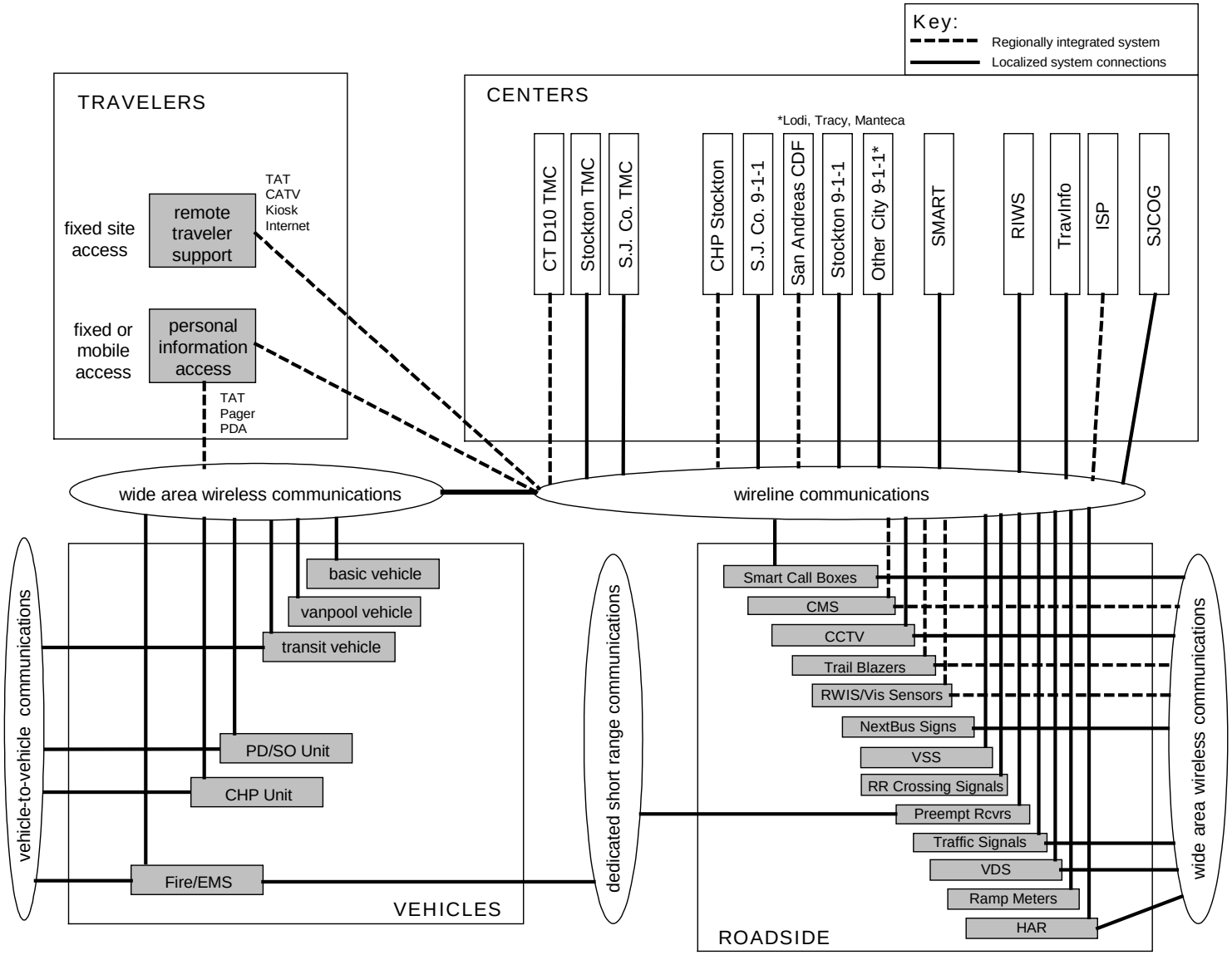


Figure 7.13: Stanislaus County Physical Architecture

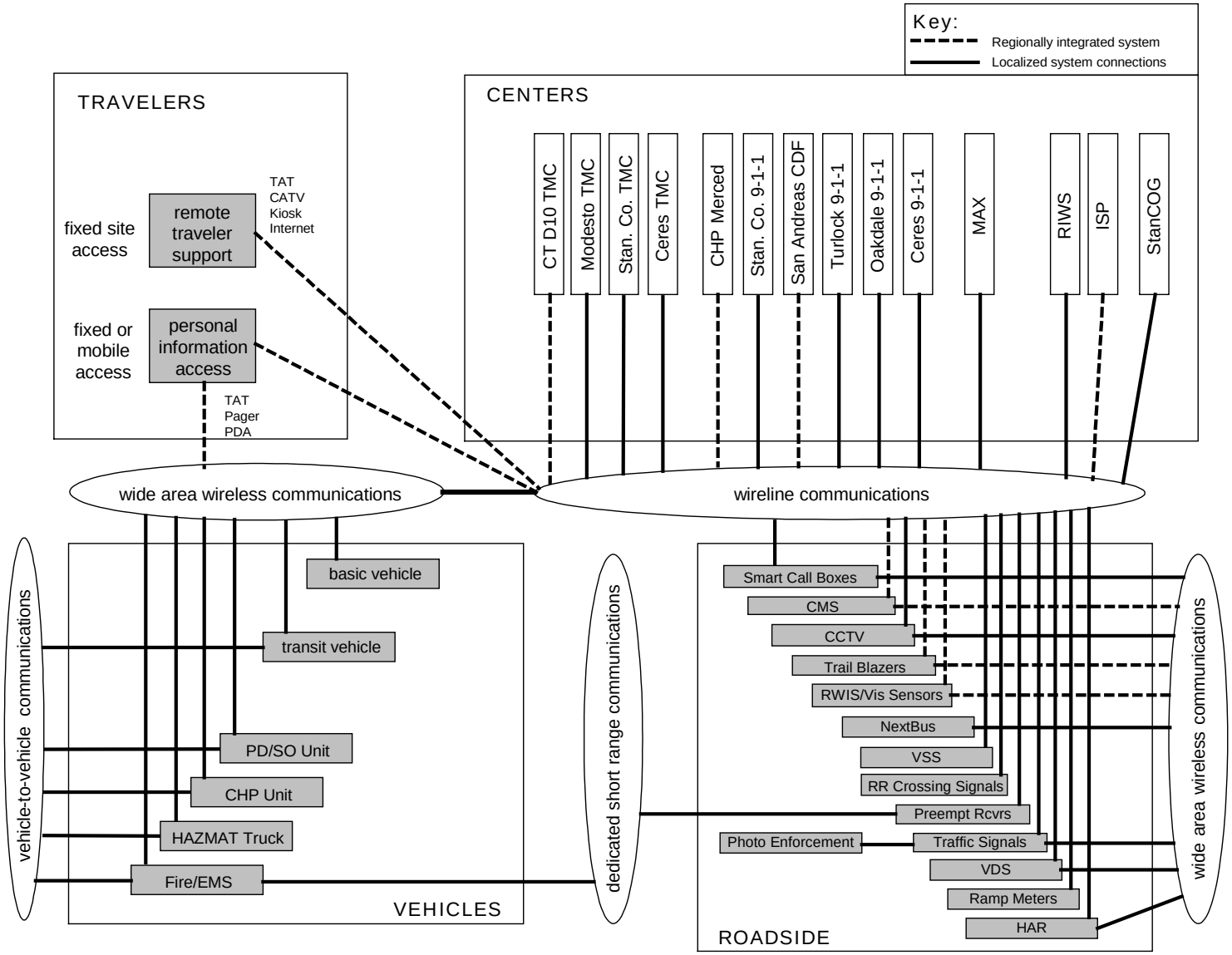


Figure 7.14: Tulare County Physical Architecture

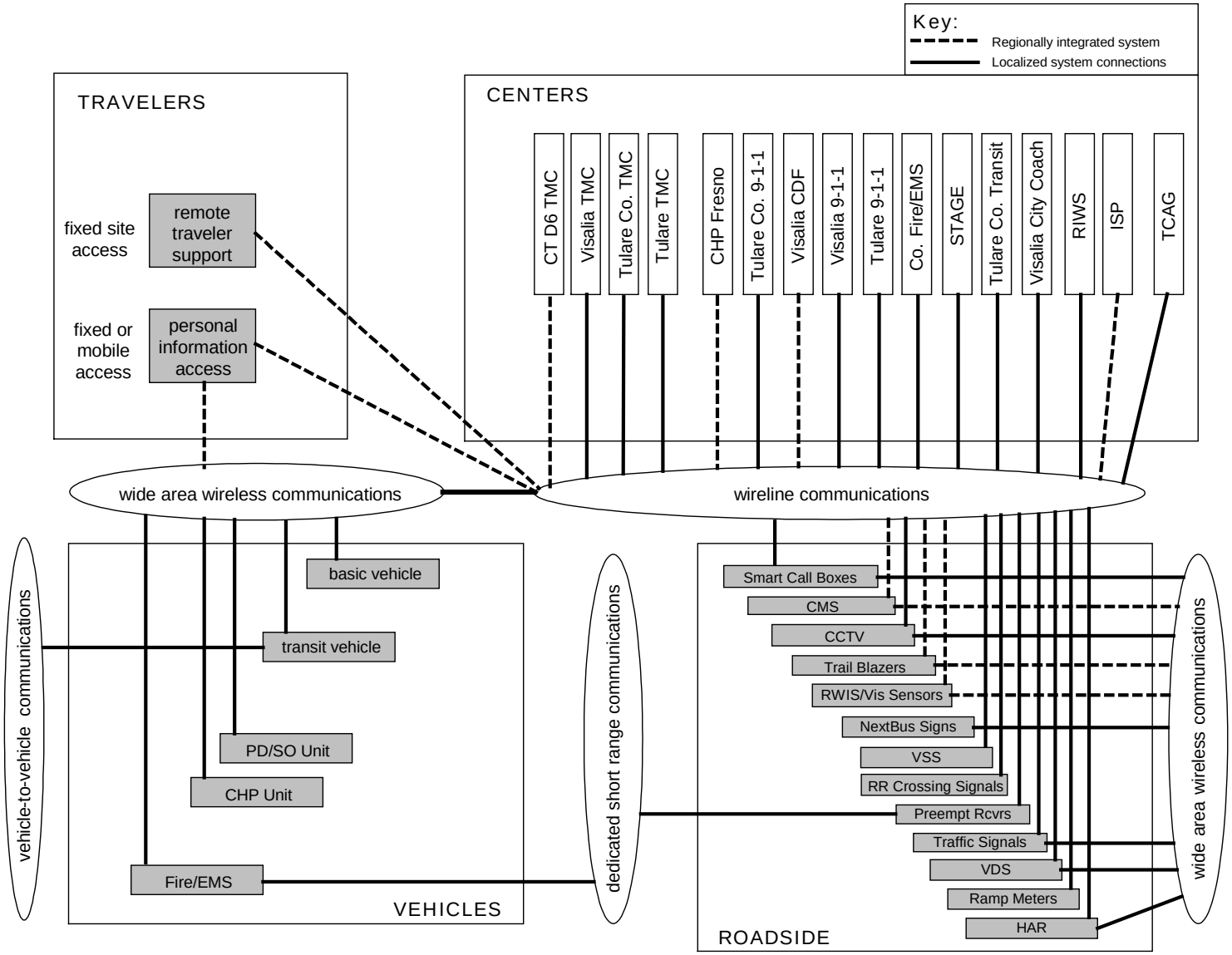


Figure 7.15: Merced County Physical Architecture

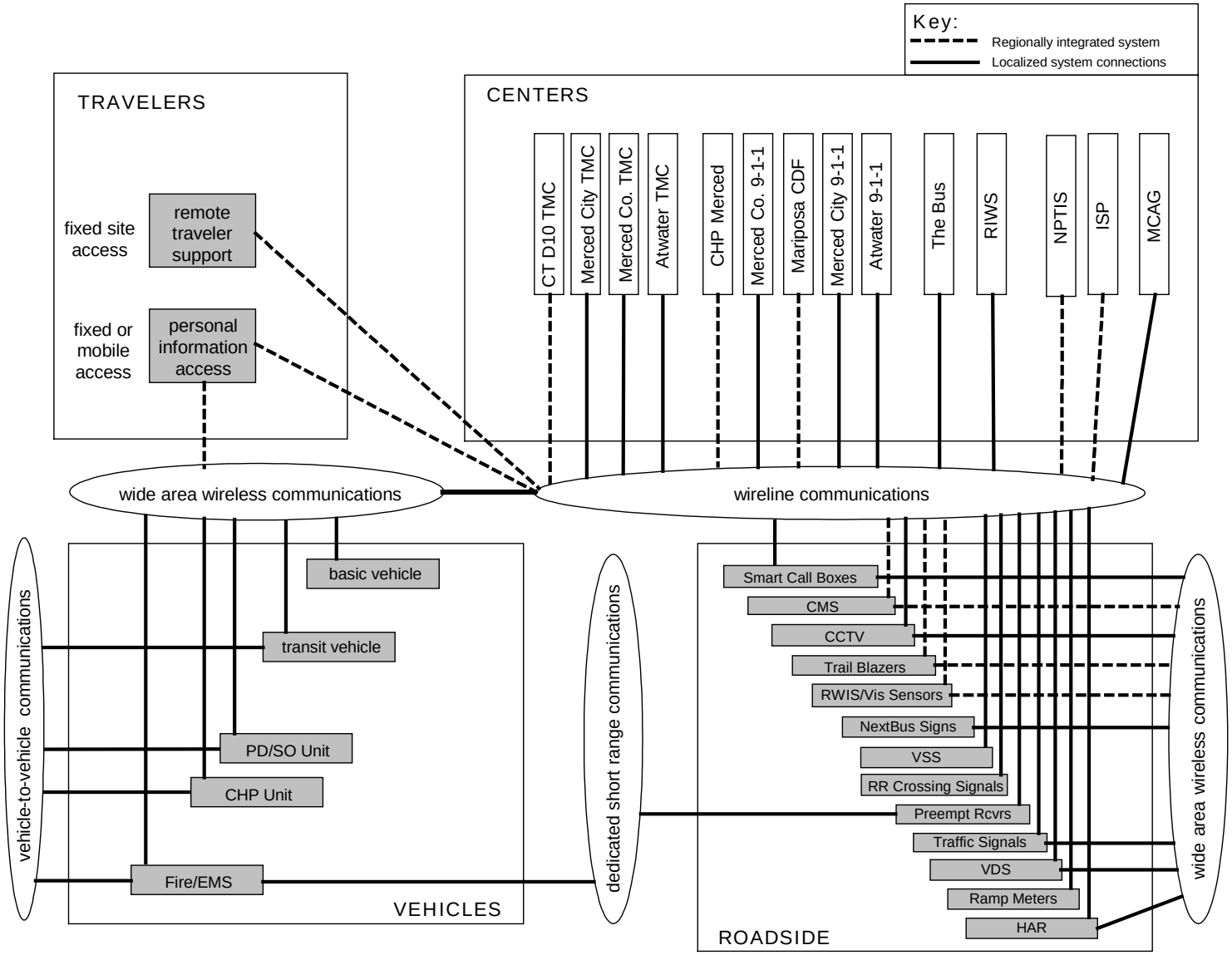


Figure 7.16: Kings County Physical Architecture

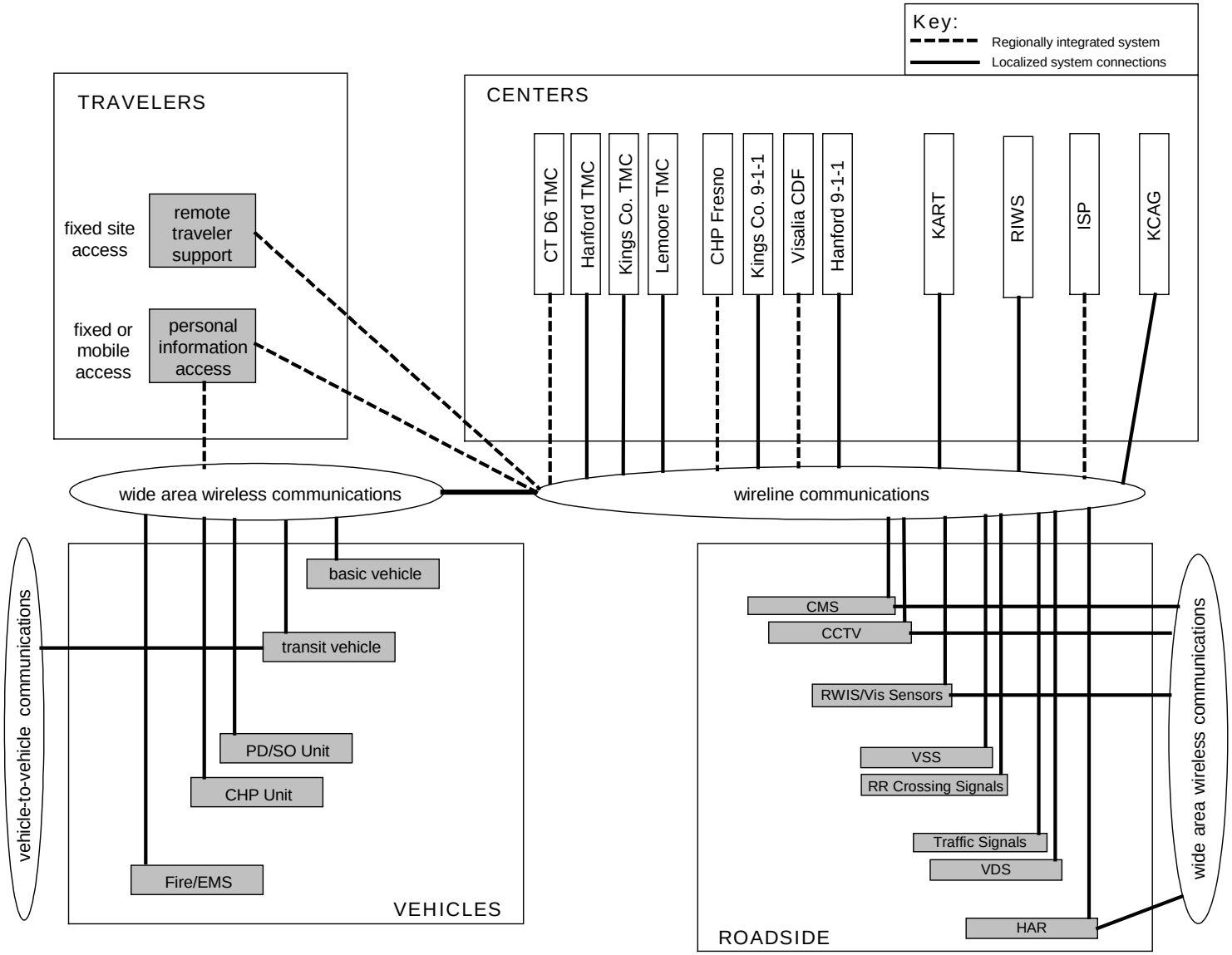
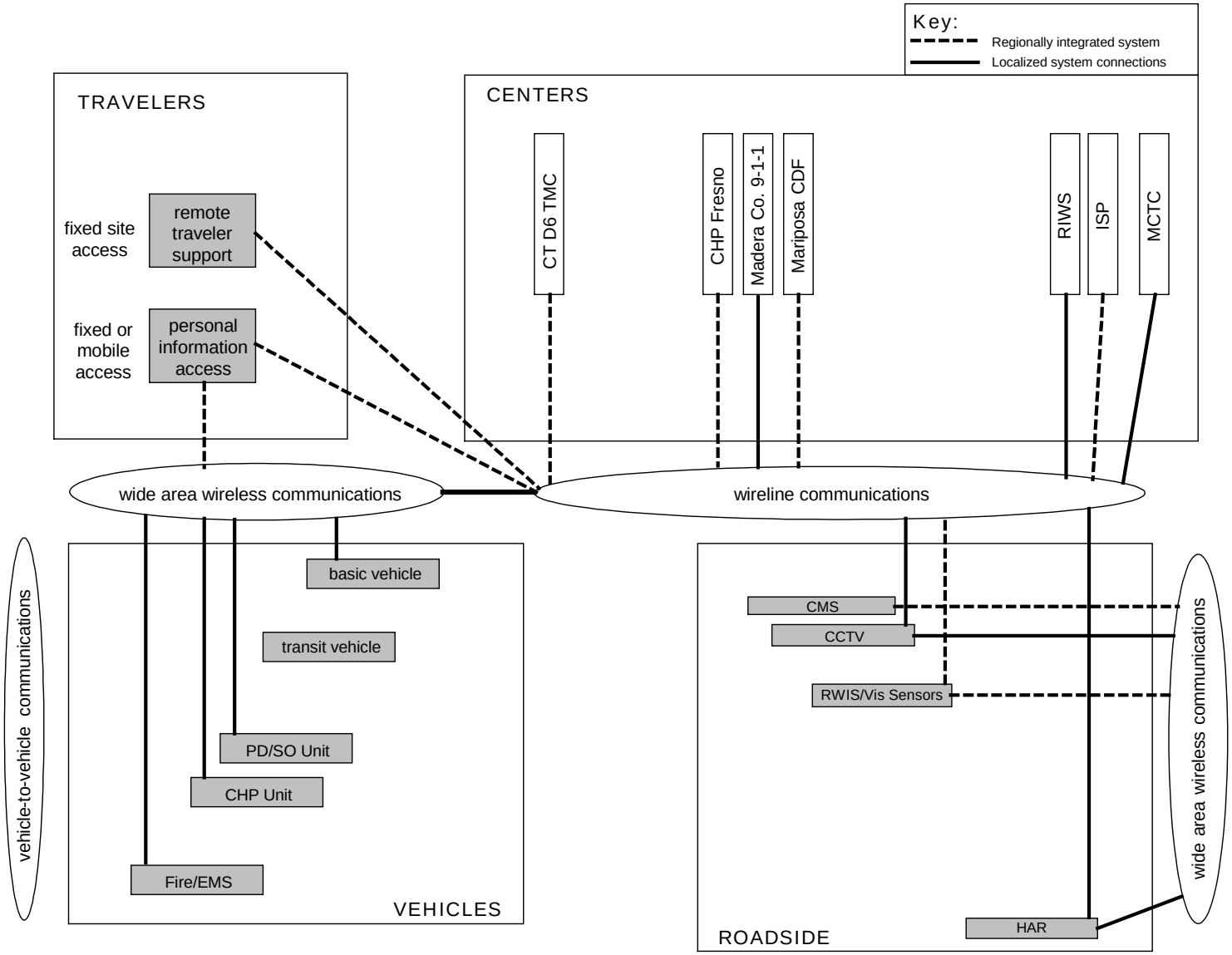


Figure 7.17: Madera County Physical Architecture



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SECTION 8.0

IDENTIFICATION OF DESIRED STANDARDS

8.0 IDENTIFICATION OF DESIRED STANDARDS

This section will provide a brief overview of the current ITS standards issues that are relevant to the San Joaquin Valley Regional Architecture. ITS standards are considered essential both for enhanced local, regional, and national interoperability and operational application. Led by the Federal Highway Administration (FHWA) in conjunction with the American Association of State Highway and Transportation Officials (AASHTO) and the Institute of Transportation Engineers (ITE), the National Electrical Manufacturers Association (NEMA) has been developing standards for the National Transportation Communications for ITS Protocol (NTCIP). NTCIP will provide a communications standard that ensures the interoperability and interchangeability of ITS devices and transportation centers. This spearheaded the development of a number of standards related to the identification, transfer, and dissemination of transportation information. The various Standards Development Organizations (SDO's) including the International Standards Organization (ISO) are actively developing critical interfacing standards including data dictionaries, message sets, and communications protocol. These SDO's are briefly described below.

8.1 Standards Development Organizations (SDO's)

The following paragraphs describe the various SDO's that are currently involved in some aspect of ITS standards development. Each of the underlined headings is a link to that organization's web site where further background information and details can be found. The overall responsibility for the ITS standards development program rests with the U.S. Department of Transportation, ITS Joint Program Office. Management and technical support for this effort is provided by ITS America (http://www.itsa.org).

American Association of State Highway and Transportation Officials (AASHTO): AASHTO, teamed with the National Electrical Manufacturers Association (NEMA) and the Institute of Transportation Engineers (ITE), is the lead organization for the National Transportation Communications for ITS Protocol (NTCIP). (Also see the NTCIP SDO description below.)

American National Standards Institute (ANSI): The American National Standards Institute (ANSI), the U.S. administrator and coordinator of private sector voluntary standardization, does not itself develop standards. An ANSI committee [the Accredited Standards Committee (ASC) X12] was chartered to develop standards to facilitate electronic data interchange (EDI) for business transactions. This committee is in the process of developing ITS-related standards involving commercial vehicle operations (CVO).

American Society for Testing & Materials (ASTM): ASTM provides a forum for producers, users, consumers, and others who have interest in standard test methods, specifications, practices, guides, classifications, and terminology. ASTM leads efforts in ITS standards concerning dedicated short-range communications (DSRC).

Commercial Vehicle Information Systems Network (CVISN – US DOT sponsored program): The scope of commercial vehicle operations, of which CVISN is a part, includes the operations and regulations associated with moving goods and passengers via commercial vehicles. It includes activities related to safety assurance, commercial vehicle credentials and tax administration, roadside operations, freight and fleet management, and vehicle operation.

Consumer Electronics Manufacturers Association (CEMA): CEMA is a sector of the Electronic Industries Alliance (EIA). Two ITS standards have been developed under the auspices of CEMA, both having to do with traveler information radio and FM subcarrier systems.

Data Interchange Standards Association (DISA): DISA was chartered by the American National Standards Institute (ANSI) to provide its Accredited Standards Committee (ASC) X12 with administrative support. Some commercial vehicle operations (CVO) related standards are available for purchase at this site.

Institute of Electrical and Electronics Engineers (IEEE): The IEEE develops and disseminates voluntary, consensus-based industry standards involving all types of electrotechnology. ITS-related standards being developed by IEEE include message sets and data dictionaries.

Institute of Transportation Engineers (ITE): The Institute of Transportation Engineers (ITE) is one of the largest professional transportation organizations in the world. ITE members include traffic engineers, transportation planners, and other professionals who are responsible for planning, designing, implementing, operating and maintaining surface transportation systems worldwide. ITE is involved in the development of NTCIP, TCIP, and other ITS standards.

ITS America (ITSA): The Intelligent Transportation Society of America fosters public/private partnerships to increase the safety and efficiency of surface transportation through the application of advanced technologies. This site contains many excellent resources for basic information on ITS and related topics.

National Electrical Manufacturers Association (NEMA): NEMA is one of the largest standards development organizations (SDOs) in the nation and represents over 600 member organizations. NEMA is a member organization of NTCIP and acts as the publisher of NTCIP standards.

National Transportation Communications for ITS Protocol (NTCIP): The primary objective of the NTCIP is to provide communication standards that ensure the interoperability and interchangeability of traffic control and intelligent transportation systems (ITS) devices. The NTCIP is the first protocol for the transportation industry that provides a communications interface between disparate hardware and software products.

Oak Ridge National Laboratory (ORNL): Oak Ridge National Laboratory's Intelligent Transportation Systems (ITS) Research Program provides technical assistance and program support to the FHWA in the following subject areas: traffic simulation, signal optimization, real-time control, human factors, automation and systems engineering, operations research, traffic models, and management information systems.

Security Industry Association (SIA): The SIA was formed in 1969 to promote growth and expansion in the access control, auto security, biometrics, burglar alarm, CCTV, lock hardware, monitoring, outdoor protection, perimeter protection, personal response systems and personal security product industries. SIA has recently begun to investigate the need for ITS-related standards.

Society of Automotive Engineers (SAE): This organization is made up of more than 75,000 engineers, business executives, educators, and students who share information and exchange ideas for advancing the engineering of mobility systems. Information about SAE's ITS standards activities can be found within the "Technical Committee" section of this Web site. SAE has developed several ITS standards related to in-vehicle electronics architectures and advanced traveler information systems.

Telecommunications Industry Association (TIA): TIA is a national trade organization that provides communications and information technology products, materials, systems, distribution services and professional services. The association's member companies manufacture or supply most of the products used in global communication networks.

Transit Communications Interface Profiles (TCIP): The TCIP is a family of ITS standards for transit communications. These new standards provide the interfaces among transit applications that will allow data to be shared by transit departments and other operating entities such as emergency response services and regional traffic management centers.

Transit Standards Consortium (TSC): The Transit Standards Consortium is a public/private, non-profit organization that facilitates the development, testing, maintenance, education, and training related to transit standards. The organization includes transit agencies, standards bodies, vendors, and other interested parties.

Volpe National Transportation Systems Center : The John A. Volpe National Transportation Systems Center (Volpe Center), located in Cambridge, MA, is an organization of the Federal Government whose principal role is to serve as a national center of transportation and logistics expertise. As such, it provides research, analytic, management, and engineering support to the U.S. Department of Transportation, other Federal agencies, and state and local governments.

8.2 Standards Elements

A number of key elements make up a standard or set of standards. These include Data Dictionaries, Message Sets, Object Definitions and Communications Protocol. Each of these will be described in more detail below.

8.2.1 DATA DICTIONARY

Data Dictionaries provide the definition and format of individual data elements that are then grouped into individual messages. In other words, messages are the sentences and data elements are the individual words.

Two good examples of data dictionaries are the Traffic Management Data Dictionary (TMDD) developed by the Institute of Transportation Engineers (ITE) and the Advanced Traveler Information Systems (ATIS) Data Dictionary developed by SAE.

8.2.2 MESSAGE SET

Message Sets (MS) are an essential component in the design and operation of modern computer based systems. They provide the basic information flows (generally described as messages) upon which communications between systems depend. Specifically, a message set provides the information definition (semantics) and format (syntax) to handle individual informational exchanges on specific topics. Thus, agreed upon message sets with unambiguous message definitions is one of the essential characteristics of standards required for information exchange between individual traffic management systems. Message sets are also important for communications between traffic management systems and other ITS users and/or suppliers of traffic related information. An example of a currently implemented Message Set is Location Reference Message Specification (LRMS). This specification standard was developed at Oak Ridge National Laboratory. The LRMS establishes standard formats for individual messages used within message sets to convey locations. The design of the LRMS is based on three fundamental concepts. First, the transfer of a location is a message in itself. Second, the use of multiple location message options (termed profiles) is used within an expandable framework. Finally, the use of a set of well-known ground control points (referred to as “datums”) is used to permit registration of different map databases to one another so that locations transferred can be understood with minimal ambiguity. Message Sets work in hand-in-hand with Data Dictionaries and Communications Protocol.

8.2.3 OBJECT DEFINITIONS

The analogy to message sets in the world of object oriented software is object definitions. Under the Common Object Request Broker Architecture (CORBA) protocol, object definitions are expressed as Interface Definition Language, or IDL. Objects are intuitive in nature – for example bus objects, traffic signal objects, vehicle detector objects, incident objects, etc. Each defined object has attributes, or characteristics and methods that act upon it. For example, a bus object contains attributes of <driver ID>, <bus number>, <passenger capacity>, <wheelchair compatible>, and so on. A bus object can be created, removed or stored – these are examples of its methods. Object definitions will gradually evolve as more and more object oriented systems are deployed. One major shortcoming of defining object-oriented architectures is that the National ITS Architecture is not yet object oriented. However, this does not necessarily lessen the value of the National Architecture in the definition of a regional architecture containing object-oriented systems.

8.2.4 COMMUNICATIONS PROTOCOL

Communications protocol is the set of data exchange rules that tie together the message set and data dictionary definitions. One could imagine having a word vocabulary and sentence structure but no grammar. This would be the situation if no communications protocol existed to allow interoperation between transportation management centers, for example. One of the more critical developments affecting a regional ITS architecture has been the evolving process of the NTCIP Application Profiles, formerly known as the NTCIP Class E or Center-to-Center standards. Currently, there are five NTCIP Application Profiles: 2301 (Simple Transportation Management Framework), 2302 (Trivial File Transfer Protocol), 2303 (File Transfer protocol), 2304 (Data Exchange ASN.1, also known as DATEX) and 2305 (Common Object Request broker Architecture – CORBA). We will concern ourselves with only the 2304 and 2305 standards at this point. Center-to-Center communications encompasses the exchange of information between domain-specific systems such as freeway management systems, transit management systems, emergency management systems, information service provider systems, traffic signal systems, and commercial vehicle systems. Because it is the fundamental standard used to interconnect management systems across modes, the C2C standard is crucial to the development of a regional architecture.

The Center-to-Center (C2C) Working Group of the NTCIP is developing the CORBA and DATEX-ASN protocols to provide optional paths for inter-system communications. These protocols complement each other and together provide a convenient means for any type of system to join a data exchange network. Through the proper use of these two protocols, the ITS industry will be able to more readily integrate disparate systems. Some specific details of CORBA are provided as an example of how center-to-center protocol might be implemented in the real world. It should be noted that the California Alliance for Advanced Transportation Systems (CAATS) Statewide ITS Architecture recognizes the existence of both CORBA and DATEX and provides for their interconnection.

CORBA uses object-oriented technologies to provide advanced data exchange services. All of the data available for data exchange are registered with the local *object request broker (ORB)*. Each center implements an ORB and related CORBA services software, comprising the CORBA system. This software is commercially available. At the simplest level, when a remote data item (such as an externally generated incident) is required to perform an action, the CORBA system is then responsible for negotiating the data exchange with the various brokers. As a result, from the programmer's perspective, all data on the network appear to be locally available. This simplifies computer code and allows a very modular design of software.

CORBA provides several features to support networks connecting object oriented systems, and assuming sufficient processing power and communications bandwidth are provided, it could be used for all applications between such systems. The DATEX protocol uses a mature message set with a less mature protocol and currently a lesser availability of commercial development tools. Conversely, CORBA uses less mature object models with a more mature protocol. Over time, as a standardized reference model emerges, new object-oriented systems come on line, and processing and communications resources are upgraded, more and more systems will use the CORBA protocol. Non-object-oriented “legacy” (pre-existing) systems may connect to a CORBA network through the Legacy Bridge function. The operation of this Legacy Bridge function in the case of transit data is illustrated in **Figure 8.1**. The proper operation of a Legacy Bridge assumes that a standard set of object definitions exists for a specific regional architecture.

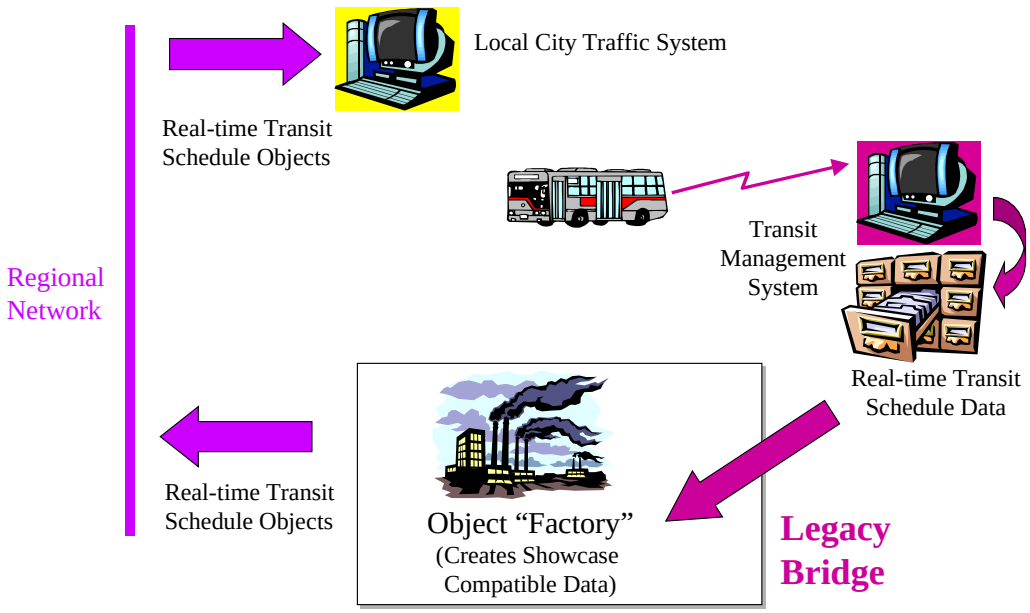


Figure 8.1: Converting Legacy Data into Standard CORBA-Compatible Object Definitions

Figure 8.2 shows how all of these standards inter-relate. For each system interface in the architecture, there must be a formal definition of (1) how the data will be exchanged (protocol), (2) the data message structure (message sets), and (3) data element definitions (data dictionary).

The IEEE Data Dictionary Standard (IEEE P1489, Box 1a in Figure 8.2) documents the basic building block used to define ITS data elements and other data concepts. The Message Set Template Standard (IEEE P1488, Box 2a) defines the format used to combine individual data elements together in order to form ITS messages. ITS messages provide a description of *what* to transfer, but not the details of *how* the information is transferred.

Functional area data dictionaries (Box 1b) and message sets (Box 2b) use the above formats to define their requirements. As mentioned previously, these standards include the Traffic Management Data Dictionary (TMDD) for ATMS systems, the Transit Communications Interface Profiles (TCIP) for transit systems, and the SAE J-Series standards for ATIS and in-vehicle devices, among others. Local agencies should also use these formats when specifying project-specific data and messages. This will allow future integration efforts to readily understand the design of the local system and allow maximum reuse of computer code.

ITS messages can be readily transmitted using the DATEX-ASN protocol (Box 3a). Alternatively, the information and functionality contained within the ITS messages can be mapped to an object-oriented data model (Box 1c) and reference model (Box 2c) according to the rules defined by Object Management Group (OMG) standards (Box 2d). These object-oriented data and reference models, described in terms of a notation scheme called Unified Modeling Language (UML) and and a data specification called Interface Definition Language (IDL), can then be used as the basis for exchanging data using the Common Object Request Broker Architecture (CORBA) protocols (Box 3b). *For the San*

Joaquin Valley architecture, the CORBA approach will be recommended since other areas in California have already invested in the development of CORBA software tools for transportation applications. Regardless of the application-specific protocol used (e.g. transportation applications), the Internet protocols (Transmission Control Protocol-TCP, User Datagram Protocol-UDP, and Internet Protocol-IP (Box 4) are normally used for sending data over the network. This is consistent with the requirements of the NTCIP 2305 CORBA Application Profile.

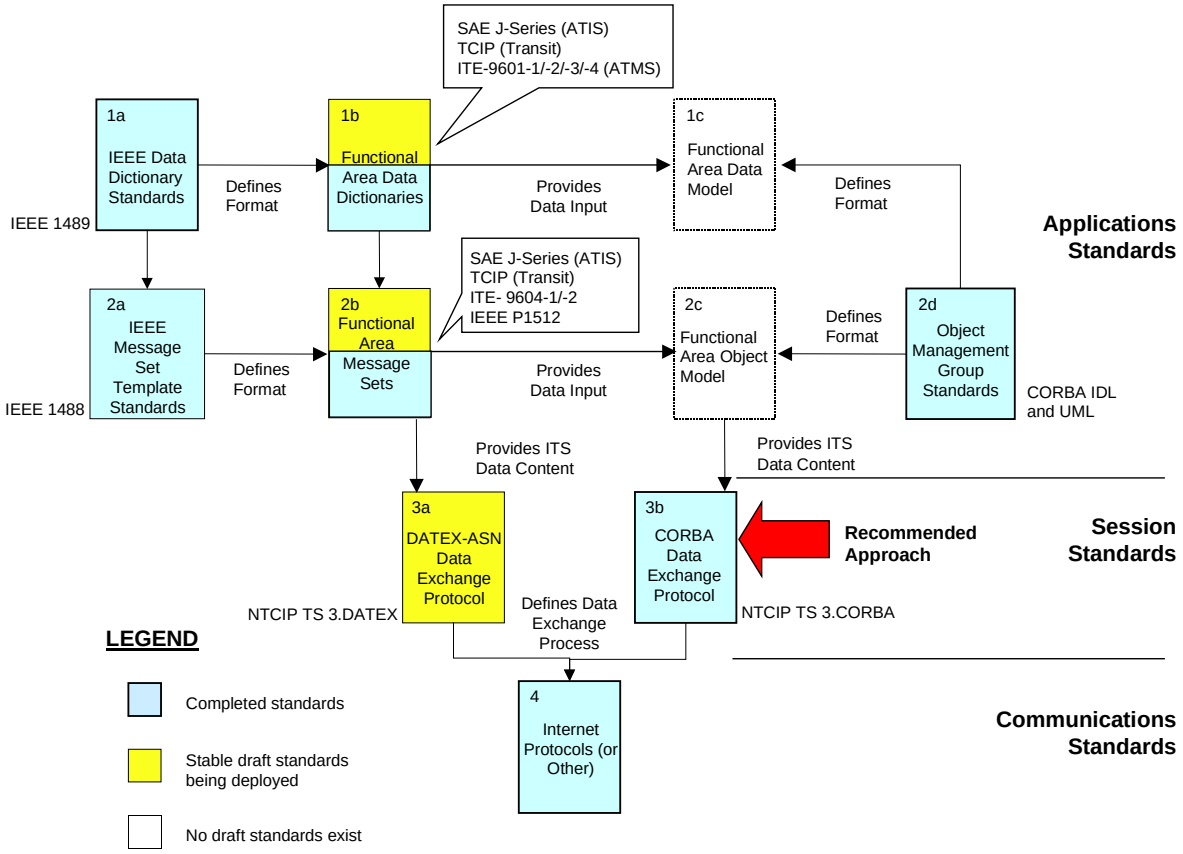


Figure 8.2: ITS Standards Architecture using Currently Defined Standards

In a more specific context, **Figure 8.3** shows where certain standards fit into a typical transportation system ATMS/ATIS architecture containing field elements, multiple transportation management centers and a traveler information system with numerous means of dissemination. A diagram similar to Figure 8-3 could be constructed for transit management, substituting the NTCIP 1400 Series standards for the SAE standards. Virtually all field device and data collection activity is covered by one of the many NTCIP standards. Center-to-center data exchanges are covered by the NTCIP 2305 CORBA or 2304 DATEX-ASN (Data Exchange – American Standard Notation). For the San Joaquin Valley architecture, the 2305 CORBA is recommended for use since current experience in Southern California provides a knowledge base and minimizes technical risk of future project implementation. Dissemination and location referencing to end users is covered by several of the SAE J-Series standards.

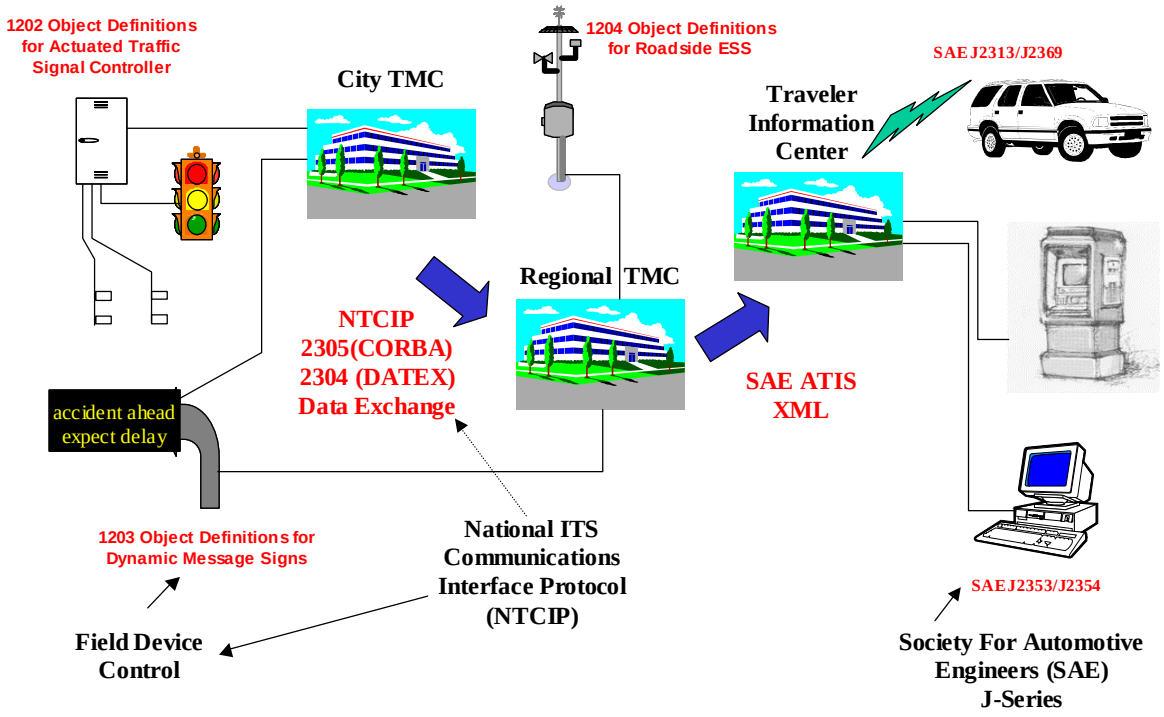


Figure 8.3: Operational Use of Standards in the San Joaquin Valley Architecture

Specific standards that are most likely to be implemented in the San Joaquin Valley over time are summarized in **Table 8.1**. The detailed application of these standards is specific to individual projects and should be addressed in Requirements Definition and High Level Design as applicable for each project. Moreover, local and regional agencies should require these standards be implemented as appropriate when ITS software and hardware systems are procured as part of project delivery. For example, if a project required control sharing through an "Intertie" communications network, the standards application would follow the pattern shown in **Figure 8.4**.

Table 8.1: Summary of High Priority Standards for SJV Projects

Standard	Functional Area	Maturity
NTCIP 1201, 1202, 1203, 1204, 1205, 1206, 1207, 1208, 1209, 1210, 1211	Global, Actuated Signal Controller, DMS, ESS, CCTV, Data Collection, Ramp Meter, Video Switches, Sensor Objects, Signal Systems Master, Signal Control Priority object definitions	Various levels (Global, Actuated Signal Controllers, DMS, ESS Approved, others Pre-ballot).
1301	Weather Report messages	Pre-ballot.
NTCIP 2304	Center to Center Application Profiles (DATEX)	Approved.
NTCIP 2305	Center to Center Application Profiles (CORBA)	Pre-ballot. Object definitions need more work. Southern CA Showcase object definitions will be the basis.

Table 8.1: Summary of High Priority Standards for SJV Projects

Standard	Functional Area	Maturity
SAE TIML (XML)	Traffic Information dissemination to ISP sites (public and private)	In development. This is an extension of the SAE J2353/J2354/J2369 ATIS standards.
TMDD (TM 1.03, TM 2.01)	Traffic Management Data Dictionary, TMC Message Sets	Being revised.
Incident Management (IEEE 1512.1/.2/.3 Series)	Traffic Incident Management for TMC, EMC and HAZMAT	In development. Balloting in late 2001 and early 2002.
NTCIP 1401-1408	Transit Management	Former TCIP standards. 1401-1407 Approved, 1408 (Fare Collection) Pre-ballot.
SAE J1708	Transit Vehicle Equipment Interface	Approved.
NTCIP 2001, 2101-2104, 2201-2203	Various Communications Protocol	Approved.

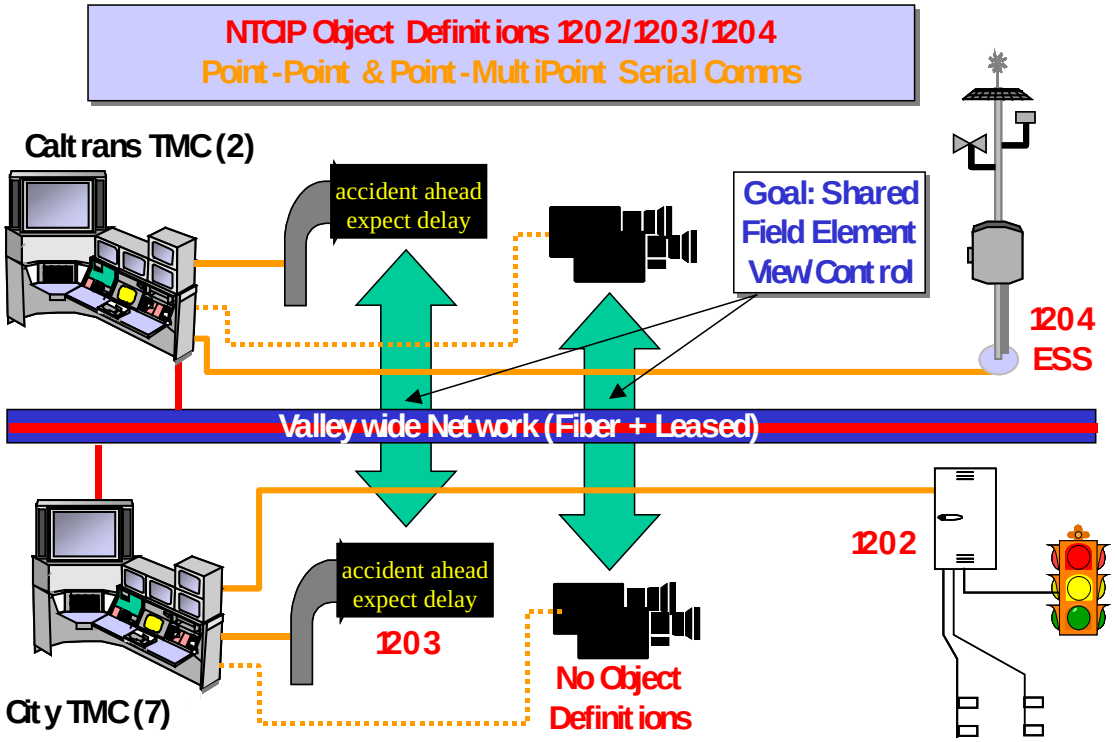


Figure 8.4: Use of Standards in a Shared Field Element Control Application

8.3 Summary

Why are national ITS standards important and how do they support the San Joaquin Valley architecture? The San Joaquin Valley ITS architecture "regionalizes" the National ITS Architecture by tailoring it to fit regional conditions. The National ITS Architecture includes all relevant ITS standards that for the most part carry over into regional architectures. *As long as the San Joaquin Valley regional architecture adheres to an agreed set of ITS standards, any system within this region can interoperate with any other system in the region or elsewhere in Northern or Southern California as appropriate. This will allow the San Joaquin Valley Region to adopt a flexible architecture within the scope of the projects that will instantiate the consensus Market Package Plan.*

We have recommended the use of the NTCIP 2305 CORBA Application Profile as the preferred standard for center-to-center connectivity within the San Joaquin Valley (see Section 8.2.4). In general this standard has the widest base of application within California and will best support connectivity between major Valley transportation management centers and to the Southern California Priority Corridor to the south. However, where connectivity will be required in the northern area of the Valley (to the Bay Area and to Sacramento), there may be a need to translate key information to the NTCIP 2304 Datex Application Profile. When this need is identified, a specific project addressing this data translation should be initiated and funded and an Operational Concept Document should be developed to document how, and under what conditions this data exchange would occur.

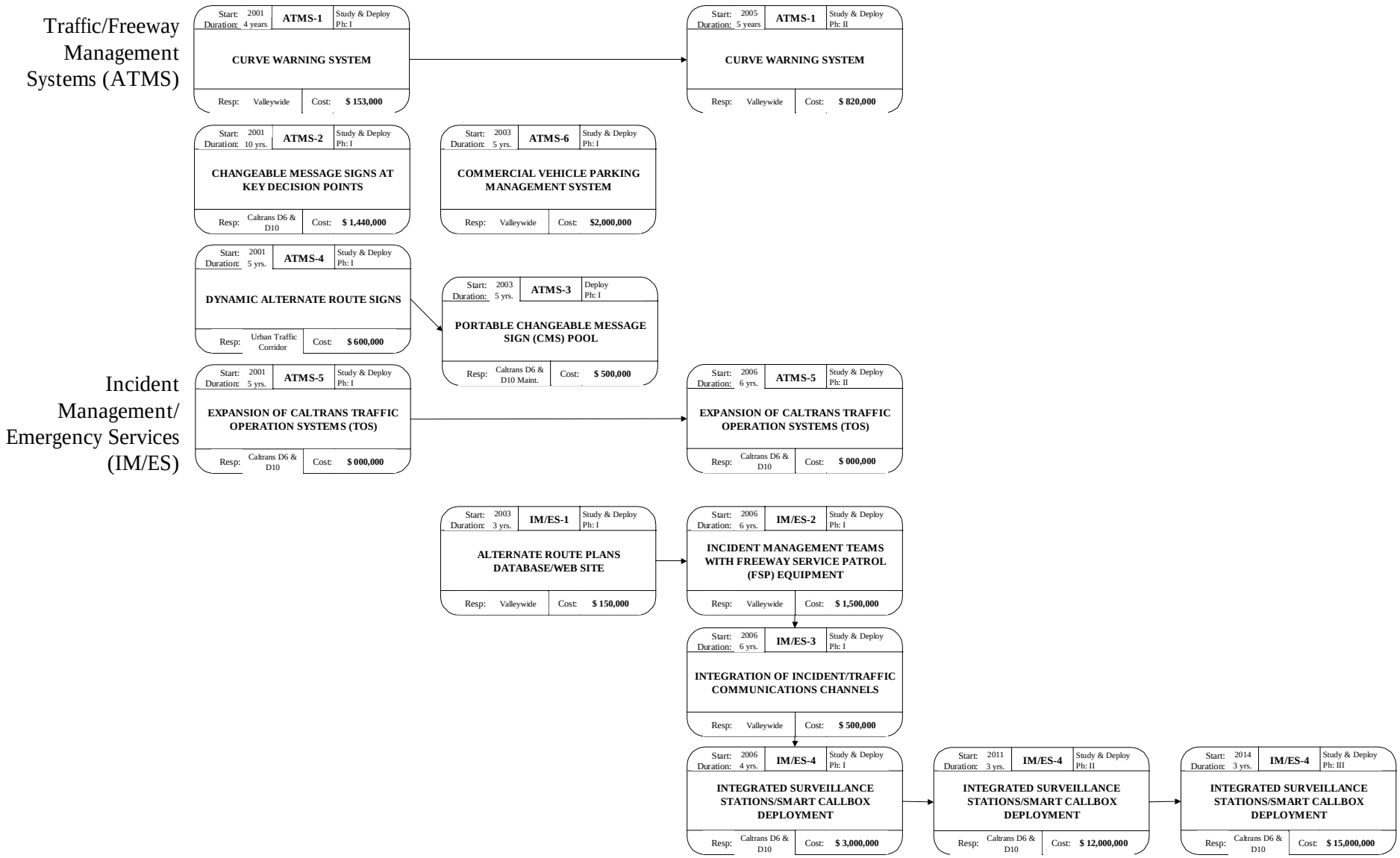
SECTION 9.0

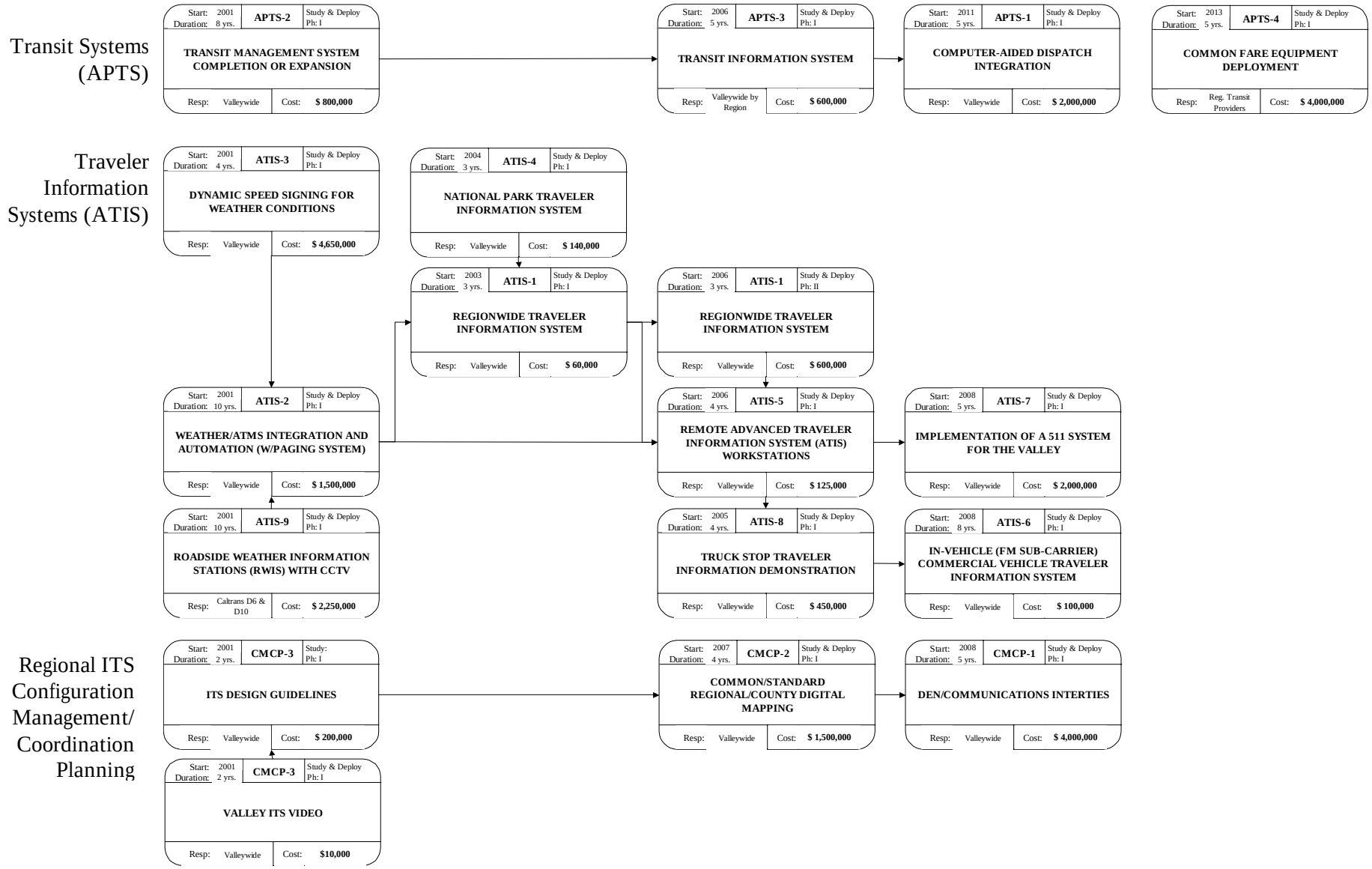
PROJECT SEQUENCING

9.0 PROJECT SEQUENCING

A project phasing chart has been developed for the prioritized Valleywide ITS projects featured in Section 6.0 of the SDP. This chart will define what projects are dependent on others to achieve success. **Figure 9.1** illustrates the sequence of projects.

Figure 9.1: Sequence of Proposed ITS Implementation Activities for the San Joaquin Valley




Transit Systems (APTS)
Start: 2001 Duration: 8 yrs. APTS-2 Study & Deploy Ph: I
TRANSIT MANAGEMENT SYSTEM COMPLETION OR EXPANSION
Resp: Valleywide Cost: $ 800,000
Start: 2006 Duration: 5 yrs. APTS-3 Study & Deploy Ph: I
TRANSIT INFORMATION SYSTEM
Resp: Valleywide by Region Cost: $ 600,000
Start: 2011 Duration: 5 yrs. APTS-1 Study & Deploy Ph: I
COMPUTER-AIDED DISPATCH INTEGRATION
Resp: Valleywide Cost: $ 2,000,000
Start: 2013 Duration: 5 yrs. APTS-4 Study & Deploy Ph: I
COMMON FARE EQUIPMENT DEPLOYMENT
Resp: Reg. Transit Providers Cost: $ 4,000,000
Traveler Information Systems (ATIS)
Start: 2001 Duration: 4 yrs. ATIS-3 Study & Deploy Ph: I
DYNAMIC SPEED SIGNING FOR WEATHER CONDITIONS
Resp: Valleywide Cost: $ 4,650,000
Start: 2004 Duration: 3 yrs. ATIS-4 Study & Deploy Ph: I
NATIONAL PARK TRAVELER INFORMATION SYSTEM
Resp: Valleywide Cost: $ 140,000
Start: 2003 Duration: 3 yrs. ATIS-1 Study & Deploy Ph: I
REGIONWIDE TRAVELER INFORMATION SYSTEM
Resp: Valleywide Cost: $ 60,000
Start: 2006 Duration: 3 yrs. ATIS-1 Study & Deploy Ph: II
REGIONWIDE TRAVELER INFORMATION SYSTEM
Resp: Valleywide Cost: $ 600,000
Start: 2001 Duration: 10 yrs. ATIS-2 Study & Deploy Ph: I
WEATHER/ATMS INTEGRATION AND AUTOMATION (W/PAGING SYSTEM)
Resp: Valleywide Cost: $ 1,500,000
Start: 2006 Duration: 4 yrs. ATIS-5 Study & Deploy Ph: I
REMOTE ADVANCED TRAVELER INFORMATION SYSTEM (ATIS) WORKSTATIONS
Resp: Valleywide Cost: $ 125,000
Start: 2008 Duration: 5 yrs. ATIS-7 Study & Deploy Ph: I
IMPLEMENTATION OF A 511 SYSTEM FOR THE VALLEY
Resp: Valleywide Cost: $ 2,000,000
Start: 2001 Duration: 10 yrs. ATIS-9 Study & Deploy Ph: I
ROADSIDE WEATHER INFORMATION STATIONS (RWIS) WITH CCTV
Resp: Caltrans D6 & D10 Cost: $ 2,250,000
Start: 2005 Duration: 4 yrs. ATIS-8 Study & Deploy Ph: I
TRUCK STOP TRAVELER INFORMATION DEMONSTRATION
Resp: Valleywide Cost: $ 450,000
Start: 2008 Duration: 8 yrs. ATIS-6 Study & Deploy Ph: I
IN-VEHICLE (FM SUB-CARRIER) COMMERCIAL VEHICLE TRAVELER INFORMATION SYSTEM
Resp: Valleywide Cost: $ 100,000
Regional ITS Configuration Management/ Coordination Planning
Start: 2001 Duration: 2 yrs. CMCP-3 Study: Ph: I
ITS DESIGN GUIDELINES
Resp: Valleywide Cost: $ 200,000
Start: 2001 Duration: 2 yrs. CMCP-3 Study & Deploy Ph: I
VALLEY ITS VIDEO
Resp: Valleywide Cost: $10,000
Start: 2007 Duration: 4 yrs. CMCP-2 Study & Deploy Ph: I
COMMON/STANDARD REGIONAL/COUNTY DIGITAL MAPPING
Resp: Valleywide Cost: $ 1,500,000
Start: 2008 Duration: 5 yrs. CMCP-1 Study & Deploy Ph: I
DEN/COMMUNICATIONS INTERTIES
Resp: Valleywide Cost: $ 4,000,000

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APPENDIX A

SAN JOAQUIN VALLEY ARCHITECTURE INVENTORY REPORT

APPENDIX A: SAN JOAQUIN VALLEY ARCHITECTURE INVENTORY REPORT (TURBO ARCHITECTURE)

Caltrans Transportation Management Center

Status: Existing
Associated Stakeholder: Caltrans District Traffic Operations Department
San Joaquin Valleywide Project TMC's are located at Stockton (District 10) and Fresno (District 6). TMC's collect data from field devices including CCTV, CMS, RWIS, HAR, VDS, ramp meters and traffic signals. TMC's manage freeway and state highway operations and respond to planned and unplanned freeway and state highway events.

Mapped to Entity: Traffic Management *Project:* San Joaquin Valleywide Project
Mapped to Entity: Other ISP *Project:* San Joaquin Valleywide Project
Mapped to Entity: Other TM *Project:* San Joaquin Valleywide Project
Mapped to Entity: Information Service Provider *Project:* San Joaquin Valleywide Project

Caltrans Transportation Management Center_Kiosks

Status: Existing
Associated Stakeholder: Caltrans District Traffic Operations Department
San Joaquin Valleywide Project Kiosks are public informational displays supporting various levels of interaction and information access and systems which provide security in public areas.

Mapped to Entity: Remote Traveler Support *Project:* San Joaquin Valleywide Project

Caltrans Transportation Management Center_Personnel

Status: Existing
Associated Stakeholder: Caltrans District Traffic Operations Department
San Joaquin Valleywide ProjectTMC personnel include TMC Operators who monitor and control freeway and state highway operations, traffic engineers who operate and maintain ramp meters and state highway traffic signals and electrical engineers who operate and maintain other field elements and district communications assets.

Mapped to Entity: Traffic Operations Personnel *Project:* San Joaquin Valleywide Project
Mapped to Entity: ISP Operator *Project:* San Joaquin Valleywide Project

Caltrans Transportation Management Center_Roadside Equipment

Status: Existing
Associated Stakeholder: Caltrans District Traffic Operations Department
San Joaquin Valleywide ProjectRoadside Equipment includes any and all equipment distributed on and along the freeways and state highways which monitor and
control traffic. This can include VDS, traffic monitoring stations, CCTV, CMS, RWIS, HAR, ramp meters and state highway traffic signals.

Mapped to Entity: Roadway Subsystem *Project:* San Joaquin Valleywide Project

CHP Commercial Vehicle Inspection Station

Status: Existing
Associated Stakeholder: CHP Division/HQ Commercial Operations Personnel
San Joaquin Valleywide ProjectCHP-operated Commercial Vehicle Inspection Stations are located at Cache Creek and Keene (SR-58), Chowchilla (SR-99), Los Banos (I-5 NB and SB) and Grapevine (I-5). Inspection stations perform routine vehicle and driver safety and credential inspections and vehicle weighing.

Mapped to Entity: Commercial Vehicle Administration *Project:* San Joaquin Valleywide Project
Mapped to Entity: Other CVAS *Project:* San Joaquin Valleywide Project

CHP Commercial Vehicle Inspection Station_Inspection Facility

Status: Existing
Associated Stakeholder: None
San Joaquin Valleywide Project - The inspection facility includes any or all equipment which performs commercial vehicle screening and/or safety inspections.

Mapped to Entity: Commercial Vehicle Check *Project:* San Joaquin Valleywide Project

CHP Communications Center

Status: Existing
Associated Stakeholder: CHP Division/HQ Operations and Communications Personnel
San Joaquin Valleywide Project - Communications Centers are located at Stockton (Valley Division), Merced, Fresno and Bakersfield (Central Division). CHP Communications Centers receive calls from the public and other agencies, communicate via radio to patrol units and operate on the statewide CLETS law enforcement network. CHP Comm Centers act as wireless 9-1-1 PSAP's including cellular and PCS and coordinate event response with other public safety agencies such as local law enforcement, fire and EMS.

Mapped to Entity: Emergency Management *Project:* San Joaquin Valleywide Project
Mapped to Entity: Other EM *Project:* San Joaquin Valleywide Project

CHP Communications Center_Personnel

Status: Existing
Associated Stakeholder: CHP Division/HQ Operations and Communications Personnel
San Joaquin Valleywide ProjectCHP Call takers answer incoming calls requesting assistance from the general public and allied agencies and create incidents in the CAD system. CHP Dispatchers control deployment of CHP patrol vehicles and Traffic Officers via radio and the CAD system and operate the CLETS statewide law enforcement network.

Mapped to Entity: Emergency System Operator *Project:* San Joaquin Valleywide Project

CHP CVO Inspector

Status: Existing
Associated Stakeholder: None
San Joaquin Valleywide Project - The CHP CVO Inspector performs regulatory inspection of Commercial Vehicles by supporting roadside inspection, weighing, and checking of credentials.

Mapped to Entity: CVO Inspector *Project:* San Joaquin Valleywide Project

CHP Emergency Vehicles

Status: Existing
Associated Stakeholder: CHP Division/HQ Operations and Communications Personnel
San Joaquin Valleywide Project - CHP emergency vehicles include ITS equipment that provides the processing, storage, display and communications functions necessary to support safe and efficient emergency response.

Mapped to Entity: Emergency Vehicle Subsystem *Project:* San Joaquin Valleywide Project

City Police Communications Center

Status: Existing
Associated Stakeholder: City Police Department Operations and Communications Personnel
San Joaquin Valleywide ProjectCity Police Communications Centers are located in major cities within San Joaquin Valley including Stockton, Merced, Modesto, Fresno, Visalia and Bakersfield, among many others. City Police Communications Centers handle incoming requests for assistance from the general public and allied agencies, dispatch patrol units and operate on the statewide CLETS law enforcement network. These centers may act as PSAP's for landline 9-1-1 calls and coordinate event response with other public safety agencies such as CHP, fire and EMS.

Mapped to Entity: Other EM *Project:* San Joaquin Valleywide Project

Mapped to Entity: Emergency Management *Project:* San Joaquin Valleywide Project

City Police Communications Center_Personnel

Status: Existing
Associated Stakeholder: City Police Department Operations and Communications Personnel
San Joaquin Valleywide Project - Police Call Takers handle incoming calls and requests for assistance from the general public and allied agencies. City Police Dispatchers control the deployment of patrol vehicles and patrol officers and provide telecommunications support to patrol officers via the CLETS statewide law enforcement network. Communications Center personnel operate the installed CAD system to manage PD resources and manage events.
Mapped to Entity: Emergency System Operator *Project:* San Joaquin Valleywide Project

City Police Emergency Vehicles

Status: Existing
Associated Stakeholder: City Police Department Operations and Communications Personnel
San Joaquin Valleywide Project - City Police Emergency vehicles include equipment that provides the processing, storage, display and communications functions necessary to support safe and efficient emergency response.
Mapped to Entity: Emergency Vehicle Subsystem *Project:* San Joaquin Valleywide Project

Commercial Vehicles

Status: Existing
Associated Stakeholder: None
San Joaquin Valleywide Project - Commercial vehicles include ITS equipment that supports safe and efficient commercial vehicle operations. This equipment monitors vehicle operation, provides the driver and motor carrier real-time information, and supports mainline electronic screening.
Mapped to Entity: Commercial Vehicle Subsystem *Project:* San Joaquin Valleywide Project

County Sheriff Communications Center

Status: Existing
Associated Stakeholder: County Sheriff Operations and Communications Personnel
San Joaquin Valleywide Project - Sheriff's Communications Centers are located in each of the counties within the San Joaquin Valley including San Joaquin, Stanislaus, Merced, Madera, Fresno, Tulare, Kings and Kern. Sheriff Communications Centers handle incoming calls for assistance from the general public and allied agencies, dispatch patrol units and Sheriff's Deputies and operate on the statewide law enforcement CLETS network. These centers may act as PSAP's for landline 9-1-1 calls and coordinate event response in unincorporated areas of the county with other public safety agencies such as CHP, fire and EMS.
Mapped to Entity: Emergency Management *Project:* San Joaquin Valleywide Project
Mapped to Entity: Other EM *Project:* San Joaquin Valleywide Project

County Sheriff Communications Center_Personnel

Status: Existing
Associated Stakeholder: County Sheriff Operations and Communications Personnel
San Joaquin Valleywide Project - Sheriff Communications Center Call Takers handle incoming calls for assistance from the general public and allied agencies. Sheriff's Dispatchers control deployment of patrol vehicles and Sheriff's Deputies and provide law enforcement telecommunications support to field personnel via the statewide CLETS network.
Mapped to Entity: Emergency System Operator *Project:* San Joaquin Valleywide Project

Local Transit Communications Center

Status: Existing
Associated Stakeholder: Transit Operations Department Personnel
San Joaquin Valleywide Project - Numerous local transit communications centers exist throughout the San Joaquin Valley region. Not all are automated with Transit Management Systems but many plan to incorporate this capability over time.
Mapped to Entity: Other TRM *Project:* San Joaquin Valleywide Project
Mapped to Entity: Transit Management *Project:* San Joaquin Valleywide Project

Local Transit Communications Center_Kiosks

Status: Existing
Associated Stakeholder: Transit Operations Department Personnel
San Joaquin Valleywide ProjectKiosks are public informational displays supporting various levels of interaction and information access and systems which provide security in public areas.
Mapped to Entity: Remote Traveler Support *Project:* San Joaquin Valleywide Project

Local Transit Communications Center_Personnel

Status: Existing
Associated Stakeholder: Transit Operations Department Personnel
San Joaquin Valleywide ProjectTransit Dispatchers communicate with bus drivers to resolve on-street problems with vehicle maintenance, fare collection, crime and decisions regarding route and schedule adherence. Dispatchers communicate with public safety agencies in the case of on-board emergencies.
Mapped to Entity: Transit System Operators *Project:* San Joaquin Valleywide Project
Mapped to Entity: Transit Fleet Manager *Project:* San Joaquin Valleywide Project

Local Transportation Management Center

Status: Planned
Associated Stakeholder: City/County Traffic Departments
San Joaquin Valleywide Project - Local TMC's will exist in the larger cities within the San Joaquin Valley region. Local TMC's operate centralized traffic signal control systems and other traffic information/control devices such as CCTV, HAR and CMS and display traffic conditions within the city, county or other designated areas.
Mapped to Entity: Information Service Provider *Project:* San Joaquin Valleywide Project
Mapped to Entity: Traffic Management *Project:* San Joaquin Valleywide Project
Mapped to Entity: Other ISP *Project:* San Joaquin Valleywide Project
Mapped to Entity: Other TM *Project:* San Joaquin Valleywide Project

Local Transportation Management Center_Personnel

Status: Planned
Associated Stakeholder: City/County Traffic Departments
San Joaquin Valleywide ProjectLocal TMC personnel operate traffic control systems and devices and maintain the traffic control devices within their jurisdiction.
Mapped to Entity: Traffic Operations Personnel *Project:* San Joaquin Valleywide Project
Mapped to Entity: ISP Operator *Project:* San Joaquin Valleywide Project

Local Transportation Management Center_Roadside Equipment

Status: Existing
Associated Stakeholder: City/County Traffic Departments
San Joaquin Valleywide ProjectRoadside Equipment includes any and all equipment distributed on and along the roadway which monitors and controls traffic. This can include equipment for tolling.
Mapped to Entity: Roadway Subsystem *Project:* San Joaquin Valleywide Project

Media

Status: Existing
Associated Stakeholder: None
San Joaquin Valleywide ProjectThe Media element represents the information systems that provide traffic reports, travel conditions, and other transportation-related news services to the traveling public through radio, TV, and other media.
Mapped to Entity: Media *Project:* San Joaquin Valleywide Project

San Joaquin Valley TIC

Status: Planned
Associated Stakeholder: Information Service Providers
San Joaquin Valleywide ProjectSan Joaquin Valley TIC will be a central source of all-mode travel information for the Valley region. The TIC will consolidate public sector travel data from a variety of sources and provide a single standard data feed to ISP's operating within the region.
Mapped to Entity: Other ISP *Project:* San Joaquin Valleywide Project
Mapped to Entity: Information Service Provider *Project:* San Joaquin Valleywide Project

San Joaquin Valley TIC_Personnel

Status: Planned
Associated Stakeholder: Information Service Providers
San Joaquin Valleywide ProjectTIC Personnel represent the operators who collect, synthesize and perform quality checks on all-mode traveler information for dissemination to ISP's.
Mapped to Entity: ISP Operator *Project:* San Joaquin Valleywide Project

Sheriff Emergency Vehicles

Status: Existing
Associated Stakeholder: County Sheriff Operations and Communications Personnel
San Joaquin Valleywide ProjectSheriff's Emergency vehicles include equipment that provides the processing, storage, display and communications functions
necessary to support safe and efficient emergency response.
Mapped to Entity: Emergency Vehicle Subsystem *Project:* San Joaquin Valleywide Project

Transit Vehicles

Status: Existing
Associated Stakeholder: Transit Operations Department Personnel
San Joaquin Valleywide ProjectTransit vehicles include ITS devices that support the safe and efficient movement of passengers. These systems collect, manage, and disseminate transit-related information to the driver, operations and maintenance personnel, and transit system patrons.
Mapped to Entity: Transit Vehicle Subsystem *Project:* San Joaquin Valleywide Project

User Personal Computing Devices

Status: Existing
Associated Stakeholder: None
San Joaquin Valleywide ProjectUser Personal Computing Devices refers to equipment an individual owns and can personalize with their choices for information about transportation networks. An Internet-connected PC is an example.
Mapped to Entity: Personal Information Access *Project:* San Joaquin Valleywide Project

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APPENDIX B

PROJECT SEQUENCING

APPENDIX B: SAN JOAQUIN VALLEY ARCHITECTURE STAKEHOLDERS REPORT (TURBO ARCHITECTURE)

Caltrans District Traffic Operations Department

Caltrans Traffic Operations Department is responsible for day-to-day operations of the freeway and state highway system and for responding to recurring and non-recurring events that occur on these highways.

Associated Element: Caltrans Transportation Management Center_Personnel
Associated Element: Caltrans Transportation Management Center_Roadside Equipment
Associated Element: Caltrans Transportation Management Center_Kiosks
Associated Element: Caltrans Transportation Management Center

CHP Division/HQ Operations and Communications Personnel

CHP Communications Centers are operated in the Valley and Central Divisions under the Assistant Division Chief for Operations. CHP Headquarters supports Communications Centers through its Information Management Division.

Associated Element: CHP Communications Center
Associated Element: CHP Communications Center_Personnel
Associated Element: CHP Emergency Vehicles

City Police Department Operations and Communications Personnel

Communications Centers are generally under the cognizance of Police Department Communications Divisions while the patrol officers are under the Operations (or Patrol) Divisions.

Associated Element: City Police Communications Center
Associated Element: City Police Communications Center_Personnel
Associated Element: City Police Emergency Vehicles

County Sheriff Operations and Communications Personnel

County Sheriff Communications Centers are generally under the cognizance of Communications Divisions within the Department while the patrol Deputies are under the Operations (or Patrol) Divisions.

Associated Element: Sheriff Emergency Vehicles
Associated Element: County Sheriff Communications Center_Personnel
Associated Element: County Sheriff Communications Center

CHP Division/HQ Commercial Operations Personnel

CHP Commercial Operations personnel are responsible for the safe operation of commercial vehicles on state highways including enforcement of vehicle and driver safety and credentialing regulations. These personnel also perform revenue collection activity through operation of the inspection station vehicle weighing equipment.

Associated Element: CHP Commercial Vehicle Inspection Station

Information Service Providers

Information Service Providers will connect to the San Joaquin Valley TIC to receive a standard data feed on all modes of traveler information within the region.

Associated Element: San Joaquin Valley TIC
Associated Element: San Joaquin Valley TIC_Personnel

City/County Traffic Departments

City/County Traffic departments are responsible for the operation of traffic control devices within their local jurisdiction and assisting local law enforcement in responding to traffic related events as needed.

Associated Element: Local Transportation Management Center
Associated Element: Local Transportation Management Center_Personnel
Associated Element: Local Transportation Management Center_Roadside Equipment

Transit Operations Department Personnel

Transit Operations Department personnel are charged with scheduling and dispatching buses and drivers on their daily routes and to maintain compliance with published schedules.

Associated Element: Local Transit Communications Center_Kiosks
Associated Element: Local Transit Communications Center
Associated Element: Local Transit Communications Center_Personnel
Associated Element: Transit Vehicles