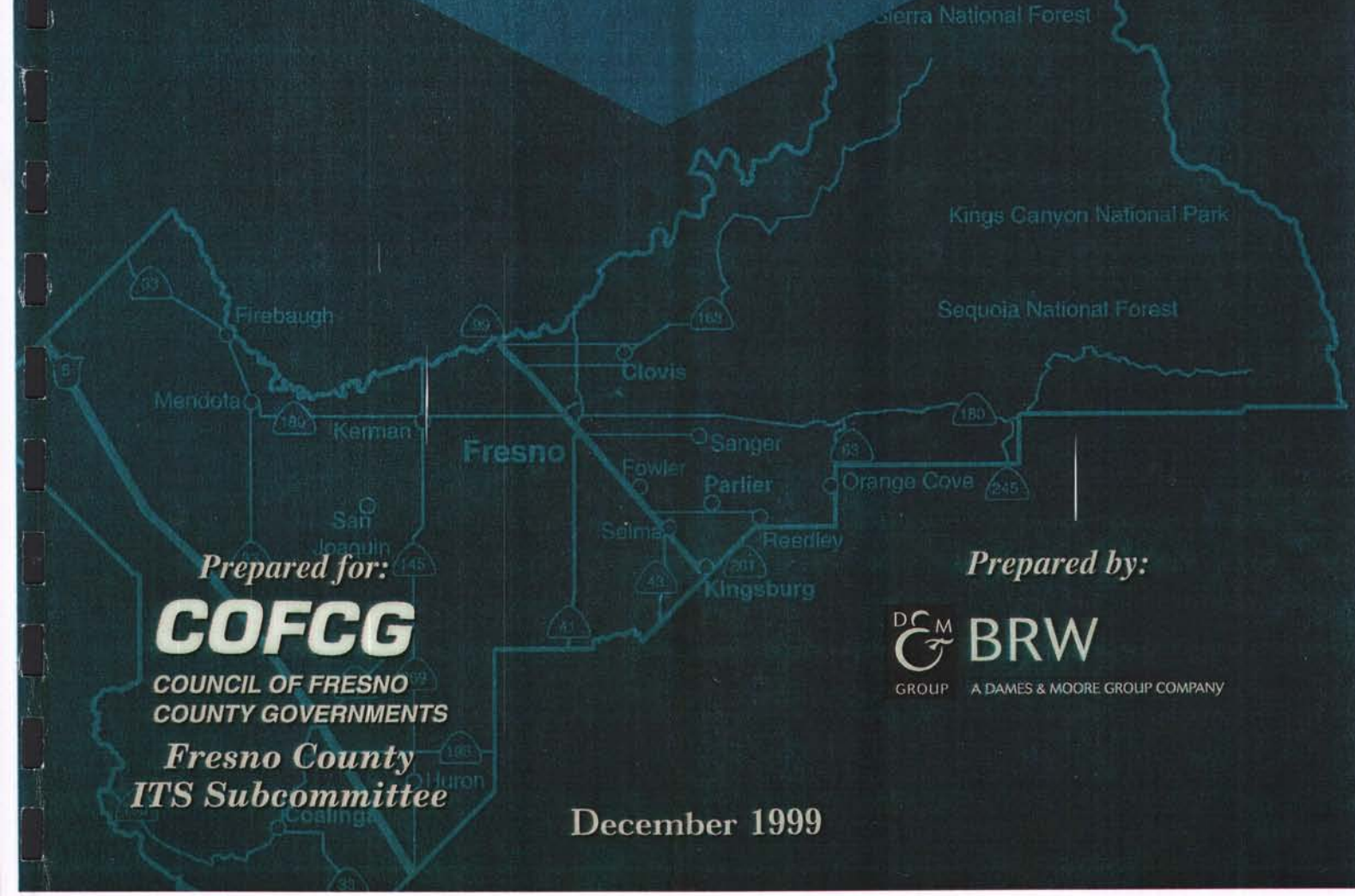
Fresno County Intelligent Transportation System Strategic Deployment Plan

Fresno County ITS Strategic Deployment Plan



Prepared for:

COFCG

COUNCIL OF FRESNO COUNTY GOVERNMENTS

Fresno County ITS Subcommittee

Prepared by:

DCM & BRW GROUP

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December 1999

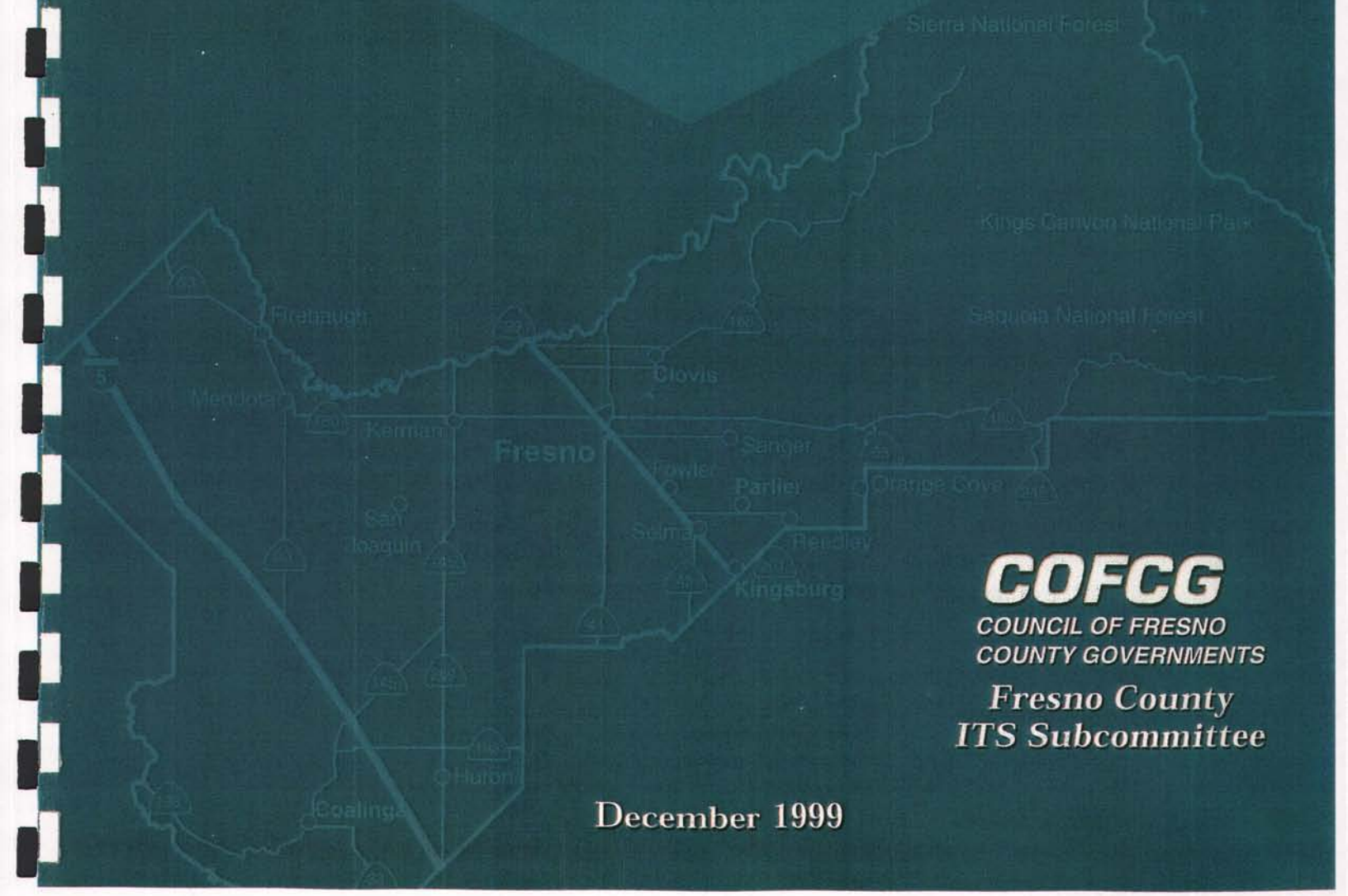
EXECUTIVE SUMMARY

Fresno County Intelligent Transportation System Strategic Deployment Plan

Fresno County

ITS

Strategic Deployment Plan



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Fresno County ITS Subcommittee

December 1999

What are Intelligent Transportation Systems?

Generaly, the increasing costs, community issues, and environmental considerations involved in funding and constructing traditional roadway and other transportation infrastructure projects mean that it is no longer possible to "build a way out of transportation problems." In order to deal with this situation, Intelligent Transportation Systems (ITS) have evolved, providing a new option for improving the efficiency of the existing and planned transportation network. By improving the transportation management tools available, ITS has become an important tool for maintaining and improving safety, operations, and capabilities of the transportation system.

Intelligent Transportation Systems (ITS) are the application of advanced technologies to enhance the efficiency of our existing transportation systems.

The Fresno County Region is a microcosm of the nation in terms of the resources needed to keep people and goods moving in a swift and efficien manner. Residents in Fresno travel the Region's freeways and highways without much consideration of the effort taken to build the infrastructure and keep it clear of congestion and incidents. They travel the surface streets without consideration for the complexities of the traffic signal control systems. They cross invisible jurisdictional boundaries withou realizing the often complex institutional and political relationships involved in their travel. In short, people do not usually concern themselves about the day to day details of the transportation system tha make their travel safe and efficient. However, they do take notice when problems occur which delay or inconvenience their travel. Unfortunately, these problems are occurring in ever increasing numbers.

Benefits of Intelligent Transportation Systems

The primary purpose behind the development of Intelligent Transportation Systems is the benefit they can provide to the transportation network, as well as the end users of that network, the general public. The technologies used in ITS deployments are well proven and readily available.

The Fresno County Intelligent Transportation Systems (ITS) Strategic Deployment Plan was developed by the Region to provide a framework and architecture for the further deployment of ITS tools.

For the purpose of the Strategic Plan, ITS projects have been categorized into five major areas known as program areas. These areas include:

- **Traffic/Freeway Management Systems** - Focuses on improving traffic and safety, as well as reducing delays along freeways and arterials. ITS projects have had considerable success in this area. The cities of Fresno and Clovis, as well as Fresno County, are deploying enhanced signal and traffic management capabilities to reduce travel times and better manage congestion.

- **Incident Management/Emergency Services** - Focuses on saving lives through decreasing incident response and clearance times. Several emergency service agencies in the Region have deployed improved computer aided dispatch and fleet management systems to improve incident coordination and response.

- **Transit Systems** - The Fresno region is already realizing the benefits from Fresno Area Express' (FAX) ITS transit management system. The Strategic Plan focuses on improving transit coordination and real-time information provided to transit patrons. FAX uses information from their system to make decisions on service options, as well as to improve day to day service.

- **Transportation User Information Systems** - Focuses on providing improved real-time transportation information to the traveling public. This information is useful to commuters as well as tourists, allowing them to make informed travel decisions. So far, the Region has deployed some simple information systems that the public relies on everyday.

- **Regional ITS Configuration Management Coordination/Planning** - Provides for the overall coordination and integration of the ITS deployment effort in the Fresno County Region.

The Fresno County Region has already initiated ITS activities with deployment projects underway by several agencies. The Strategic Plan seeks to bring together and enhance these efforts through a larger regional focus and to provide a guideline for coordinated deployment and operation of ITS systems. In addition, this plan is intended to integrate, in both technical and strategic terms, with other ITS plans in the state. The goal is to form a seamless statewide system architecture consistent with the National ITS Architecure.

Many agencies within the Fresno County Region have already implemented initial ITS projects, including:

- *Communications and freeway surveillance*
- *Signal control/management*
- *Transit management/tracking systems*

The plan focuses on how to expand these efforts to maximize benefits .

Fresno County Region Priority Transportation Problems

RANK	PRIORITY PROBLEM	SCORE
1	Lack of Integration / Cooperation / Coordination / Common Communications	33
2	Signal Coordination (Needed)	22
3	Emergency Response Time	19
4	Air Quality	18
5	Funding	15
6	Lack of Traveler Information	12
7	Staffing	9
8	Red Light Running	7
9	GIS Mapping / Mapping Standards / Old Maps	5
10	Visibility Related Incidents (Fog/Dust)	3
11	Lack of Surveillance	2
12	Data Needs (Data needed for transportation planning & evaluation purposes)	1
12	Incidents (General)	1
12	Lack of Known Standards	1

As part of the Strategic Plan development efforts, the Fresno County ITS Subcommittee was formed to represent all of COFCG's member agencies, as well as the Region's transportation stakeholders. The Subcommittee identified several priority regional transportation problems. ITS projects offering solutions to these problems provided the framework for the Strategic Plan. The priority problems identified by the Subcommittee are displayed in the table to the left.

Many agencies in the Fresno County Region are already receiving benefits from their initial ITS deployment efforts.

Intelligent Transportation Systems Strategic Deployment Plan and Projects

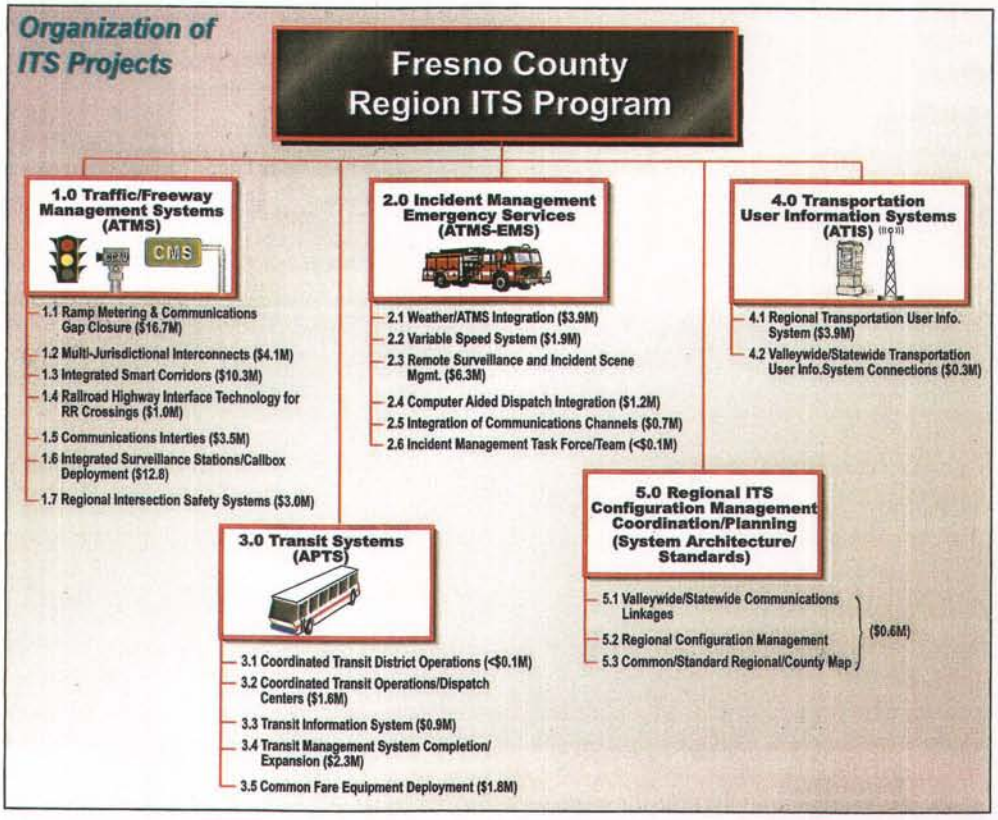
The Fresno County Intelligent Transportation Systems (ITS) Strategic Deployment Plan represents a comprehensive effort to build consensus on the application of advanced technologies to allow public agencies to better manage the existing transportation system. The Fresno County ITS Subcommittee, representing major transportation stakeholders in the Region, and the Council of Fresno County Governments (COFCG) oversaw development of the Plan. The Plan covers a 20-year timespan with a greater focus on the first five years of implementation. The Plan is not an end in itself, instead it is a starting point for regional ITS coordination, programming, and implementation efforts.

The Plan includes background information, suggestions, and recommendations in the following areas:

- Definition of ITS
- Benefits of ITS
- Priority transportation problems in the Region as defined by the Fresno County ITS Subcommittee
- Definitions of potential ITS projects to be deployed in the Region
- Relationships between the identified ITS projects presented in the Plan and the National ITS Architecture
- Suggested institutional structure to support key areas of ITS implementation
- Suggested approaches for funding and implementing the ITS projects presented in the Plan

The Fresno County ITS Strategic Deployment Plan only serves as a starting point for the deployment of improved transportation management systems in the Region. The success and effective operation of these improved systems will rely on the proactive participation of transportation professionals and stakeholders in the Fresno County Region.

Twenty-three different projects and five program areas have been identified by the ITS Subcommittee and described in the Plan. The organization chart below displays these projects and their estimated capital costs in millions of 1999 dollars. It is likely that the Region will proceed with implementing only a few projects at any one time. The actual timeline for the implementation of projects will largely be a function of regional priorities. Timing and priorities for implementation will be captured in the Regional Transportation Plan (RTP) and other regional planning and programming efforts.



Institutional Structure and Suggested Policies

To support the deployment of ITS projects in the Region, the ITS Subcommittee defined a potential institutional structure and supporting policies. The identified supporting policies include:

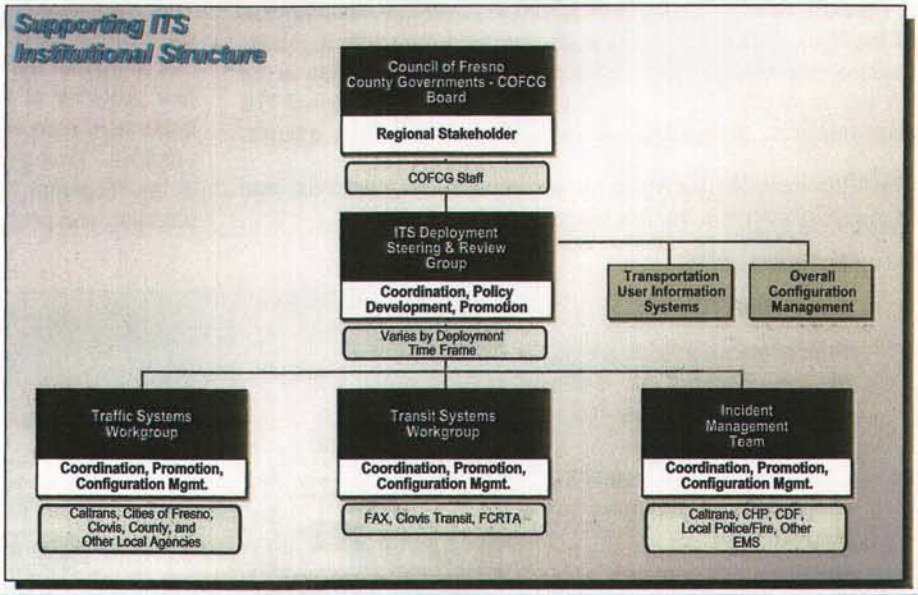
- Cooperate to program, deploy, and operate common ITS resources and systems.
- Incorporate or allow for communications infrastructure during the development of regionally significant transportation infrastructure.
- Adopt the regional, statewide, and national architecture to support the exchange of transportation related information and integration of systems between agencies.
- Utilize regional standards for communications, transportation management and/or information, and emergency services systems.
- Seek institutional arrangements where the joint deployment of ITS promotes economies of scale, avoids duplication of effort, and/or promotes regional integration of systems.
- Funding preference should be given to projects that are a cooperative effort between two or more agencies, all other factors being equal.
- Cooperate at local and regional levels to establish common and/or seamless transportation operations across jurisdictional boundaries.
- Agencies should always retain the ability to "take control" of their respective components of integrated system(s).
- Incorporate ITS elements as part of major transportation projects during the project development process.
- Deploy ITS to enhance the accuracy and extent of transportation user information provided to the traveling public.

ITS projects include "behind the scenes" management functions such as coordinated traffic signal control and more visible components such as changeable message signs.

The Plan is only the first step in regional ITS deployment. Success will require continued:

- *Leadership*
- *Cooperation*
- *Persistence*

Supporting ITS Institutional Structure

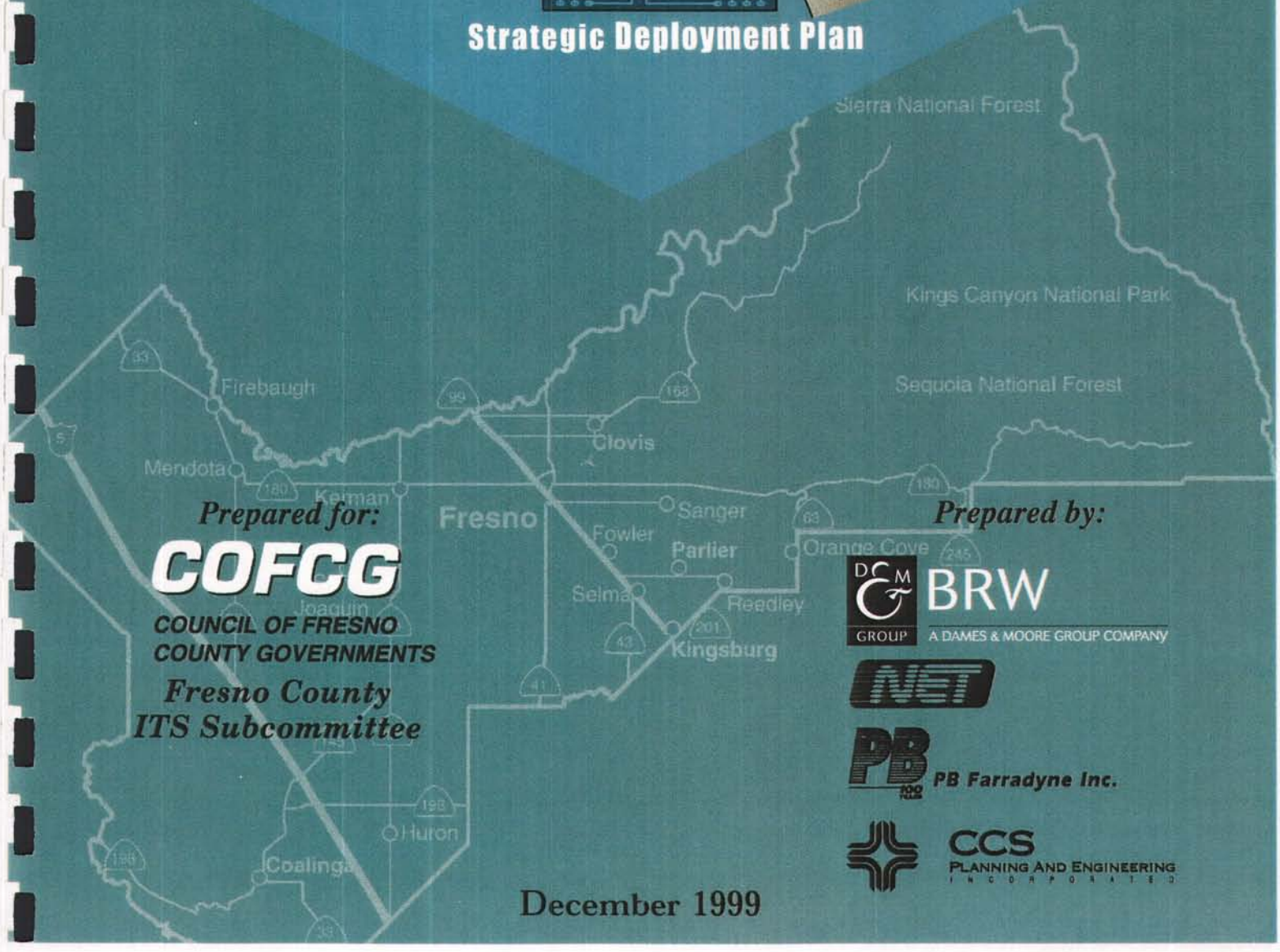


LIST OF STRATEGIC DEPLOYMENT PLAN STAKEHOLDERS

Caltrans District 6 Systems Planning	City of Reedley	Selma Fire Department
California Highway Patrol	City of Selma	California Department of Forestry - Fire
Caltrans District 6 TMC - Operations	COFCG - Freeway Service Patrol	Fresno County Emergency Services
Caltrans New Technology & Research	San Joaquin Valley APCD	American Ambulance
City of Clovis	City of Sanger	Community Hospitals
City of Clovis Police Department	City of Parlier	City of Kingsburg
City of Clovis Fire Department	City of Huron	Chamber Transportation Commission
City of Coalinga	County of Fresno	Fresno-Madera Area Agency on Aging
City of Fresno	Fresno Area Express	City of San Joaquin
City of Fresno Fire Department	Fresno County Rural Transit Agency	Fresno Cycling Club
City of Fresno Department of Airports	Fresno County Transportation Authority	City of Orange Cove
City of Firebaugh	Clovis Chamber of Commerce	City of Fowler
City of Kerman	Fresno County EOC	City of Clovis Transit
City of Mendota	Fresno County Fire Protect. District	

Fresno County Intelligent Transportation System Strategic Deployment Plan

Fresno County ITS Strategic Deployment Plan



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Fresno County ITS Subcommittee

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December 1999

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SECTION Overview

STRATEGIC DEPLOYMENT PLAN OVERVIEW

O.1 PURPOSE OF THE PLAN 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 Fresno County Region.

This Section of the Fresno County Intelligent Transportation Systems (ITS) Strategic Deployment Plan (SDP) serves as an overview and summary of the overall Plan. For more detailed information, readers should refer to the specific Sections of interest:

- Section 1.0 Introduction
- Section 2.0 Vision and Goals
- Section 3.0 Regional User Needs
- Section 4.0 Market Packages
- Section 5.0 System Architecture
- Section 6.0 Program Areas and Projects
- Section 7.0 Deployment Element
- Section 8.0 Funding Element
- Section 9.0 Management Element

In addition to this overview and the SDP itself, a brief two-page Executive Summary has been developed to highlight the key points of the Fresno County Region's ITS Plan. This Executive Summary is meant for quick reference and reading by high-level managers and politicians interested in ITS. It serves as a supplement to information provided by their staff. The Executive Summary focuses on a definition of ITS, benefits of ITS, priority regional transportation problems, as well as proposed ITS projects and suggested institutional policies.

O.2 PURPOSE OF THE STRATEGIC DEPLOYMENT PLAN

The Plan is not an end in itself, instead it is 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. Individual agencies in the Fresno County Region have already undertaken several 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. However, these projects have largely been independent efforts focused

mproving the capabilities of a single agency without major consideration for larger regional ds and issues.

e development of this Plan represents a new level of effort in the coordinated deployment of projects. It brings together the independent efforts and needs of the various agencies in the gion and provides a comprehensive regional viewpoint. Along these lines, this Plan has en developed to serve as a:

- Primary reference document for ITS planning, programming, and deployment guidelines in the Fresno Region.
- A guide for the coordinated deployment of regional ITS efforts in accordance with the standards developed for the regional, statewide, and national ITS architectures.
- A comprehensive listing and documentation of ITS projects proposed for the Fresno County Region for the foreseeable future.
- Summary of key technical documents prepared for the Fresno County Region as part of the ITS planning process, including: problems/needs assessment, technology considerations, system architecture, project definitions, as well as other important items.
- Primary document for distribution to Regional stakeholders and other interested parties.
- Focusing tool that provides a consensus based view of ITS deployment in the Fresno County Region for the foreseeable future.

These six purposes represent relatively difficult goals to obtain, given that the SDP must provide for both near-term and longer-term ITS considerations. However, it is important to note that the SDP should be seen as a framework and guiding document, and not as the final word on ITS in the Fresno Region.

O.3 PLAN DEVELOPMENT PROCESS

The development of the Fresno County ITS SDP followed the federal ITS planning process as discussed in Section 1.0 of the Plan. As the lead agency, the Council of Fresno County Governments (COFCG) initiated the creation of the Fresno County ITS Subcommittee to provide input into and oversee the development of the SDP. This Subcommittee includes representatives from all of the COFCG member agencies, as well as Federal Highway Administration (FHWA), Caltrans Headquarters, and the private sector. Within this Subcommittee several meetings were held that separated representatives into their specific areas of interest (traffic systems, incident management, transit, etc.) in order to provide for more focused input at key points in the development of the Plan.

In general, the development of the SDP followed a combined planning and broad level systems engineering approach. This approach included:

- Identification of problems and needs
- Definition of an ITS vision and goals for the Region

TABLE O-2
SUMMARY OF ITS PROJECTS

ID	Program Area/Project	Brief Description	Project Initiation*			Capital Cost Estimates by Phase (millions of $1999)**			
			N	M	L	1	2	3	Total
2.3	Remote Surveillance and Incident Scene Management	Enhances incident scene management capabilities by providing for remote video and communications between field commanders and specialists at fixed locations/centers.		●		$0.3			**$0.3**
2.4	Computer Aided Dispatch Integration	Enhances interagency incident response by providing integration between CAD systems operated by various emergency services in the Region.		●		$1.2			**$1.2**
2.5	Integration of Communications Channels	Integrates on-site interagency communications to improve incident management and coordination tools for site commanders.		●		$0.7			**$0.7**
2.6	Incident Management Team/Task Force	Improves interagency coordination and response for emergency services and traffic managers through joint meetings and training exercises. This group would also support the regional procurement of needed incident management equipment.	●			< $0.1			**< $0.1**
3.0 Transit Systems									
3.1	Coordinated Transit District Operations	Institutional effort to improve transit agency coordination and deployment efforts, as well as service to patrons, in situations where services interconnect.	●			< $0.1			**< $0.1**
3.2	Coordinated Transit Operations/Dispatch Integration	Enhances coordination between transit agencies by providing enhanced communications and information sharing between transit dispatch centers in the Region.		●		$1.6			**$1.6**
3.3	Transit Information System	Provides real-time transit information to patrons at key transit stops and stations through the use of the transit management system and well-established display technologies.		●		$0.9			**$0.9**
3.4	Transit Management System Completion/ Expansion	Deploys transit management system (GPS) capabilities to undeployed transit services (mostly FCRTA and Clovis Transit) to enhance regional transit management and information functions.		●		$1.6	$0.7		**$2.3**
3.5	Common Fare Equipment Deployment	Simplifies and enhances transit fares for patrons by deploying a common regional transit fare system and structure.		●		$1.5	$0.3		**$1.8**
4.0 Transportation User Information Systems									
4.1	Regional Transportation User Information System	Deploys roadside, internet, and other transportation information dissemination equipment, as well as enhances the accuracy and timeliness of information provided to the traveling public.			●	$3.9			**$3.9**
4.2	Coordination with Valleywide/Statewide Information Systems	A coordination effort to maximize the regional gains from statewide and valleywide traveler information deployment efforts.			●	$0.3			**$0.3**

TABLE O-2
SUMMARY OF ITS PROJECTS

ID	Program Area/Project	Brief Description	Project Initiation*			Capital Cost Estimates by Phase (millions of $1999)**			
			N	M	L	1	2	3	Total
5.0 Regional ITS Configuration Management/Coordination/Planning									
5.1	Valleywide/Statewide Communications Linkages	Coordinates and provides for communications linkages between the Fresno County Region, neighboring regions, and the rest of the State.			•	< $0.1			< $0.1
5.2	Regional Configuration Management	Essential on-going effort to ensure common standards and interoperability of systems within the Region. This is a key component of developing a regional ITS effort.	•			< $0.1			< $0.1
5.3	Common/Standard Regional Map	Develops a common and accurate (for automatic vehicle location purposes) map of the Region, and establishes a common referencing/grid system for emergency management purposes.		•		$0.4			$0.4
Total Estimated Capital Deployment Costs for All Potential ITS Projects Over 20 Years									**$71M**

Notes:

* Project initiation timeframes - N = Years 1-2, M = Years 3-5, L = Years 6+

** All capital costs are approximate and rounded for purposes of this table. For more detailed information specific reference should be made to Sections 6.0 and 7.0 of the Plan.

As displayed in Table O.2, the overall capital costs for all of the ITS projects identified in this Plan over a 20 year timeframe come to approximately $71 million. It should be noted that it is unlikely that all of the identified projects will be deployed given likely funding limitations and potential changes in priorities over time. Operations and maintenance issues and cost estimates are discussed in greater detail for each project in Sections 6.0 and 7.0 of the Plan.

Funding opportunities and processes are outlined in Section 8.0, and deployment steps are discussed in Sections 7.0 and 9.0 of the Plan. In general, there are three key ITS project deployment considerations:

- Projects need a deployment champion and sponsoring agency in order to be successful in obtaining funds and proceeding to deployment phase.
- Projects should involve multiple agencies, and preferably the whole Region, in order to attract federal funds and support interoperability of systems across the Region. The selection of common standards for the Region is key to maintaining interoperability between the various systems which will be deployed over time.
- Projects should be integrated into the traditional transportation planning and programming process; and where possible, be deployed with the associated transportation infrastructure. For example, when a new roadway is constructed it should include the needed communications and field devices to support ITS deployment.

O.8 SUGGESTED POLICIES AND INSTITUTIONAL STRUCTURE

O.8.1 SUGGESTED INSTITUTIONAL STRUCTURE

Figure O-2 displays the suggested institutional structure for ITS deployment in the Fresno County Region. 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 O-2 summarizes the name, general roles and responsibilities, and agency involvement for each component of the institutional structure which include:

- **Council of Fresno County Governments (COFCG) Board**

  The COFCG Board 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, COFCG 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.

- **Fresno County Region ITS Deployment Steering & Review Group**

  This Group is already established as the Fresno County ITS Subcommittee, however there should be a shift from the development of the Strategic Deployment Plan to deployment activities. This Group 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 COFCG Board, reviewing and adopting project concepts, supporting funding and grant development efforts, and providing a venue for the identification and resolution of institutional issues.

- **Traffic Systems Workgroup**

  Previous cooperative efforts between the City of Fresno, City of Clovis, and County of Fresno have laid the groundwork for this Workgroup. 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.

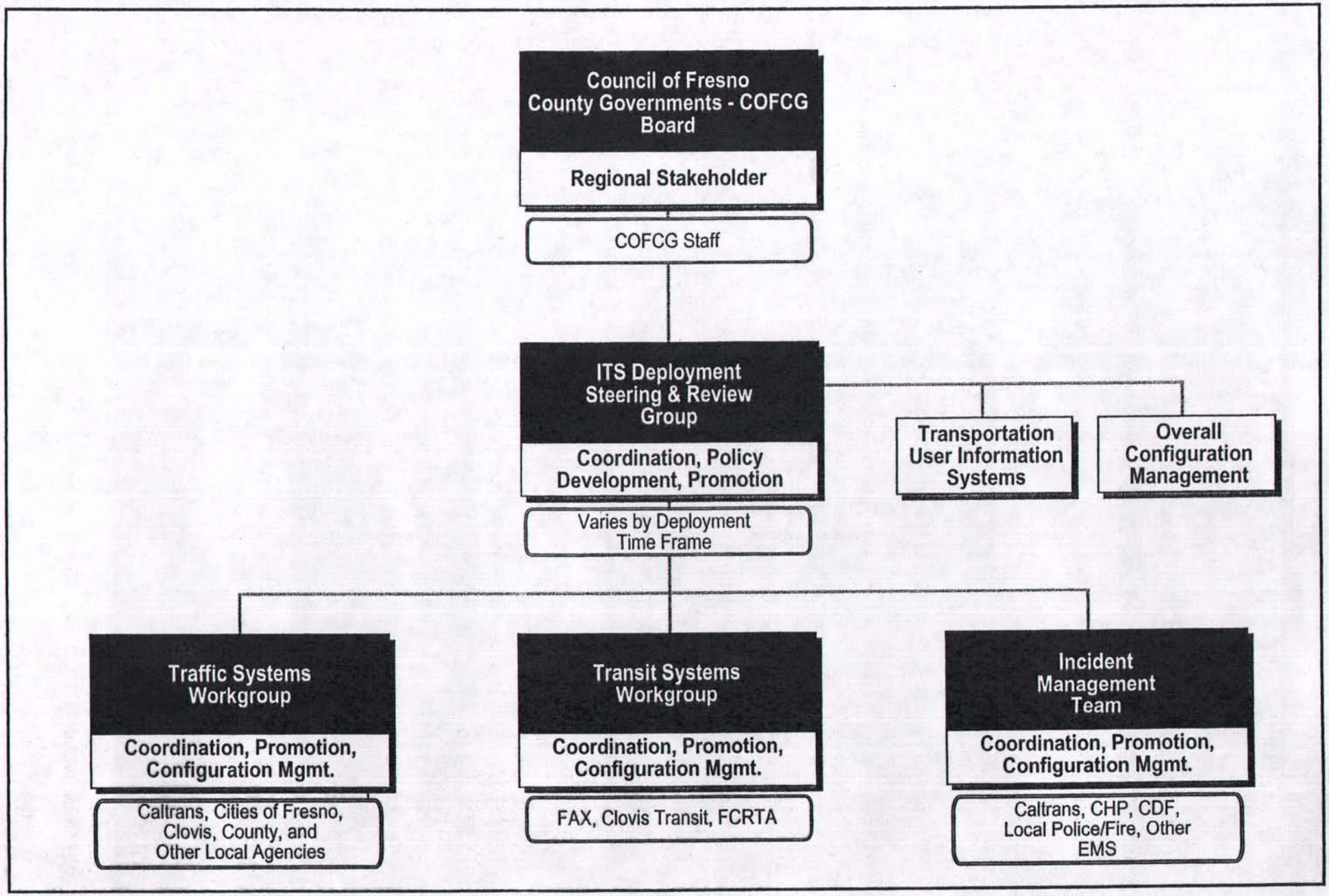


Figure O-2
Suggested Institutional Structure for Fresno Region ITS Deployment Coordination

- **Transit Systems Workgroup**

  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 better-coordinated transit operations.

- **Incident Management Team/Task Force**

  Two meetings of regional incident management stakeholders were held as a part of the Strategic Deployment Planning effort. It should be noted that emergency service agencies have already adopted the well-established Incident Command System (ICS), and that agencies have established good working relationships amongst one another. The efforts of this Workgroup would focus on further enhancing day to day interagency coordination and cooperation for incident management purposes. More so than the other two Workgroups, the Incident Management Team must address both operations and systems deployment considerations. The Incident Management Team should work to promote inter-agency training, development of incident response guidelines for multiple agencies, clarification of on-scene responsibilities at incidents, and inter-agency procurement and operation of improved incident management and communications resources.

The suggested institutional structure, as well as the roles and objectives of each component of this structure are discussed in greater detail in Section 9.0 of this Plan.

O.8.2 SUGGESTED POLICIES

The following suggested policies should be considered for adoption by agencies in the Fresno County Region to promote and support effective ITS deployment:

- Agencies in the Fresno County Region 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 funding to projects is considered, preference should be given to projects that are 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 transportation user 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

SECTION 1.0 INTRODUCTION

1.1 OVERVIEW OF THE STRATEGIC DEPLOYMENT PLAN

Literally millions of people go about their daily travels without the slightest consideration of the magnitude of effort put into getting them from one point to another. Whether they are using transit or driving in their own vehicle, the infrastructure, personnel, knowledge, and technology resources behind the scenes of their seemingly straight-forward travel activities are often truly staggering.

The Fresno County Region is a microcosm of the nation in terms of the resources needed to keep people and goods moving in a swift and efficient manner. Fresno residents travel the Region's freeways and highways without knowing the effort taken to build this infrastructure and keep it clear of congestion and incidents. They travel the surface streets unaware of the complexities of the traffic signal control systems. They cross invisible jurisdictional boundaries without realizing the often complex institutional and political relationships involved in their travel. In short, people do not give much consideration to the details of the transportation system that makes their day to day travel relatively safe and efficient. However, they do take notice when problems occur which delay or inconvenience their travel. Unfortunately, these problems are occurring in ever increasing numbers at ever increasing intervals.

The Fresno County Region is somewhat fortunate in that many of the more pressing transportation problems have yet to occur, and there are still significant efforts underway to enhance the basic transportation infrastructure of freeways, highways, and streets. However, it has been widely recognized that the construction of new infrastructure is not as simple or affordable as it used to be. Transportation professionals have recognized the need to turn to additional measures of improving performance on the transportation system in order to provide for the most efficient movement of people and goods possible within the limited funds available to them.

Intelligent Transportation Systems (ITS) is one of many tools available to increase the effectiveness of our transportation system.

Intelligent Transportation Systems (ITS) represent one major category of these additional measures available to transportation professionals. The Region has the opportunity to enhance the efficiency of the existing transportation systems using ITS, while at the same time, building the enhanced efficiencies offered through ITS into new infrastructure being programmed and constructed.

The Fresno County ITS Strategic Deployment Plan (SDP) has been developed to serve as a:

- Primary reference document for ITS planning, programming, and deployment guidelines in the Fresno Region.
- A guide for the coordinated deployment of regional ITS efforts in accordance with the standards developed for the regional, statewide, and national ITS architectures.
- A comprehensive listing and documentation of ITS projects proposed for the Fresno County Region in the foreseeable future.
- Summary of key technical documents prepared for the Fresno County Region as part of the ITS planning process, including: problems/needs assessment, technology considerations, system architecture and project definitions.
- Primary document for distribution to Regional stakeholders and other interested parties.
- Focusing tool that provides a consensus based view of ITS deployment for the Fresno County Region in the foreseeable future.

These six purposes represent relatively difficult goals to obtain given that the SDP must provide for both near-term and longer-term ITS considerations. However, it is important to note that the SDP should be seen as a framework and guiding document, and not as the final word on ITS in the Fresno Region.

The study area for this SDP includes all of Fresno County as displayed in Figure 1-1. While the impacts of neighboring ITS efforts are considered, the primary focus is on ITS applications within the Fresno County Region itself, including the Fresno-Clovis Metropolitan Area (FCMA) and the more rural areas of the County.

The Council of Fresno County Governments (COFCG) and the Fresno Region ITS Subcommittee have provided oversight in the development of this SDP. The members of the ITS Subcommittee are listed later in this Introduction.

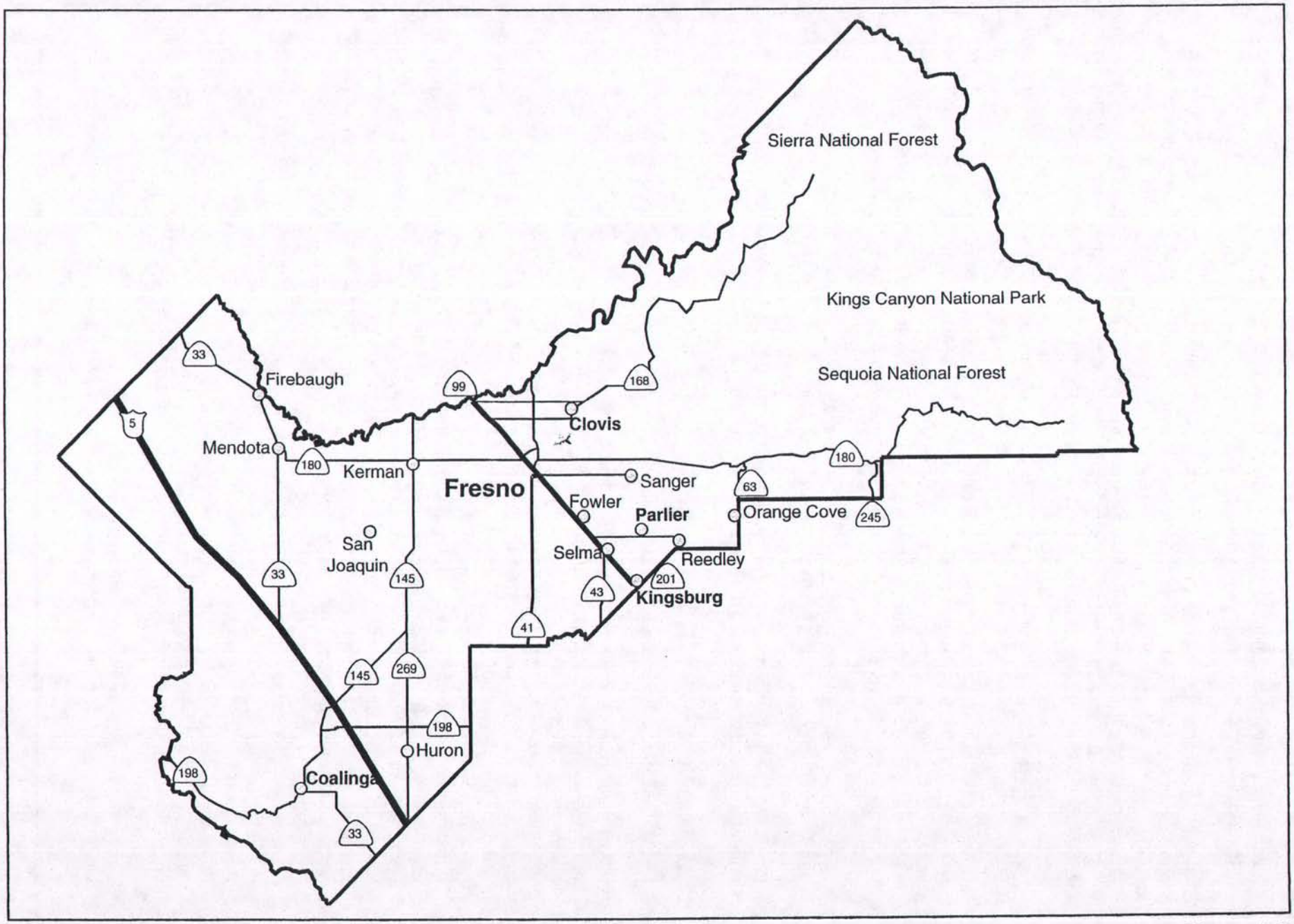
1.2 DEFINITION OF INTELLIGENT TRANSPORTATION SYSTEMS

There are several manners in which Intelligent Transportation Systems (ITS) can be defined, but the simplest view is this:

"ITS is the utilization of technology to make our transportation system smarter"

ITS seeks to make the transportation system "smarter" by:

- Combining new systems with old, linking previously independent systems together through systems, networking, and communications technology;
- Improving the information available for transportation systems managers and the general public; and



Fresno County Strategic Deployment Plan COFCG

Figure 1-1
Map of the Fresno County Region

- Automating traffic management functions in a manner that allows network managers to respond to the rapidly changing transportation environment.

ITS is the tying together of what transportation professionals already know about how the transportation system operates with the new communications, calculations, and integration capabilities that have recently become available. ITS can be as simple as linking two older traffic controllers together to allow them to communicate and coordinate timings, or as complex as providing a full sensor image of the entire transportation system and automating transportation system management functions.

1.2.1 A COMMON MISCONCEPTION

There is a common misconception that ITS must be "high tech" or utilize new technologies. Many of the systems that transportation professionals have worked with for years, such as centralized traffic signal control systems and ramp meters, are considered part of the overall ITS picture. Intelligent Transportation Systems represent more concepts than they do any single type of technology. The focus of the entire ITS "concept" is to promote:

- Application of technology in order to improve the management capabilities of transportation professionals and enhance the effectiveness of the transportation system.

- Integration and interoperation of the many separate transportation management systems to enhance interjurisdictional or interdepartmental efficiencies.

1.2.2 MANAGEMENT SYSTEMS AND INTEGRATION

Before proceeding, it is important to clarify a couple of concepts related to ITS. Transportation management systems are the basic component of any ITS program or effort. The integration of management systems is quite frequently the end goal of an ITS program or effort. Management systems and the integration of system can be thought of as:

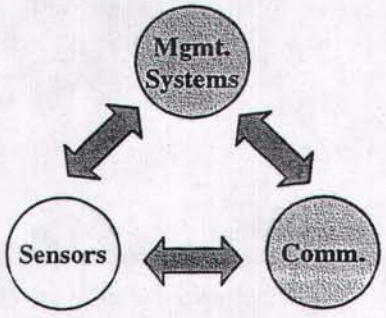


Figure 1-2: Components of a Management System

- **Management Systems** – are a functional combination of software, computers, communications, and sensors which serve a particular function. For example, a traffic signal control system is comprised of the loops in the road and the signal lights (sensors), the communications lines from the sensors to the controller cabinet and from the cabinet to a control center, and the computers and software that provide operational control of the signal. Figure 1-2 displays the three components of a single system.

- **Integration** – is the tying together of two or more separate computerized management systems. By tying systems together, data, information and even control can be exchanged or shared between systems. Figure 1-3 represents the integration of two systems. Integration can occur at many

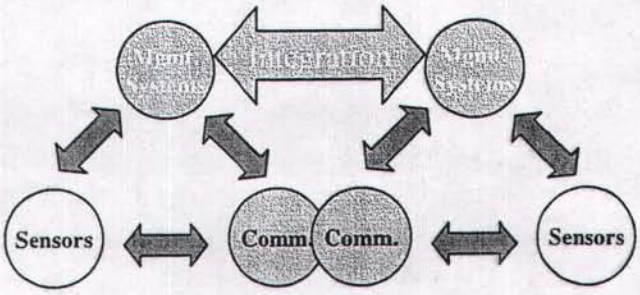


Figure 1-3: Integration of Management Systems

different levels. For example, a business may choose to integrate its payroll and invoicing systems to speed the billing process. Continuing the traffic signal control example, two separate signal systems can be integrated to allow the sharing of signal status and timing plans.

1.3 BENEFITS OF INTELLIGENT TRANSPORTATION SYSTEMS

The primary purpose behind the development of Intelligent Transportation Systems is the benefits it can provide to the transportation network, as well as to the end users of that network, the general public. For the purposes of this Plan, ITS projects have been categorized into five major areas known as program areas. These areas include:

- Traffic/Freeway Management Systems
- Incident Management/Emergency Services
- Transit Systems
- Transportation User Information Systems
- Regional ITS Configuration Management Coordination/Planning

These categories remain consistent throughout the Plan. The general benefits of ITS deployment in each of the five is discussed below.

Traffic/Freeway Management Systems

Traffic/freeway management systems can reduce travel time by improving the flow of traffic through improved communications and control techniques. An example of this is the use of ramp meters on congested freeways. Safety improvements occur in management systems by controlling the conflict between different streams of traffic through improved control devices or by improving compliance with those devices. By reducing the number of accidents, the severity of accidents should also decrease. Improving the flow of traffic and reducing congestion would lead to a reduction in fuel consumption, and an improvement in local air quality. Cost reductions benefit both the system operators and the system users. By improving the traffic flow, a greater number of vehicles can travel a system in a shorter period of time. Users perceive that reducing the amount of time they spend traveling saves them actual dollars, and allows them more time for activities other than traveling.

A component of traffic/freeway management systems are traffic signal technologies that allow the traffic signal system to respond to real time conditions. This includes giving priority to emergency and transit vehicles. Emergency and transit vehicles can be equipped with devices to speed or maintain a green light in the direction the vehicles are traveling. Signal coordination systems that respond to special event (such as concerts or sporting events) traffic to ease congestion are also a component of this program area. Additionally, a traffic control center can adjust a coordinated signal system to smooth the flow of traffic due to high traffic volumes or an incident.

Summary of Benefits:

- Reduction in travel time
- Improve safety (reduction in both number and severity of accidents)
- Improve communications ability among a variety of agencies

- Improve response time to incidents
- Reduction in fuel consumption
- Reduction in emissions
- Reduction in costs

Incident Management/Emergency Services

The weather conditions in the Fresno area can change quickly, and conditions such as Tule fog can occur fairly suddenly. By improving the integration between weather information and traffic management systems (ATMS), messages can be sent via HAR and/or CMS alerting drivers to dangerous conditions. This should help reduce the number and severity of accidents due to dangerous weather conditions. The increased weather condition information can also help agencies allocate personnel in a way to better serve the systems users.

By automating incident detection and verification systems, it is possible to reduce the time it takes to quickly identify the location of the accident and verify the type so that appropriate responses can be taken. By quickly and accurately responding to the incidents, delays can be reduced.

Secondary crashes are a serious problem for response agencies and the motoring public. Studies have documented that between 20 and 31 percent of crashes occur as the result of previous incidents. These numbers can be reduced significantly through the proper use of ITS technology; especially by providing for motorist information.

Summary of Benefits:

- Obtaining and providing accurate weather information
- Improvement in identifying, locating, and responding to incidents
- Reduction in delays due to incidents

Transit Systems

Coordinating transit operations and dispatch centers would increase efficiency among transit operators in the region. Redundancy of routes can be eliminated, and coordination can improve the ease of transferring from one system to another. This would also provide time savings for the operators and users, and may lead to an increase in ridership.

Time savings occur through the improvements of vehicle operation and overall operation of the transportation network. Emissions can be reduced by maximizing the operation of the fleet, providing transit when it is needed, and reducing service when and where it is not necessary. Improving the transit system may also attract more riders, reducing the number of single-occupancy vehicles on the road. Fuel savings occurs by maximizing the operations of the transit fleet, and by attracting riders from private vehicles through improved service.

Improved operations and maintenance includes having greater flexibility to increase or slightly alter service when incidents demand it, and by reducing maintenance costs to a fleet by tracking each vehicle. Improving vehicle usage and purchase of new vehicles is another benefit of utilizing ITS for transit systems. Approaching the purchase of new vehicles from a regional perspective can also reduce the operators costs by sharing expenses.

By reducing travel time and maximizing service in all areas, an agency may be able to reduce the number of vehicles in the fleet, and purchase appropriate vehicles based on the existing and predicted future service demands.

Summary of Benefits:

- Improved cooperation/coordination between transit operators in the area
- Time savings
- Improved operations and maintenance
- More efficient vehicle use/purchase
- Improved information dissemination
- Fuel savings
- Cost savings on system expansions and completions

Transportation User Information Systems

Transportation User Information Systems can reduce travel times by providing needed information to travelers in order for them to select the best route for each trip. By improving the travel time, there would be a reduction in fuel usage and a reduction in emissions. The information provided to travelers can also allow system users to avoid delays or unsafe conditions based on weather, roadway, or traffic conditions.

Weather and fog were identified as being significant problems related to travel conditions on the area highways. A Transportation User Information System, in conjunction with the weather information system, would help to alert highway users of fog and weather conditions, allowing the user to alter their travel plans. This may aid in reducing the number and severity of highway incidents related to Tule fog and other problematic weather conditions that impact the Fresno region.

Summary of Benefits:

- Reduction in travel time
- Savings in fuel
- Reduction in emissions
- Reduction in accidents

Regional ITS Configuration Management Coordination/Planning

This project area would encourage the coordination, cooperation, and communication among a number of local and state agencies. This would enable the region to develop a system that would satisfy the needs of the agencies involved, as well as lead to a system that is compatible with others. While a direct communication link may not be established immediately between the Fresno County area and other regions, the ability to do so in the future would allow the system to grow as needed.

Summary of Benefits:

- Improved communication among agencies, both local and state
- Compatibility of systems within the region
- Compatibility of systems with other regions

1.4 BENEFITS OF AN ITS STRATEGIC DEPLOYMENT PLAN

The Fresno County 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 Fresno 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.

1.5 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 LAX 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 Fresno 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.

The nation is moving forward. The Fresno Region has already taken significant steps towards deploying ITS infrastructure components. The 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.

1.6 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 1-4.

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.

1.6.1 DEVELOPMENT OF THE ITS STRATEGIC DEPLOYMENT PLAN

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

Agency Coordination and Stakeholder Outreach

The Fresno ITS Subcommittee 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 COFCG 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 Fresno 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 ITS Subcommittee and influenced the development of the SDP.

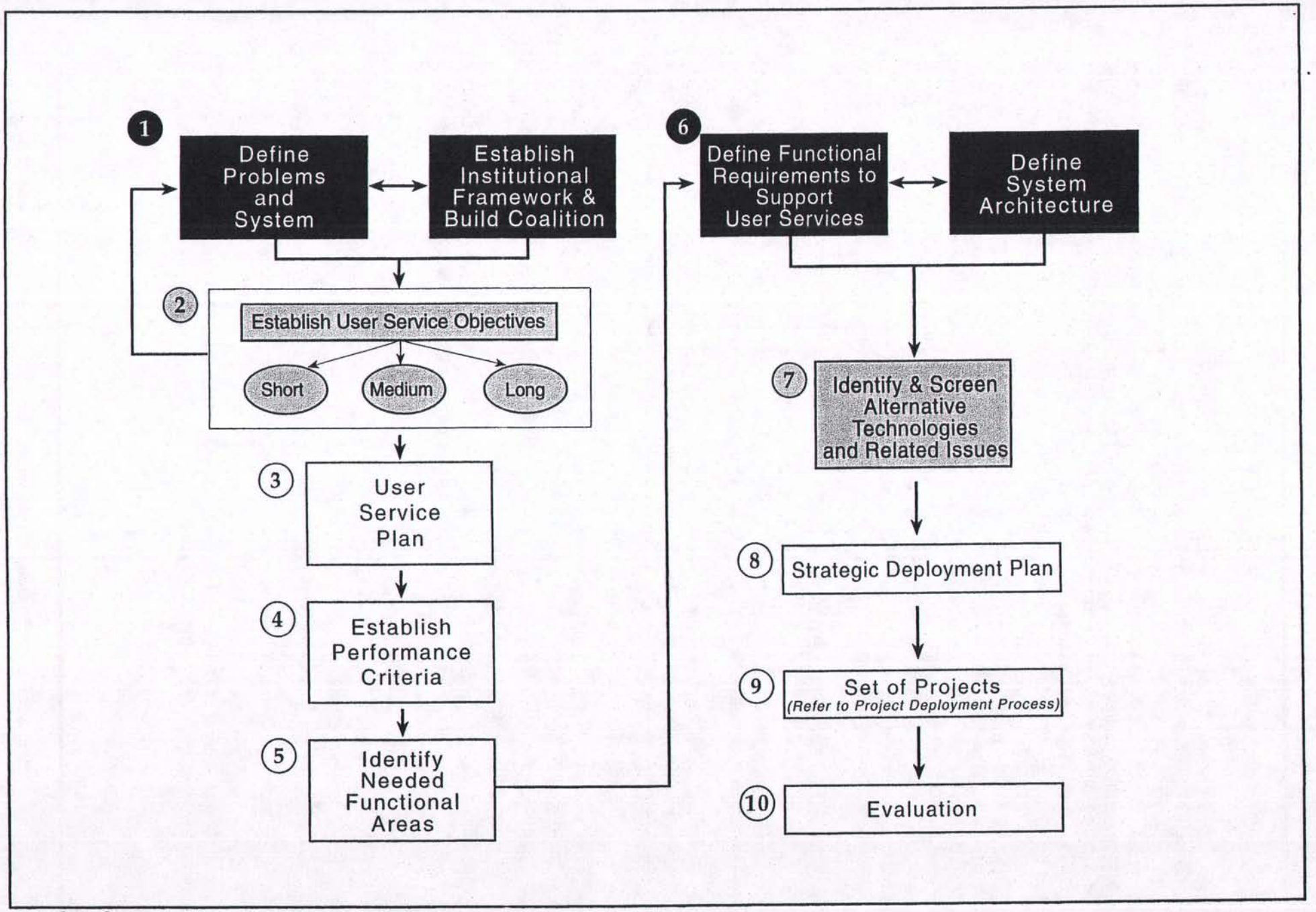


Figure 1-4
FHWA ITS Planning Process

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 Subcommittee. A preliminary potential project list was submitted to the Subcommittee based on the problems and needs assessment performed in the early stages of the SDP's development. The Subcommittee further refined these projects in a workshop and a series of break-out groups focusing on each stakeholder's area of interest. Progressive versions of the project definitions were submitted to the Subcommittee 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 ITS Subcommittee 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.

1.6.2 SUPPORTING DOCUMENTS

Numerous documents were produced which support this Strategic Plan. All of these documents are available under separate cover and many are summarized in this Plan. These documents consist of:

- Fresno County ITS Strategic Deployment Plan: Transportation System and Technology Uses Inventory Report (December 1998) – available under separate cover.
- Fresno County ITS Strategic Deployment Plan: Problems and Opportunities Working Paper (November 1998) – summarized in Section 3.0 of this Plan.
- Fresno County ITS Strategic Deployment Plan: User Service Plan and Definitions (February 1999) – summarized in Section 3.0 of this Plan.
- Fresno County ITS Strategic Deployment Plan: Market Package Plan and Definitions (March 1999) – summarized in Section 4.0 of this Plan.
- Fresno County ITS Strategic Deployment Plan: Performance Criteria and Acceptance Testing (March 1999) – available under separate cover with acceptance testing summarized in Section 8.0 of this Plan.
- Fresno Regional System Architecture (May 1999) – provided in full as Section 5.0 of this Plan.
- ITS Technology Glossary (May 1999) – available under separate cover.
- Fresno County ITS Strategic Deployment Plan: Technology Options Report (June 1999)
- ITS Glossary of Terms and Acronyms – included at the back of this Plan.

Copies of the documents available under separate cover can be obtained from the Council of Fresno County Governments (COFCG).

1.7 STRATEGIC DEPLOYMENT PLAN ELEMENTS

There are nine Sections in this SDP. Table 1.1 provides a brief outline of the information contained in each.

TABLE 1.1
DESCRIPTION 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 Fresno County Region as defined by the ITS Subcommittee.
3.0	Regional User Needs	Summarizes transportation problems/needs identified by stakeholders in the Fresno County Region. Includes priority user services.
4.0	Market Packages and Functional Requirements	Summarizes the priority market packages and functional requirements identified for the Fresno County Region
5.0	System Architecture	Defines an open architecture based on object oriented 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 Fresno 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 Fresno 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 Fresno Region.

1.8 PLAN STAKEHOLDERS

Table 1.2 lists the key stakeholders that provided input to the SDP and/or participated in the ITS Subcommittee.

TABLE 1.2
LIST OF STRATEGIC DEPLOYMENT PLAN STAKEHOLDERS

Caltrans District 6 Planning	County of Fresno
Caltrans District 6 Systems	Fresno Area Express
Caltrans District 6 TMC – Operations	Fresno County Rural Transit Agency
Caltrans New Technology & Research Program	FCTA
City of Clovis	Clovis Chamber of Commerce
City of Clovis Police Department	Federal Highway Administration
City of Clovis Fire Department	Fresno County Economic Opportunities Council
City of Coalinga	Fresno County Fire Protect. District
City of Fresno	Selma Fire Department
City of Fresno Police Department	California Department of Forestry – Fire
City of Fresno Fire Department	Fresno County Emergency Services
City of Fresno Department of Airports	American Ambulance
City of Firebaugh	Community Hospitals
City of Kerman	California Highway Patrol
City of Mendota	City of Kingsburg
City of Reedley	Chamber Transportation Commission
City of Selma	Fresno-Madera Area Agency on Aging
COFCG – Freeway Service Patrol	City of San Joaquin
San Joaquin Valley Air Pollution Control District	Fresno Cycling Club
City of Sanger	City of Orange Cove
City of Parlier	City of Fowler
City of Huron	City of Clovis Transit

The COFCG and ITS Subcommittee would like to thank these stakeholders for their participation in the development of this Plan.

1.9 PROJECT CONSULTANTS

A consultant team was contracted by COFCG in order to assist COFCG and the Fresno Region ITS Subcommittee in the development of the SDP. This consultant team included:

- BRW, Inc. (project team prime consultant)
- National Engineering Technology (NET)
- Parsons Brinkerhoff Farradyne, Inc (PBFI)
- CCS Planning and Engineering

SECTION 2.0 VISION AND GOALS

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.

2.2 FRESNO COUNTY REGION ITS VISION

2.2.1 VISION STATEMENT

The ITS Subcommittee developed and accepted a vision statement for the deployment of ITS in Fresno County. This vision is displayed in Figure 2-1 and stated as follows:

"The ITS vision for Fresno County is to enhance safety, mobility, efficiency, and transportation productivity, and to improve the quality of life and environment through the use of cost effective ITS technologies and systems."

It is important to return to this vision statement as the deployment of ITS proceeds in the Fresno County Region. The purpose of ITS in Fresno is not to deploy technology for technologies sake, but to effectively employ ITS to assist in solving problems related to transportation in the Region.

Through every ITS deployment, the Fresno Region should seek to establish a clear path towards providing a viable and sustainable ITS solution that meets the stated vision and goals of the Region. Prototyping and any field tests should focus towards this end, rather than simply deploying a test which will be decommissioned a few months following deployment.

2.2.2 MODAL VISION ELEMENTS

The overall ITS vision statement has different implications within each general transportation area or mode within the Fresno County Region. Based on the input of the ITS Subcommittee,

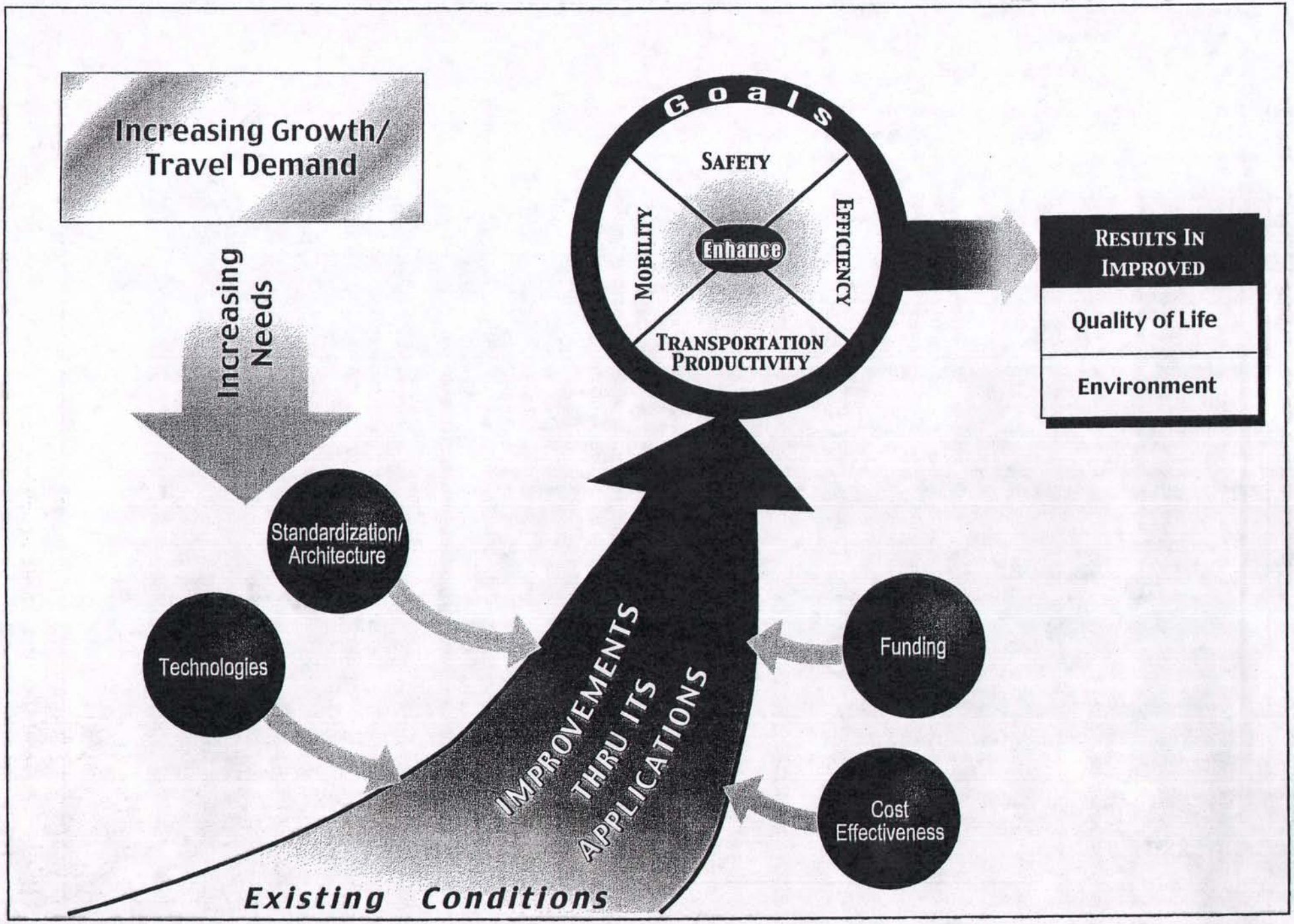


Figure 2-1
Fresno County Region
ITS Vision

Table 2.1 displays the general vision for each modal or ITS area within the Region.

TABLE 2.1
MODAL VISION ELEMENTS

Elements	Vision Description
Freeway Management	Caltrans District 6 has already deployed ITS infrastructure (cameras, weather stations, advisory radios, ramp meters) in many areas. The vision for continued deployment focuses on filling in deployment gaps in urban areas, enhancing rural area coverage, and improving systems integration and management software. This includes upgrades to the Transportation Management Center (TMC).
Traffic Management	The Cities of Fresno, Clovis, and the County of Fresno have led the way in local agency traffic management ITS deployment in the Region. Previous efforts have focused on signal system improvements. This focus is expected to continue, but with a growing emphasis on other local traffic management technologies as well. Together these agencies developed an overall Implementation Plan for local ITS elements. The overall vision for traffic management in the Fresno Region focuses on continued integration and coordination between these key agencies combined with the carry-over of key ITS components to the smaller more rural cities.
Incident Management	The incident management vision for the Fresno Region is to enhance interagency incident response and coordination through the application of ITS technologies, and formation of an on-going Incident Management Task Force. 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 motorist information by ITS means will prevent secondary collisions, improve traffic flow, and reduce emissions.
Transit Management	The transit ITS vision for the Region focuses around increasing the capabilities and scope of the existing Fresno Area Express deployments. The concept is to avoid re-inventing the wheel by maximizing compatibility between urban and rural systems. This vision also incorporates enhanced cooperation and coordination between Fresno and Clovis transit agencies.
Transportation User Information	The vision for transportation user information (also known as traveler information) in the Region is to provide some enhanced information based on the expanding capabilities of the transportation management systems, and at the same time, preparing for the impending statewide and possibly valleywide transportation information deployment efforts.
Configuration Management/ Systems Integration	The systems integration vision for the Region is based on not re-inventing the wheel. The concept is to utilize the national and statewide architectures as a basis, and then providing for coordinated deployments and standards within the Region.

2.3 SUPPORTING GOALS

To support this vision statement the ITS Subcommittee reviewed and accepted a series of supporting ITS goals and objectives. The accepted goals and related objectives are as follows:

- **Enhance Productivity**
  - To reduce the travel delay and increase the reliability and predictability of moving people and goods for all transportation users.

- To improve the ability of users and operators to perform travel planning using real-time travel information.
- To reduce the operational costs to operators incurred from poorly operating transportation facilities.
- To reduce the scheduling and processing delays and costs to users and operators associated with the regulation of vehicles.
- To reduce the costs and improve the quality of data collection for transportation system planning, use, operations, maintenance and installations.

➢ **Improve Safety**

- To reduce the number and severity of motor vehicle collisions and associated injuries and fatalities.
- To improve the average response time of emergency services.
- To improve the ability to identify, respond, remove and/or mitigate the effects of incidents.
- To improve the tracking of hazardous material movements, and the response to and mitigation of the effects due to loss of containment situations.
- To enhance personal security on all modes of transportation.
- To reduce safety hazards stemming from adverse road/weather conditions.

➢ **Improve the Environment**

- To increase the use of public transit and other shared ride alternatives.
- To reduce harmful emissions per unit of travel for all transportation modes.
- To maintain and improve air quality standards.
- To reduce the energy consumption per unit of travel for all transportation modes.
- To reduce the need for new right-of-way requirements and related community disruption associated with transportation facility improvements.
- To reduce vehicle miles traveled.

➢ **Increase Efficiency**

- To reduce congestion and associated costs.
- To optimize the operational efficiency of goods and people movement on existing facilities.
- To increase average vehicle occupancy.
- To reduce time lost in intermodal interchange.
- To increase capacity of existing infrastructure through ITS Deployment.
- To reduce travel time.

➢ **Create a State-of-the-Art ITS Transportation System**

- To establish an ITS architecture that is:
  - open, receptive and adaptable to meet future area architecture needs.
  - consistent to the maximum degree possible with developing national standards and architecture.
- To develop and integrate the following systems throughout the area as appropriate:
  - Travel and Transportation Management
  - Travel Demand Management
  - Public Transportation Operations
  - Commercial Vehicle Operations
  - Emergency Management

The regional ITS vision and associated goals and objectives serve as guiding principles for the development of the Fresno County ITS SDP. While many of the goals and objectives represent "motherhood and apple pie" type statements, it is still critical to note and document that they were reviewed, discussed, and accepted by the ITS Subcommittee.

2.4 ITS VISIONS FOR NEIGHBORING REGIONS

Deployment of ITS is occurring throughout the Central Valley, as well as the State. There are numerous neighboring regions with strong transportation relationships with the Fresno Region. These include Kern County, Los Angeles, Bay Area, and the remaining counties which comprise the Central Valley Region. It is important that ITS deployments within the Fresno Region consider the implications of deployments in neighboring regions. This consideration begins with a review of the ITS visions of these neighboring regions:

➢ **Kern County Region** – While the Kern ITS Early Deployment Plan does not include a specific vision statement, it does make note of priority problems and ITS goals. The primary focus of the Kern ITS vision centers on improving safety through the application of ITS solutions. In addition, the Plan notes that improved information sharing, enhanced transit service, decreased traffic delays, improved air quality, and enhanced commercial vehicle operations are all key to the Kern County region's ITS program.

➢ **Los Angeles Region** – The Los Angeles region defines it ITS vision in a somewhat more complex manner than Fresno or Kern 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."
- **Central Valley Region** – The Central Valley region will be moving forward with its ITS planning process near the completion of the Fresno plan. It will incorporate the information and findings of the Kern and Fresno ITS plans with new information from the rest of the Central Valley. While a vision has yet to be defined for the entire Central Valley, it is likely that it will hold much in common with the vision defined for Fresno and Kern counties.

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 Fresno region to consider what opportunities exist for cooperation with neighboring regions.

The Fresno County 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 Fresno Region may choose to draw upon certain architecture and system efforts that support the Region's goals. In terms of Kern County and the rest of the Central Valley, it implies a much closer and more cooperative effort where joint deployments should be a primary consideration.

SECTION 3.0 REGIONAL USER NEEDS

3.1 PURPOSE OF USER NEEDS ASSESSMENT

Prior to the development of Intelligent Transportation System (ITS) project concepts for the Fresno County Region, regional transportation stakeholders worked together to define their priority transportation problems and ITS service needs. Priority problems and ITS services were utilized as a starting point for the development of potential ITS projects for the Region. Together these priority problems and ITS services comprise the user needs assessment for the Region. It is important to note that this assessment focuses on the potential application of ITS within the Region and does not include the full range of transportation issues within the Region. This Section of the Plan summarizes the results of this process.

Additional detailed information on the needs identification process and results is contained in two supporting documents for this Plan:

- Fresno County ITS Strategic Deployment Plan: Problems and Opportunities Working Paper (November 1998); and
- User Service Plan and Definitions (February 1999).

Both of these documents are available from COFCG.

3.2 DEFINITION OF USER NEEDS

The ITS user needs of stakeholders in the Fresno County Region are comprised of two primary components:

1. **Transportation Related Problems** – These are simply the pressing transportation problems within the Fresno County Region, as identified by the ITS Subcommittee and other various transportation stakeholders.
2. **ITS User Services** *(Represents the Potential Solutions)* - Through the development of the National Architecture, USDOT has identified 31 ITS user services. Together these services comprise the breadth of potential ITS deployment within a region. A user service is defined as:

One or more specific ITS applications that address specific needs for a specific set of users.

A user service is simply a way of breaking down the extensive array of ITS applications available in a manner that is more easily understood and allows for classification and prioritization of ITS applications.

3.3 USER NEEDS IDENTIFICATION PROCESS

To assess user needs for the Fresno County Region a three pronged approach was used. This approach involved:

1. **Surveys of a broad base of potential transportation stakeholders.**

   The surveys allowed for input from a broad range of stakeholders including transportation agencies, emergency services, community groups, planning councils, economic development councils, cities, the County, Federal Highway Administration (FHWA), Caltrans, and others. The surveys included opportunities for input on transportation problems, user needs, and potential project ideas. Over 150 surveys were distributed, and results from the returned surveys were reviewed and compiled. A return rate of approximately 20% was achieved.

2. **On-site and phone interviews with numerous transportation agencies and stakeholders.**

   Numerous on-site interviews and tours of facilities were conducted with key transportation stakeholders in Fresno County. Interviews provided insight and background on key transportation problems, agency coordination issues, on-going ITS efforts, and related concerns.

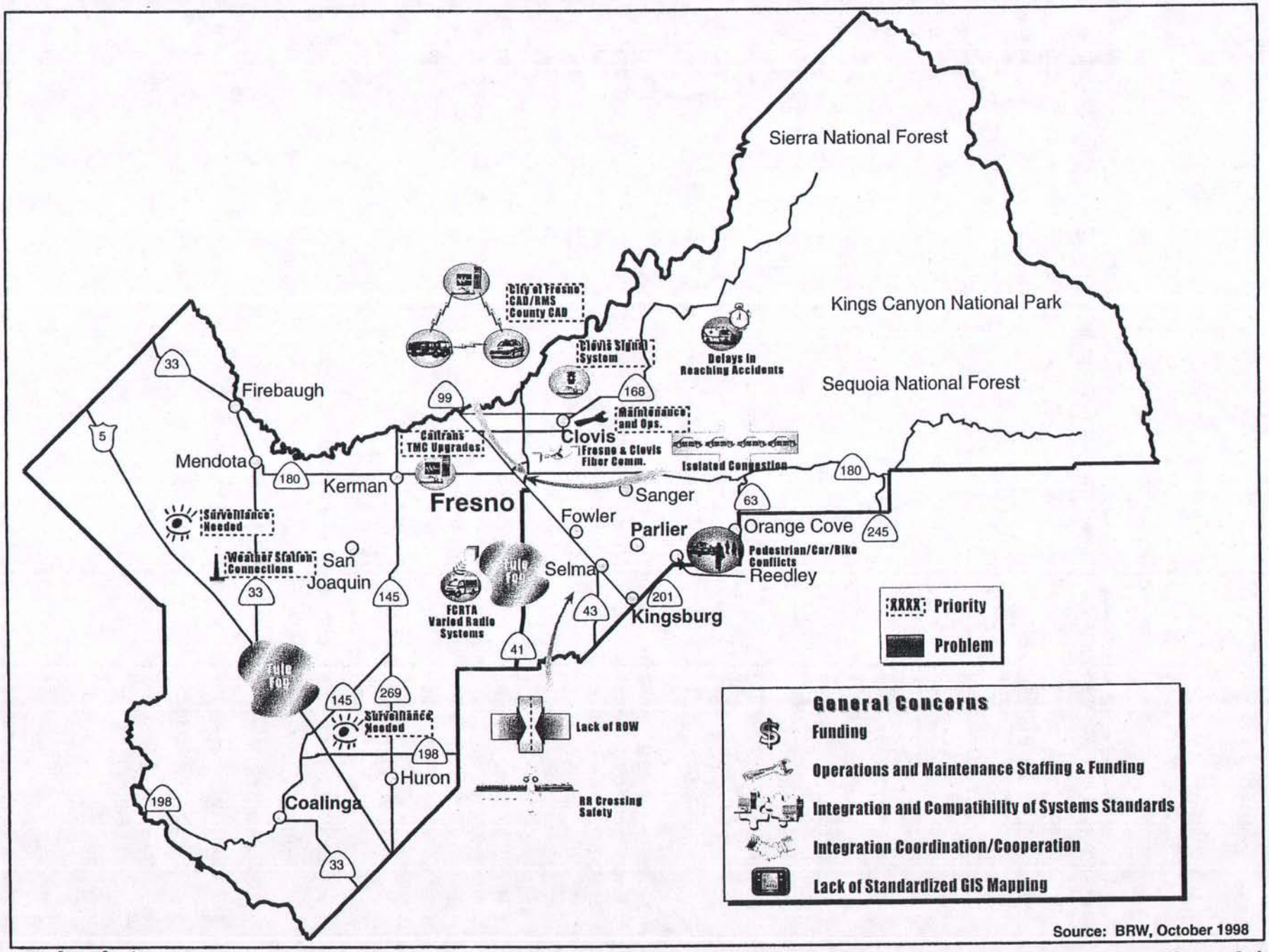
3. **ITS Subcommittee Meetings**

   The Fresno ITS Subcommittee met on approximately a monthly basis to discuss key issues and review materials. Several interactive exercises and discussion were held with this group to identify, define, and prioritize transportation problems and ITS user services for the Fresno County Region.

At each stage of the outreach and needs assessment process results were reviewed with the ITS Subcommittee to clarify issues and keep the assessment on track with the goals of the Strategic Plan.

3.4 PRIORITY USER NEEDS

The priority transportation problems and ITS user services identified through the development of this Strategic Plan are displayed in Figure 3-1 and summarized below. In some cases, relationships between problems, causes, and potential user service solutions are outlined



Source: BRW, October 1998

Fresno County ITS Strategic Deployment Plan

Fresno County Strategic Deployment Plan COFCG

Figure 3-1
Regional Transportation/ Related Problems and Priorities

3.4.1 PRIORITY TRANSPORTATION PROBLEMS

Table 3.1 displays the priority transportation problems for the Fresno County Region as defined by the ITS Subcommittee and other stakeholders.

TABLE 3.1
TOP OVERALL REGIONAL PRIORITY TRANSPORTATION PROBLEMS

Rank	Priority Problem	Score
1	Lack of Integration/Cooperation/Coordination/Common Communications	33
2	Signal Coordination (Needed)	22
3	Emergency Response Time	19
4	Air Quality	18
5	Funding	15
6	Lack of Traveler Information	12
7	Staffing	9
8	Red Light Running	7
9	GIS Mapping/Mapping Standards/Old Maps	5
10	Visibility Related Incidents (Fog/Dust)	3
11	Lack of Surveillance	2
12	Data Needs (Data needed for transportation planning & evaluation purposes)	1
12	Incidents (General)	1
12	Lack of Known Standards	1

Source: ITS Subcommittee Problem Exercise, September 1998.

Notably, the greatest problem indicated by the ITS Subcommittee was a general lack of systems integration, common communications, and coordinated operations. This problem encompasses a large number of institutional and technical issues. In addition the Subcommittee gave high priority to a number of institutional problems such as limited funding, staffing resources, and lack of known standards. A need for greater signal coordination was noted, while local street traffic congestion was not indicated as a priority problem. It was indicated that long waits at traffic signals tend to increase motorist propensity to run red lights. Air quality ranked higher than many other areas for which ITS plans have been completed. Visibility reducing weather conditions such as Tule fog and dust storms were noted as a priority problem. The need for increased surveillance on transportation facilities and general incidents rounded out the priority regional problems.

The ITS Subcommittee did make note of a few other regional problems including:

- Security concerns on integrated communications systems;
- Morning peak hour congestion along a handful of urban "hot spots;"
- Evening peak hour congestion on SR 41 northbound;
- Railroad crossing traffic and emergency response delay;
- Railroad crossing safety;
- Seasonal tourist based traffic congestion along recreational routes and major events centers; and
- Special events traffic.

While these problems did not rank as the highest regional priorities they still represent notable problems for the Fresno County area.

In addition to considering the priority transportation problems for the Fresno County Region, the Subcommittee also reviewed and discussed the potential underlying causes of those problems. This exercise was useful in identifying whether or not the priority problems stated by stakeholders were directly or indirectly related to the root cause of the problem. For example, it is useful to say that a train is always late. Certainly this could be classified as a problem. But simply stating that a train is always late may not be enough to determine the root cause of the train's frequent tardiness. The train may always be late because there is too much rail traffic competing on a single track, or perhaps the train is frequently late because the schedule does not realistically reflect the time it takes to travel from one point to another. While this seems like a simple concept, it is important to note that the Subcommittee assessed these causes. Table 3.2 displays a set of potential causes that may be attributed to each priority transportation problem.

TABLE 3.2
POTENTIAL CAUSES OF PRIORITY TRANSPORTATION PROBLEMS

Rank	Priority Problem	Potential Causes
1	Lack of Integration/ Cooperation/ Coordination/ Common Communications	Lack of common standards, configuration management, interagency coordination, and common communications resources, lack of common deployment efforts, lack of funds
2	Signal Coordination (Needed)	Real Problem – Local Street Traffic Congestion Causes - high traffic volumes, lack of intra-agency signal coordination, lack of interjurisdictional signal coordination, lack of proper communications, signal system standards, lack of funds and staffing resources, lack of interagency cooperation/coordination
3	Emergency Response Time	Traffic congestion, signal delay, failure of traffic to yield, difficulty in finding incidents, difficulty in relaying incidents to appropriate responder.
4	Air Quality	Traffic congestion, high polluting vehicles, RR emissions/delays, lack of signal coordination, vehicles waiting at major generators.
5	Funding	Lack of interagency cooperation, general lack of available funds, lack of project promotion, lack of proper project packaging, failure to gain political support.
6	Lack of Traveler Information	Lack of data collection systems/methods, lack of data distribution methods
7	Staffing	Lack of funds, lack of internal agency support, lack of external political support
8	Red Light Running	Failure of motorists to obey laws, visibility of signals, lack of signal coordination, high signal delay, motorist impatience
9	GIS Mapping/Mapping Standards/Old Maps	Lack of common mapping standard, lack of interagency coordination, lack of regional mapping needs assessment, variations in real-time/non-real time mapping needs, lack of funds
10	Visibility Related Incidents (Fog/Dust)	Weather conditions, failure of motorists to slow to safer speeds, failure to obey CMS signs, lack of motorist education, lack of enforcement.
11	Lack of Surveillance	Lack of funds, failure to fully promote surveillance in new roadway projects, lack of communications, lack of staff support, lack of agency or political support.

TABLE 3.2
POTENTIAL CAUSES OF PRIORITY TRANSPORTATION PROBLEMS

Rank	Priority Problem	Potential Causes
12	Data Needs (Data needed for transportation planning & evaluation purposes)	Lack of surveillance, lack of communications, lack of interagency coordination/data sharing, need for systems to support planning functions as well as traffic management functions.
12	Incidents (General)	Failure of motorists to drive safely, lack of visibility, unsafe roads/weather situations, unsafe vehicles, chance.
12	Lack of Known Standards	Lack of interagency coordination/cooperation, lack of an official attempts to set standards.

Source: BRW, October 1998.

3.4.2 User Services Versus Priority Regional Problems

In order to assist the Subcommittee in the development of project concepts, a matrix relating user services to priority problems was provided prior to the December 10, 1998 Workshop. This matrix is displayed as Figure 3-2. Strong relationships between user services and priority problems are indicated by an "s", while more moderate relationships display an "m." Figure 3-2 also displays the relationship between priority regional problems and a series of need areas related to user services, including:

- Institutional coordination
- Communications
- Education programs
- Configuration management
- System architecture

The purpose of these additional areas of need is to document needs which have been clearly identified by stakeholders and that are not clearly contained within any individual user service. In general, each of these need areas is important to the implementation of any of the user services.

As shown in Figure 3-2, there are strong relationships between most of the priority regional problems and Travel and Traffic Management user services. A number of the priority problems relate directly to the Traffic Control and Incident Management user services. There are also a number of strong relationships between priority problems and Advanced Vehicle Control & Safety Systems. However, the Region has generally acknowledged that these user services will be deployed either through private or federal initiatives. There are only moderately strong linkages between Commercial Vehicle Operations user services and priority regional problems.

3.4.3 Projects Concepts Compared to User Services

As indicated earlier, the Subcommittee chose to evaluate user services in light of the preliminary project concepts they developed. These project concepts were developed through a day long interactive Workshop with regional transportation stakeholders. After discussing ITS deployment in general and reviewing the priority problem results, stakeholders broke up into three subgroups to discuss project concepts.

- Traffic/Freeway Management
- Incident Management/Emergency Services
- Transit

FIGURE 3-2
USER SERVICE RELATIONSHIPS TO PRIORITY REGIONAL PROBLEMS

KEY:
S = Strong Relationship Between the User Service and the Priority Problem
M = Minor or Indirect Relationship Between the User Service and Priority Problem

USER SERVICES / PRIORITY REGIONAL PROBLEMS	Lack of Integration/Coordination/Communications	Signal Coordination (needed)	Emergency Response Time	Air Quality	Funding	Lack of Traveler Information	Staffing	Red Light Running	GIS Mapping/Standards	Visibility Related Incidents	Lack of Surveillance	Incidents (general)	Lack of Known Standards
Travel and Traffic Management	M	S	S	S		S		S		S	S	S	
En-Route Driver Information				M		S				S	S	S	
Traveler Services Information						S							
Route Guidance						S				S		S	
Incident Management	M		S	S						S	S	S	
Traffic Control	M	S	M	S				S		S	S	S	
Emissions Testing and Mitigation				S									
Pre-Trip Traveler Information				M		S				S	S	S	
Highway/Railroad Crossing/Safety				M						M	M	S	
Travel Demand Management *				M		M							
Ride Matching and Reservation				M		M							
Demand Management & Operations				M									
Public Transportation Management	M		M	S		S							
En-Route Transit Information				M		S							
Public Transportation Management	M		M	S		M							
Personalized Public Transit				S									
Public Travel Security													
Electronic Payment				M									
Electronic Payment Services				M									
Commercial Vehicle Operations			M	M						M		M	
Commercial Vehicle Electronic Clearance				M									
Commercial Vehicle Administrative Processes				M									
On-Board Safety Monitoring			M							M		M	
Commercial Fleet Management			M	M						M		M	
Automated Roadside Safety Inspection			M									M	
Hazardous Material Incident Response			M									M	
Emergency Management			S							S	M	S	
Emergency Vehicle Management			S							S	M	S	
gency Vehicle Notification and Personal Security			S							M		M	
Advanced Vehicle Control & Safety Systems										S		S	
Longitudinal Collision Avoidance										S		S	
Lateral Collision Avoidance										S		S	
Intersection Collision Avoidance								S		S		S	
Vision Enhancement for Crash Avoidance								S		S		S	
Safety Readiness			M										
Pre-Crash Restraint Deployment			M										
Automated Highway Systems			M							S		S	
Related Areas of Need	S	S	S	S	S	S	S	S	S	S	S	S	S
Institutional Coordination	S	S	M	S	S	S	S	M	S	S	M	S	S
Communications	S	S	M			S		M		S	S	S	
Education Programs	M	M	S	S	M	M	M	S	M	S	M	S	S
Configuration Management	S	S	M		M	S	S		S	M	S	M	S
System Architecture	S	S	S		M	S	S	M	M	M	S	M	S

Note: * For purposes of clarity travel demand related user services are shown separately from their defined user service bundle.

Each of these subgroups was asked to develop four to six preliminary project definitions, and provide details for their top one or two priorities. Each subgroup reported back to the larger group on their project concepts. The project definitions developed by these subgroups are listed in Table 3.3.

TABLE 3.3
PRELIMINARY PROJECT DEFINITIONS

Bundle	User Services
1.0 Traffic/Freeway Management Systems	
1.1	Ramp Metering & Communications Gap Closure
1.2	Multi-jurisdictional Interconnects
1.3	Integrated Smart Corridors
1.4	Railroad Highway Interface Technology for RR Crossings
1.5	Communications Interties
1.6	Integrated Surveillance Stations/Callbox Deployment
2.0 Incident Management/Emergency Services	
2.1	Weather/ATMS Integration
2.2	Variable Speed System
2.3	Remote Surveillance and Incident Scene Mgmt.
2.4	Computer Aided Dispatch Integration
2.5	Integration of Communications Channels
2.6	Incident Management Task Force/Team
3.0 Transit Systems	
3.1	Combined Transit District Concept
3.2	Combined Transit Operations/Dispatch Centers
3.3	Transit Information System
3.4	Transit Management System Completion/Expansion
3.5	Common/Standard Regional/County Map
3.6	Common Fare Equipment Deployment

Source: Fresno ITS Subcommittee – December 10, 1999 Workshop

Following the Workshop, the preliminary definitions were compared to the 31 user services. Figure 3-3 displays the results of this comparison. As shown in Figure 3-3, a majority of the projects have a direct relationship with Travel and Traffic Management user services. Logically, project definitions from the transit subgroup have a direct relationship with some of the Public Transportation Management user services. There were no direct relationships between the project definitions and the user services in the Commercial Vehicle Operations, Travel Demand Management, or Advanced Vehicle Control and Safety Systems user services.

3.4.4 Gaps in User Service Deployment

By comparing Figures 3-2 and 3-3, it was possible to determine which user services with strong relationships to priority problems had not been included in a project definition. The following user services have the potential to address priority regional problems, but have not necessarily been covered by the project definitions and concepts developed by stakeholders.

- Traveler Services Information
- Route Guidance
- Emissions Testing and Mitigation
- Pre-Trip Traveler Information

FIGURE 3-3
COMPARISON OF USER SERVICES AND PROJECT DEFINITIONS

Key:
X = direct relationship between user service and project definition.
O = supporting relationship between the user service and project definition.

USER SERVICES / Preliminary Project Definitions	1.0 Traffic/Freeway Management Systems	1.1 Ramp Metering & Communications Gap Closure	1.2 Multi-jurisdictional Interconnects	1.3 Integrated Smart Corridors	1.4 Railroad Highway Interface Technology for RR Crossin	1.5 Communications Interties	1.6 Integrated Surveillance Stations/Callbox Deployment	2.0 Incident Management/Emergency Services	2.1 Weather/ATMS Integration	2.2 Variable Speed System	2.3 Remote Surveillance and Incident Scene Mgmt.	2.4 Computer Aided Dispatch Integration	2.5 Integration of Communications Channels	2.6 Incident Management Task Force/Team	3.0 Transit Systems	3.1 Combined Transit District Concept	3.2 Combined Transit Operations/Dispatch Centers	3.3 Transit Information System	3.4 Transit Management System Completion/Expansion	3.5 Common/Standard Regional/County Map	3.6 Common Fare Equipment Deployment
Travel and Traffic Management																					
En-Route Driver Information			O	X			O	X													
Traveler Services Information			O		O		X														
Route Guidance			O																		
Incident Management			X			X		O	X	X	X	X							O		
Traffic Control	X	X	X		O	X	X	X	X										O		
Emissions Testing and Mitigation																					
Pre-Trip Traveler Information			O				O														
Highway/Railroad Crossing/Safety				X																	
Travel Demand Management *																					
Ride Matching and Reservation																					
Demand Management & Operations																					
Public Transportation Management																					
En-Route Transit Information																	X				
Public Transportation Management					O											X		X			X
Personalized Public Transit																					
Public Travel Security																					
Electronic Payment																					
Electronic Payment Services																					X
Commercial Vehicle Operations																					
Commercial Vehicle Electronic Clearance																					
Commercial Vehicle Administrative Processes																					
On-Board Safety Monitoring																					
Commercial Fleet Management																					
Automated Roadside Safety Inspection																					
Hazardous Material Incident Response																					
Emergency Management																					
Emergency Vehicle Management					O					X	X	O									
gency Vehicle Notification and Personal Security						O															
Advanced Vehicle Control & Safety Systems																					
Longitudinal Collision Avoidance																					
Lateral Collision Avoidance																					
Intersection Collision Avoidance																					
Vision Enhancement for Crash Avoidance																					
Safety Readiness																					
Pre-Crash Restraint Deployment																					
Automated Highway Systems																					
Related Areas of Need																					
Institutional Coordination													X	X							X
Communications	X	X			X							X									
Education Programs																					
Configuration Management																			X		
System Architecture																					

Note: * For purposes of clarity travel demand related user services are shown separately from their defined user service bundle.

In addition, none of the project definitions developed by the Subcommittee involved Advanced Vehicle Control and Safety System user services. The deployment of these user services is generally envisioned as a private sector or federal government undertaking. The potential applications of the new Data Archiving Service should be reviewed further as it may prove helpful in some of the more institutional and funding related priority problems.

To fill these gaps, the ITS Subcommittee developed two additional program areas: (1) Transportation User Information System; and (2) Regional ITS Configuration Management/Coordination/Planning. Specific projects were identified for each of these areas, and these projects are detailed in Section 6.0 of this Plan. No specific projects were identified for the Emissions Testing and Mitigation component of ITS, as the Subcommittee generally felt that air quality benefits would be received by most of the other projects being proposed.

3.4.5 User Service Priorities

While no specific user service prioritization efforts were undertaken by the Subcommittee. It is clear from the results of the Workshop that there are strong priorities for the Incident Management and Traffic Control user services. This would seem consistent with most of the priority regional problems identified for the Region. Public Transportation Management user services were the next priority. Commercial Vehicle Operations did not receive what could be considered a high priority by the Subcommittee, however the area was acknowledged as important by the group. Instead of identifying specific projects for Commercial Vehicle Operations, the Subcommittee choose to focus on improving transportation management and user information capabilities within the Region to assist commercial vehicle mobility. The Subcommittee expects that Statewide and federal efforts will take the lead in the regulatory area of commercial operation.

Institutional coordination, communications, and the setting of regional standards (configuration management) are all high priorities for the Subcommittee. While these areas of need are not identified with specific user services they are clearly critical to ITS deployment in the Region and specific projects and institutional suggestions are made within this Plan to support this need.

SECTION 4.0 MARKET PACKAGES

4.1 PURPOSE OF MARKET PACKAGES

This Section serves to define and identify the high priority or near term market packages for the Fresno County 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. In short, market packages define ITS building blocks for meeting user needs within the guidelines defined by the National Architecture.

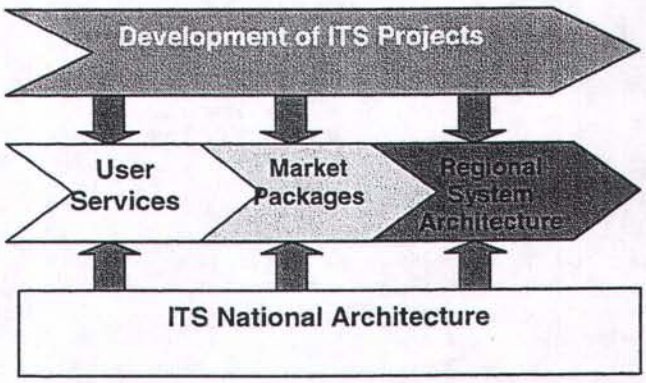


Figure 4-1
Relationships with Market Packages

The Fresno County Region ITS Subcommittee 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 2.0.

4.2 DEFINING MARKET PACKAGES

4.2.1 GENERAL DEFINITION OF MARKET PACKAGES

Market packages provide an accessible, deployment oriented perspective to the National Architecture. They are tailored to fit - separately or in combination - real world transportation problems and needs. They address the specific service requirements of traffic managers, transit operators, travelers, and other ITS stakeholders. In short a market package is:

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 capabilites 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 54 market packages that are models of what an agency or company might deploy to provide a user service. (e.g. Interactive Traveler Information that includes equipment packages for Interactive Infrastructure Information on the infrastructure side, and Interactive Vehicle Information in the vehicle).

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 identifies 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 allowing for more advanced packages to be efficiently implemented by building on common elements that were deployed earlier with more basic packages. The complete set of market packages is identified in Table 4.1.

TABLE 4.1
LIST OF MARKET PACKAGES

Traffic Management (ATMS)
- Network Surveillance
- Probe Surveillance
- Surface Street Control
- Freeway Control
- HOV and Reversible Lane Management
- Traffic Information Dissemination
- Regional Traffic Control
- Incident Management System
- Traffic Network Performance Evaluation
- Dynamic Toll/Parking Fee Management
- Emissions and Environmental Hazards Sensing
- Virtual TMC and Smart Probe
- Standard Railroad Grade Crossing
- Advanced Railroad Grade Crossing
- Railroad Operations Coordination

Emergency Management (EM)
- Emergency Response
- Emergency Routing
- Mayday Support

Traveler Information (ATIS)
- Broadcast Traveler Information
- Interactive Traveler Information
- Autonomous Route Guidance
- Dynamic Route Guidance
- ISP Based Route Guidance
- Integrated Transportation Management/Route Guidance
- Yellow Pages and Reservation
- Dynamic Ridesharing
- In Vehicle Signing

Commercial Vehicles (CVO)
- Fleet Administration
- Freight Administration
- Electronic Clearance
- Electronic Clearance Enrollment
- International Border Electronic Clearance
- Weigh-In-Motion
- Roadside CVO Safety
- On-board CVO Safety
- CVO Fleet Maintenance
- HAZMAT Management

Transit 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

Advanced Vehicles (AVSS)
- 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

ITS Planning
- ITS Planning

Detailed definitions of these market packages are provided in the National Architecture (Version 2.0) documentation, and therefore they are not included in this Section.

4.2.2 EXAMPLE OF A MARKET PACKAGE DEFINITION

This Section should be used as a guide for referring to the National Architecture and the market package definitions provided in Appendix B of the Implementation Strategy section of the

National Architecture. To assist in understanding these definitions, an example definition is provided below (excerpt from the National Architecture (Version 2.0/USDOT).

- **Network Surveillance (ATMS01) -** 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 4-2
Example Market Package Definition Diagram (Network Surveillance)

As shown in Figure 4-2, each market package definition includes a descriptive diagram. This diagram displays the various subsystems involved in the deployment of the market package, as well as the data flows between the various subsystems. The information service provider box on the left of the figure represents an external subsystem that is described in another market package. The connotations behind the market package should become clear once the implications of deploying it are considered. For example, to fully deploy this market package in the Fresno County Region, various traffic management systems would need to pass pertinent traffic information to an external source that provides information to the users of the transportation system. Of course, it is not necessary to implement each part of the market package to deploy an effective system, however a clear and documented decision should be made as to what parts of the package are and are not to be deployed.

Overall the market package definitions are relatively straight forward, and taken independently are understandable. Because of this the market packages may seem of limited use at first. However, their usefulness resides in their ability to be understood while at the same time acting as building blocks which can be brought together in the regional system architecture.

4.2.3 MARKET PACKAGES AND USER SERVICES

Market packages can be related back to the user service or general user needs which they fulfill. The ITS Subcommittee identified seven user services as being important or high priority for the Fresno County Region:

1. Traffic Control
2. Incident Management
3. Highway/Railroad Grade Crossing Safety

4. Public Transportation Management
5. Pre-Trip Traveler Information
6. En-route Driver Information
7. Emergency Vehicle Management

Table 4.2 displays the relationship between market packages and the high priority user services identified for the Fresno County Region.

TABLE 4.2
MAPPING OF PRIORITY USER SERVICES AND MARKET PACKAGES

Priority User Service	Related Market Packages
Traffic Control	Network Surveillance (ATMS01) Probe Surveillance (ATMS02) Surface Street Control (ATMS03) Freeway Control (ATMS04) HOV Lane Management (ATMS05) Traffic Information Dissemination (ATMS06) Regional Traffic Control (ATMS07) Traffic Prediction and Demand Management (ATMS09) Virtual TMC and Smart Probe Data (ATMS12) Reversible Lane Management (ATMS17) Multi-modal Coordination (APTS7) In-Vehicle Signing (ATIS9)
Incident Management	Surface Street Control (ATMS03) Freeway Control (ATMS04) Incident Management System (ATMS08) Virtual TMC and Smart Probe Data (ATMS12) HAZMAT Management (CVO10)
Highway/Railroad Grade Crossing Safety	Traffic Information Dissemination (ATMS06) Standard Railroad Grade Crossing (ATMS13) Advanced Railroad Grade Crossing (ATMS14) Rail Operations Coordination (ATMS15) Intersection Safety Warning (AVSS05) Intersection Collision Avoidance (AVSS10) In-Vehicle Signing (ATIS9)
Public Transportation Management	Transit Vehicle Tracking (APTS1) Transit Fixed-Route Operations (APTS2) Demand Response Transit Operations (APTS3) Transit Passenger and Fare Management (APTS4) Transit Security (APTS5) Transit Maintenance (APTS6) Multi-modal Coordination (APTS7) HAZMAT Management (CVO10)
Pre-Trip Traveler Information	Broadcast Traveler Information (ATIS1) Interactive Traveler Information (ATIS2) ISP Based Route Guidance (ATIS5) Yellow Pages and Reservation (ATIS7) Dynamic Ridesharing (ATIS8)
En-route Driver Information	Virtual TMC and Smart Probe Data (ATMS12) Broadcast Traveler Information (ATIS1) Interactive Traveler Information (ATIS2) Autonomous Route Guidance (ATIS3) Dynamic Route Guidance (ATIS4) ISP Based Route Guidance (ATIS5) Integrated Transportation Management/Route Guidance (ATIS6) Yellow Pages and Reservation (ATIS7) Dynamic Ridesharing (ATIS8) In-Vehicle Signing (ATIS9)

TABLE 4.2
MAPPING OF PRIORITY USER SERVICES AND MARKET PACKAGES

Priority User Service	Related Market Packages
Emergency Vehicle Management	Emergency Response (EM01) Emergency Routing (EM02) Mayday Support (EM03)

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

Figure 4-3 on the following page displays the overall relationship between market packages and user services. It is important to note that many of the market packages should be considered longer-term efforts because near-term deployment may represent an unacceptable risk. Market packages are meant to be deployable with today's technologies, but there should be a clear distinction between those market packages that may be deployed with limited risk and those which represent a higher risk due to their use of the newest technologies.

4.3 MARKET PACKAGES AND PROJECT CONCEPTS

Early in the development of the Strategic Deployment Plan, the ITS Subcommittee determined that the development of projects would parallel the identification and prioritization of user services and market packages. At a December 10, 1998 workshop, regional transportation stakeholders worked to define a series of projects. These definitions were further refined by the ITS Subcommittee at a February 4, 1999 meeting, and the final version of the project definitions is provided in Section 6.0 of this Plan. In order to relate these efforts to the National Architecture, it was necessary to identify the basic relationships between market packages and these project definitions.

Figure 4-4, to follow, provides a matrix of these relationships and identifies those market packages with strong near-term relationships to projects and those with weaker longer term relationships. It is important to note that this matrix represents preliminary results as the project definitions are not yet fully defined. Finally, relationships between market packages and communications projects are somewhat loosely defined based on the transportation management systems likely to be linked by the communications projects. Generally, communications is seen as a form of supporting infrastructure to the deployment of market packages.

4.4 PRIORITY MARKET PACKAGES AND DEPLOYMENT CONSIDERATIONS

The overall objective of the market package plan is to provide in-roads into the regional system architecture. The regional system architecture serves to tie together the market packages into a comprehensive and viable regional ITS framework. The end result should be a deployable framework that can be implemented over time as the transportation needs of the Region dictate.

As the independent ITS projects move towards deployment, it is important that the sponsoring parties take time to review and consider the information included in the market package definitions and the regional system architecture. Clear and documented decisions should be

FIGURE 4-3
MARKET PACKAGES AND USER SERVICES

Key:

X = Relationship exists between market packages and user services

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 Services 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 Services	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 Securit	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
Advanced Transportation Mgmt. Systems																														
ATMS01 Network Surveillance						X																								
ATMS02 Probe Surveillance						X																								
ATMS03 Surface Street Control						X	X																							
ATMS04 Freeway Control						X	X	X																						
ATMS05 HOV Lane Management						X		X																						
ATMS06 Traffic Information Dissemination						X				X																				
ATMS07 Regional Traffic Control						X																								
ATMS08 Incident Management System							X																							
ATMS09 Traffic Prediction & Demand Mgmt.																														
ATMS10 Electronic Toll Collection																														
ATMS11 Emission Monitoring & Management									X																					
ATMS12 Virtual TMC and Smart Probe Data		X				X	X																							
ATMS13 Standard Railroad Grade Crossing										X																				
ATMS14 Advanced Railroad Grade Crossing										X																				
ATMS15 Railroad Operations Coordination										X																				
ATMS16 Parking Facility Management																														
ATMS17 Reversible Lane Management						X		X																						
ATMS18 Road Weather Information System																														
Advanced Public Transportation Systems																														
APTS01 Transit Vehicle Tracking											X	X	X	X																
APTS02 Transit Fixed Route Operations											X	X																		
APTS03 Demand Responsive Transit Ops.											X	X	X																	
APTS04 Transit Pass. & Fare Mgmt.												X			X															
APTS05 Transit Security											X			X																
APTS06 Transit Maintenance											X																			
APTS07 Multi-modal Coordination						X		X			X																			
APTS08 Transit Traveler Information																														
Advanced Traveler Information Systems																														
ATIS01 Broadcast Traveler Information	X	X										X																		
ATIS02 Interactive Traveler Information	X	X										X	X		X															
ATIS03 Autonomous Route Guidance		X	X												X															
ATIS04 Dynamic Route Guidance		X	X																											
ATIS05 ISP Based Route Guidance	X	X	X												X															
ATIS06 Integrat. Trans. Mgmt./Route Guidance		X	X												X															
ATIS07 Yellow Pages and Reservation	X	X			X										X															
ATIS08 Dynamic Ridesharing	X	X		X								X	X		X															
ATIS09 In-Vehicle Signing		X				X				X																				
Advanced Vehicle Safety Systems*																														
AVSS01 Vehicle Safety Monitoring																													X	X
AVSS02 Driver Safety Monitoring																													X	
AVSS03 Longitudinal Safety Warning																								X					X	
AVSS04 Lateral Safety Warning																										X			X	
AVSS05 Intersection Safety Warning										X																	X		X	
AVSS06 Pre-Crash Restraint Deployment																													X	X
AVSS07 Driver Visibility Improvement																												X		
AVSS08 Advanced Vehicle Longitudinal Control																								X						
AVSS09 Advanced Vehicle Lateral Control																										X				
AVSS10 Intersection Collision Avoidance										X																	X			
AVSS11 Automated Highway System																														X
Emergency Services																														
EM01 Emergency Response																								X						
EM02 Emergency Routing																								X						
EM03 Mayday Support													X										X	X						
Commercial Vehicle Operations																														
CVO01 Fleet Administration																														
CVO02 Freight Administration																					X									
CVO03 Electronic Clearance																X			X											
CVO04 CV Administrative Processes																X			X											
CVO05 ernational Border Electronic Clearance																X			X											
CVO06 Weigh-In-Motion																X														
CVO07 Roadside CVO Safety																	X													
CVO08 On-board CVO Safety																		X												
CVO09 CVO Fleet Maintenance																		X				X								
CVO10 HAZMAT Management							X				X									X	X									
Planning Service																														
ITS01 ITS Planning											X																			

Source: USDOT National Architecture Version 2.0

FIGURE 4-4
COMPARISON OF MARKET PACKAGES AND PROJECT CONCEPT DEFINITIONS

KEY:

N = Strong near-term relationship between the deployment of the proposed project and the market package.

L = Weaker mid- to long- term relationship between the project and the market package.

Market Packages*		Preliminary Project Definitions	1.0 Traffic/Freeway Management Systems	1.1 Ramp Metering & Communications Gap Closure	1.2 Multi-jurisdictional Interconnects	1.3 Integrated Smart Corridors	1.4 Railroad Highway Interface Technology for RR Crossing	1.5 Communications Interties	1.6 Integrated Surveillance Stations/Callbox Deployment	2.0 Incident Management/Emergency Services	2.1 Weather/ATMS Integration	2.2 Variable Speed System	2.3 Remote Surveillance and Incident Scene Mgmt.	2.4 Computer Aided Dispatch Integration	2.5 Integration of Communications Channels	2.6 Incident Management/Response Task Force/Team	3.0 Transit Systems	3.1 Coordinated Transit District Concept	3.2 Coordinated Transit Operations/Dispatch Centers	3.3 Transit Information System	3.4 Transit Management System Completion/Expansion	3.6 Common Fare Equipment Deployment**	4.0 Transportation User Information Systems	4.1 Regional Transportation User Info. System	5.0 Regional ITS Config. Mgmt. Coord./Plan	5.1 Valleywide/Statewide Communications Linkages	5.2 Regional Configuration Management	3.5 Common/Standard Regional/County Map
Advanced Transportation Mgmt. Systems																												
ATMS01	Network Surveillance			N	N		N	N																				
ATMS02	Probe Surveillance				L																							N
ATMS03	Surface Street Control		L	N	N		N	N																				
ATMS04	Freeway Control		N	N	N		N	N			N																	
ATMS05	HOV Lane Management																											
ATMS06	Traffic Information Dissemination			N	N	N	N	N		N	N																	
ATMS07	Regional Traffic Control		L	N	N		N	N		N																		
ATMS08	Incident Management System				L		N	N					N	N	N	N												
ATMS09	Traffic Prediction & Demand Mgmt.		N	L	L																							
ATMS10	Electronic Toll Collection																											
ATMS11	Emission Monitoring & Management							L																				
ATMS12	Virtual TMC and Smart Probe Data							L																				
ATMS13	Standard Railroad Grade Crossing					N																						
ATMS14	Advanced Railroad Grade Crossing					L																						
ATMS15	Railroad Operations Coordination					L																						
ATMS16	Parking Facility Management																											
ATMS17	Reversible Lane Management																											
ATMS18	Road Weather Information System			N	N		N	N			N	N																
Advanced Public Transportation Systems																												
APTS01	Transit Vehicle Tracking																	N	N	N								
APTS02	Transit Fixed Route Operations																	N	N	N								
APTS03	Demand Responsive Transit Ops.																	N	N	N								
APTS04	Transit Pass. & Fare Mgmt.																L			N	N							
APTS05	Transit Security																			N								
APTS06	Transit Maintenance																			L								
APTS07	Multi-modal Coordination			L													L	L	L									
APTS08	Transit Traveler Information																	L	N			N						
Advanced Traveler Information Systems																												
ATIS01	Broadcast Traveler Information									N	N											N		N				N
ATIS02	Interactive Traveler Information																					N		N				N
ATIS03	Autonomous Route Guidance																							L				
ATIS04	Dynamic Route Guidance																							L				
ATIS05	ISP Based Route Guidance																					N		N				
ATIS06	Int. Trans. Mgmt./Route Guidance																					L		L				L
ATIS07	Yellow Pages and Reservation																					N		N				
ATIS08	Dynamic Ridesharing																					N		N				
ATIS09	In-Vehicle Signing					L				L	L											L		L				
Advanced Vehicle Safety Systems*																												
AVSS05	Intersection Safety Warning					N																						
AVSS10	Intersection Collision Avoidance					L																						
Emergency Services																												
EM01	Emergency Response							N				N	N	N	N													N
EM02	Emergency Routing											N	N	N	N													N
EM03	Mayday Support							N					N															N
Planning Service																												
ITS01	ITS Planning				N			N							N		N										N	N

NOTES: * CVO and some AVSS market packages have been removed from the list due to lack of relationships with the defined projects.
** Original project 3.5 was reassigned as 5.3.

9/27/99

made as to whether or not to implement each part of a market package or its connections with related market packages.

4.4.1 PRIORITY MARKET PACKAGES FOR THE REGION

Taking the results of the mapping of market packages to priority user services and preliminary project definitions, a few priority market packages become evident. Priority market packages are those that have strong and/or multiple near-term relationships with the preliminary project definitions and priority user services. Table 4.3 displays these priority market packages by general category.

TABLE 4.3
PRIORITY MARKET PACKAGES

ID	Market Packages
ATMS	**Advanced Transportation Management Systems**
ATMS01	Network Surveillance*
ATMS03	Surface Street Control*
ATMS04	Freeway Control*
ATMS06	Traffic Information Dissemination
ATMS07	Regional Traffic Control
ATMS08	Incident Management System
APTS	**Advanced Public Transportation Systems**
APTS01	Transit Vehicle Tracking*
APTS02	Transit Fixed Route Operations*
APTS03	Demand Responsive Transit Operations
APTS04	Transit Passenger & Fare Management
APTS08	Transit Traveler Information
ATIS	**Advanced Traveler Information Services**
ATIS01	Broadcast Traveler Information*
ATIS02	Interactive Traveler Information
ATIS05	ISP Based Route Guidance
ATIS07	Yellow Pages and Reservations
EM	**Emergency Services**
EM01	Emergency Response*
EM02	Emergency Routing
ITS01	**ITS Planning**

Note: * Indicates that initial deployment of the market package is underway in the Region.

As shown in Table 4.3, there are a large number of "priority" market packages. It is not necessary for the Region to deploy each market package in order to develop an effective regional ITS structure.

4.4.2 PRIORITY MARKET PACKAGE CONSIDERATIONS

There are several issues and factors to be considered prior to deployment of the priority market packages. Among these are:

- Previous deployments within the Region and the architecture of those deployments.
- Institutional issues that impact effective deployment.
- Emerging national standards which may either promote or hinder deployment depending on the current status of the standard definitions.

- Deployment efforts in neighboring regions, throughout the State, and possibly across the nation.
- Funding, costs, and operational considerations.
- Other issues.

Table 4.4 serves as a summary of some of the key issues or considerations for the priority market packages identified in Table 4.3.

4.4.3 MARKET PACKAGES AND THE REGIONAL SYSTEM ARCHITECTURE

The Fresno County Region system architecture is outlined in Section 5.0 of this Plan. The system architecture provides concepts and a framework for connecting and integrating the various transportation management and information systems in the Region. It also outlines an overall framework for the flow of data between systems and the potential applicability of standards to Fresno ITS projects. In many ways market packages can be seen as building blocks that fit within the Region system architecture. However, the market packages should be seen as a guide, and compatibility with the Regional, valleywide, statewide, and/or neighboring regional architectures should take precedence.

TABLE 4.4
PRIORITY MARKET PACKAGE CONSIDERATIONS

ID	Market Packages	Regional Considerations	Other Considerations
ATMS	**Advanced Transportation Management Systems**		
ATMS01	Network Surveillance*	➢ Existing deployments by Caltrans & City of Fresno ➢ Near-term expansion along new freeway 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 ➢ City of Fresno 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 (SR180/41/etc.)	➢ 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 exists ➢ 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 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

TABLE 4.4
PRIORITY MARKET PACKAGE CONSIDERATIONS

ID	Market Packages	Regional Considerations	Other Considerations
APTS	**Advanced Public Transportation Systems**		
APTS01	Transit Vehicle Tracking*	➢ FAX system already deployed ➢ Need to expand existing deployment ➢ Radio system lacking for smaller transit agencies ➢ Possibility to deploy Region on common system	➢ J1708 – Region is compliant ➢ Instability of vendor market a concern
APTS02	Transit Fixed Route Operations*	➢ FAX system deployed ➢ Clovis operates separately ➢ Institutional considerations need to be resolved to allow better coordination ➢ Need to expand the system and add transit information linkage	➢ Costs ➢ Market options somewhat limited
APTS03	Demand Responsive Transit Operations	➢ FCRTA radio system 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 FAX GFI system ➢ 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 FAX 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

TABLE 4.4
PRIORITY MARKET PACKAGE CONSIDERATIONS

ID	Market Packages	Regional Considerations	Other Considerations
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
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

SECTION 5.0 REGIONAL SYSTEM ARCHITECTURE

5.1 PURPOSE OF THE SYSTEM ARCHITECTURE

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

The Fresno County 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, and Southern California. Where feasible, the Fresno County 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) is nearing completion of the statewide ITS architecture, with an emphasis on the integration of statewide Advanced Traveler Information Systems. The recommended Fresno architecture recognizes this effort and is flexible enough to fit within the guidelines of the statewide effort. In fact, the Fresno region will depend heavily upon the 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 projects discussed in Section 6.0 and the national standardization efforts underway. This architecture uses National Architecture Market Packages, suitably customized for the Fresno region, as a baseline for intermodal system connectivity. The Fresno 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 5.5.

Agencies wishing to deploy an ITS project in the Fresno County Region are encouraged to review this regional architecture, followed by review of the national and neighboring architectures. Depending on the specific situation, the market packages defined in the National Architecture may be helpful. Conformity with the National Architecture is a requirement of receiving federal funding under TEA-21. Agencies should work cooperatively to define regional standards for deploying ITS projects. These standards should stem from the national standardization efforts.

5.2 REGIONAL ITS SYSTEM ARCHITECTURE

An architecture can be thought of as the set of guidelines or blueprints that integrate the region's consensus market packages. We start with a two-level description of the role of an "architecture" in deploying ITS systems. The first level is intended for a non-technical audience and provides a simple definition and explanation of "architecture" while answering the question

of "why do we need to know about architectures to complete the ITS planning process"? The second level provides a more in-depth discussion that will be of primary use to system implementers. The in-depth discussion covers both physical and logical architectures and provides customized Market Package diagrams showing local system connectivity requirements. We then discuss the relevance and applicability of the developing SHOWCASE architecture in Southern California to the development of an architecture for the Fresno Region. Finally we discuss the role of standards in the region's ability to achieve conformity with the National ITS Architecture.

5.3 LEVEL 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 Fresno Region operational and institutional environment.

To put the concept of an ITS architecture into the real world, consider the following. The Fresno region desires to build a multi-jurisdictional "Smart Corridor" system consisting of integrated freeway and arterial traffic management elements. These elements include:

- A regional Transportation Management Center that controls 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 Fresno Region in particular, and in the Central Valley in general, 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.

5.4 LEVEL 2 – DETAILED ARCHITECTURE DISCUSSION

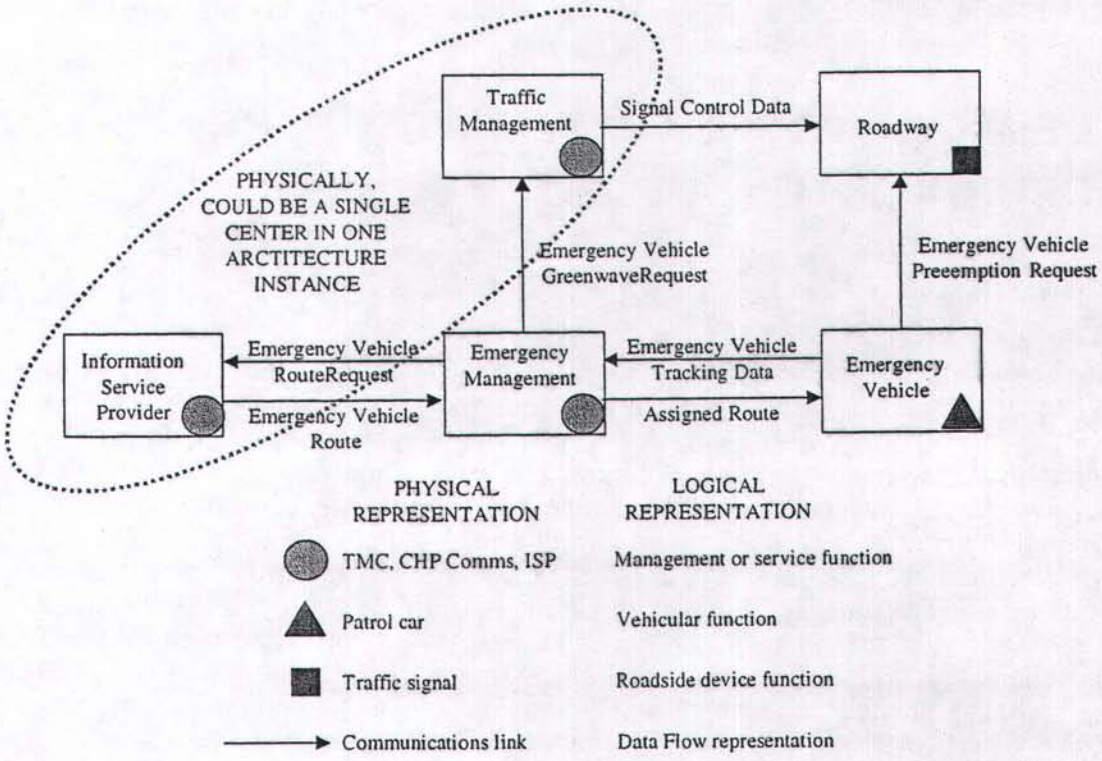
5.4.1 DEFINITIONS

When we speak of an **architecture**, we mean the **logical** and **physical** relationship of certain defined **entities** within a **system**. A **system** can be thought of in many ways: the Internet is a system. The highway network within the Fresno 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 **entities** such as **communications links**, **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. **Communications link** entities range from underground fiber optic networks to commercial broadcast stations and paging networks. **Operations Center** entities are as diverse as the CHP communications center in Fresno, a local Traffic Management Center in the city of Fresno, a private information provider or a private truck dispatch facility desiring information about travel conditions in Fresno County. **Roadside device** entities 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** entities include cars, buses, trucks, emergency vehicles, trains (passenger and freight) and aircraft.

What is the difference between the physical and logical parts 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**, 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 Fresno 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 5-1
Example of Logical and Physical Architecture for Emergency Vehicle Routing Market Package.

Figure 5-1 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.*

5.4.2 LOGICAL ARCHITECTURE

General

The logical architecture for the Fresno Region is depicted in some detail by the amalgamation of those high priority packages that were summarized in the Market Package Report, Section 4, Table 4.3. The illustration in Figure 5-2 is used as a 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 in Section 4:

- There is an implied hierarchical relationship between the regional TMC (Caltrans District 6) and local TMC's (example: the City of Fresno TMC) in the Figure. At least one level of local TMC's will be accommodated in the Fresno Region's ITS architecture.

- The District 6 TMC will be connected to the TMC's in Los Angeles 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 model being developed in Orange County;

- 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;

- Multiple Independent Service Providers will be encouraged to participate in the region's ITS deployment;

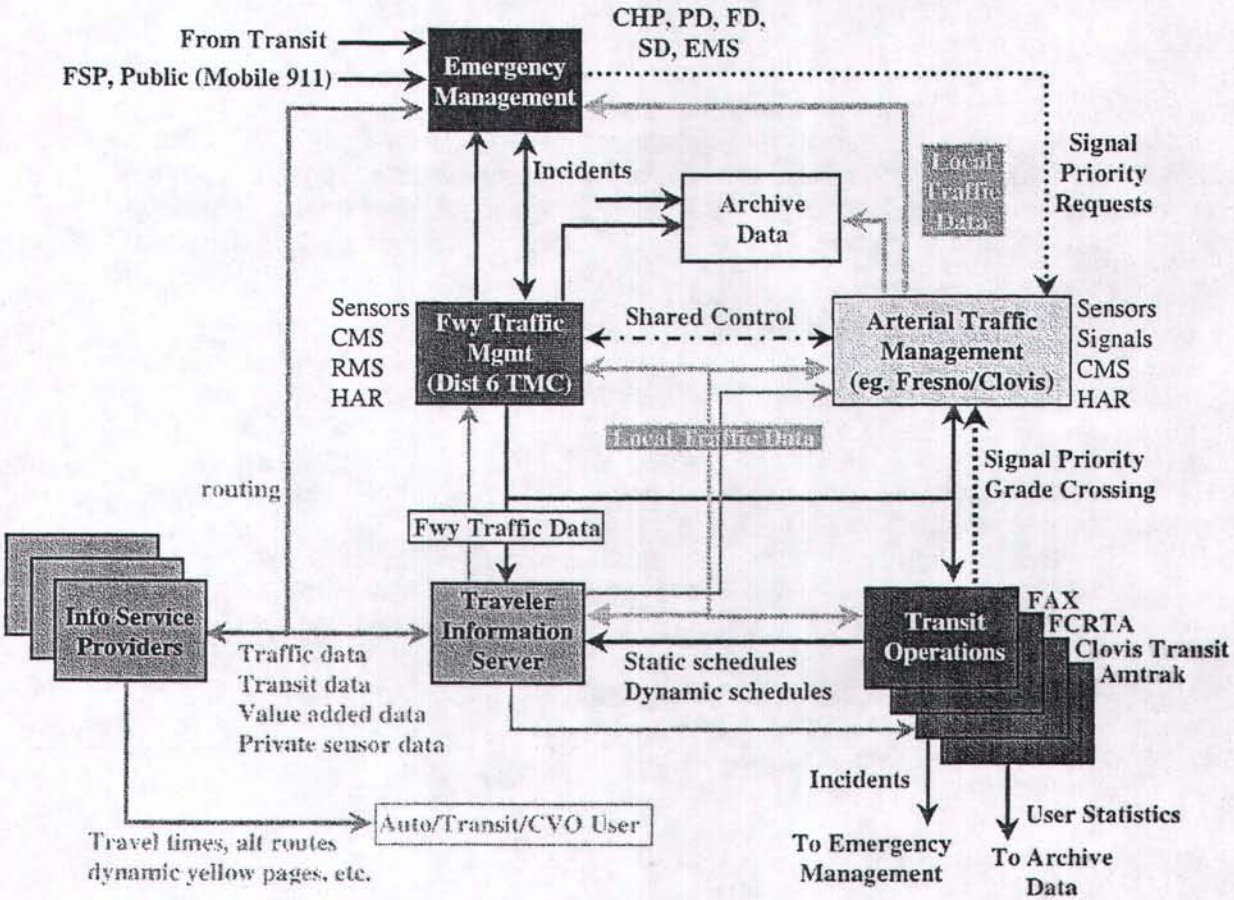
- It may not be necessary to have a centralized Transit Management Center, but instead each major transit property (FAX, FCRTA and Clovis Transit) could operate independent centers. These centers could also be remoted from a central database. In either case, the architecture goal is that these centers 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 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;



▲Figure 5-2
Summary Of Fresno Region Logical Architecture.

- Tailored traveler information services will be provided to commercial operators through one or more Independent Service Providers as well as through the Internet; and

- Regional and local TMCs will be integrated into at least one major "Smart Corridor" which will encompass the SR 41/SR 168/SR 180 routes. This corridor will be considered a prototype for other corridors in the region.

Figures 5-3 through 5-9 depict the high priority Market Packages as derived from the National Architecture and modified to eliminate non-existent or redundant nodes and data flows as well as to indicate the agency participants within the region. Figure 5-3 shows freeway and arterial Traffic Management relationships. Figure 5-4 shows specific data flows related to Incident Management. Figure 5-5 shows system relationships to implement Project 1.4, Railroad/Highway Interface for Railroad Crossings. Figure 5-6 covers both fixed route and demand responsive Transit Management operations. Figure 5-7 illustrates the relationships

Figure 5-3
Traffic Management Market Packages

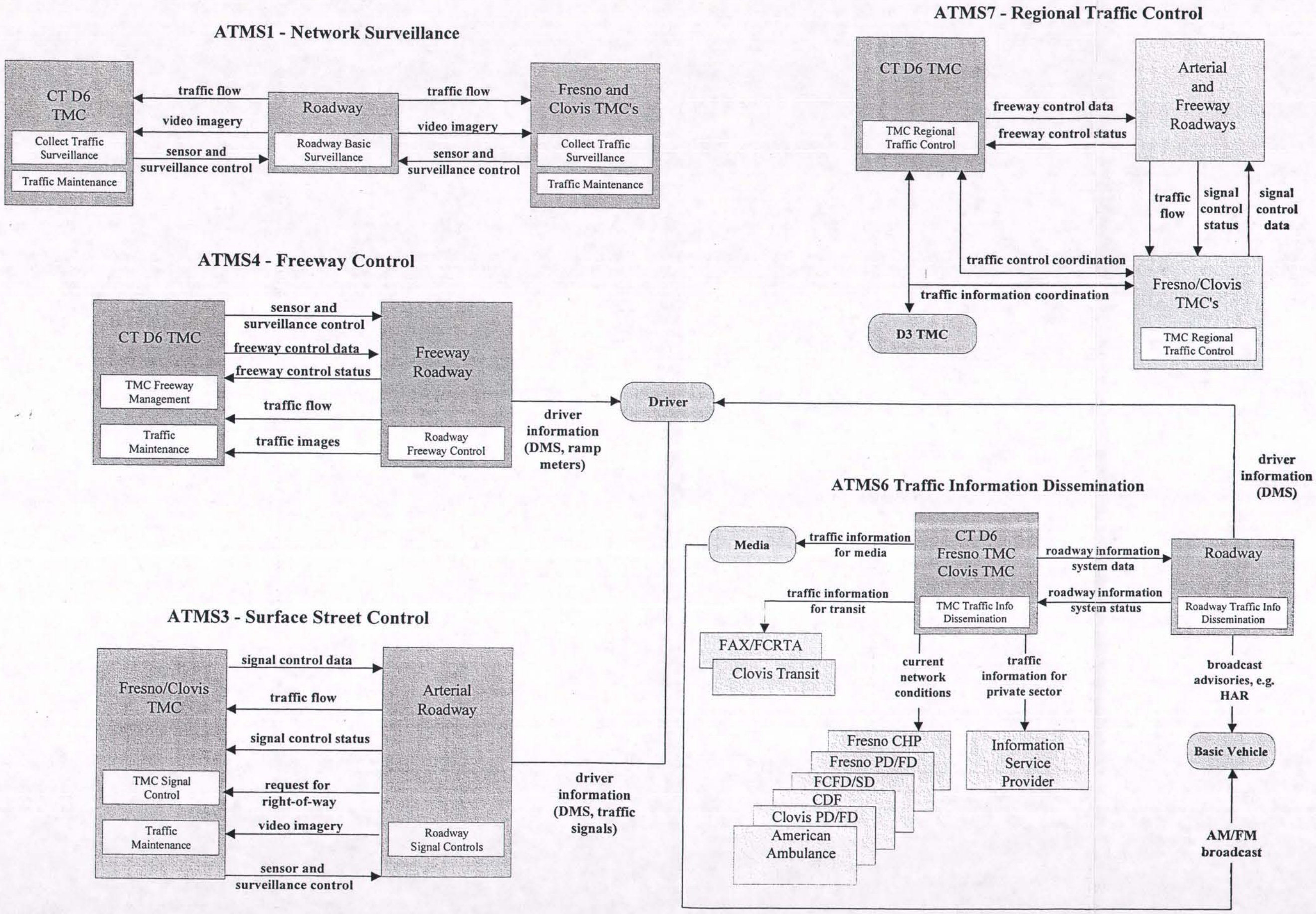
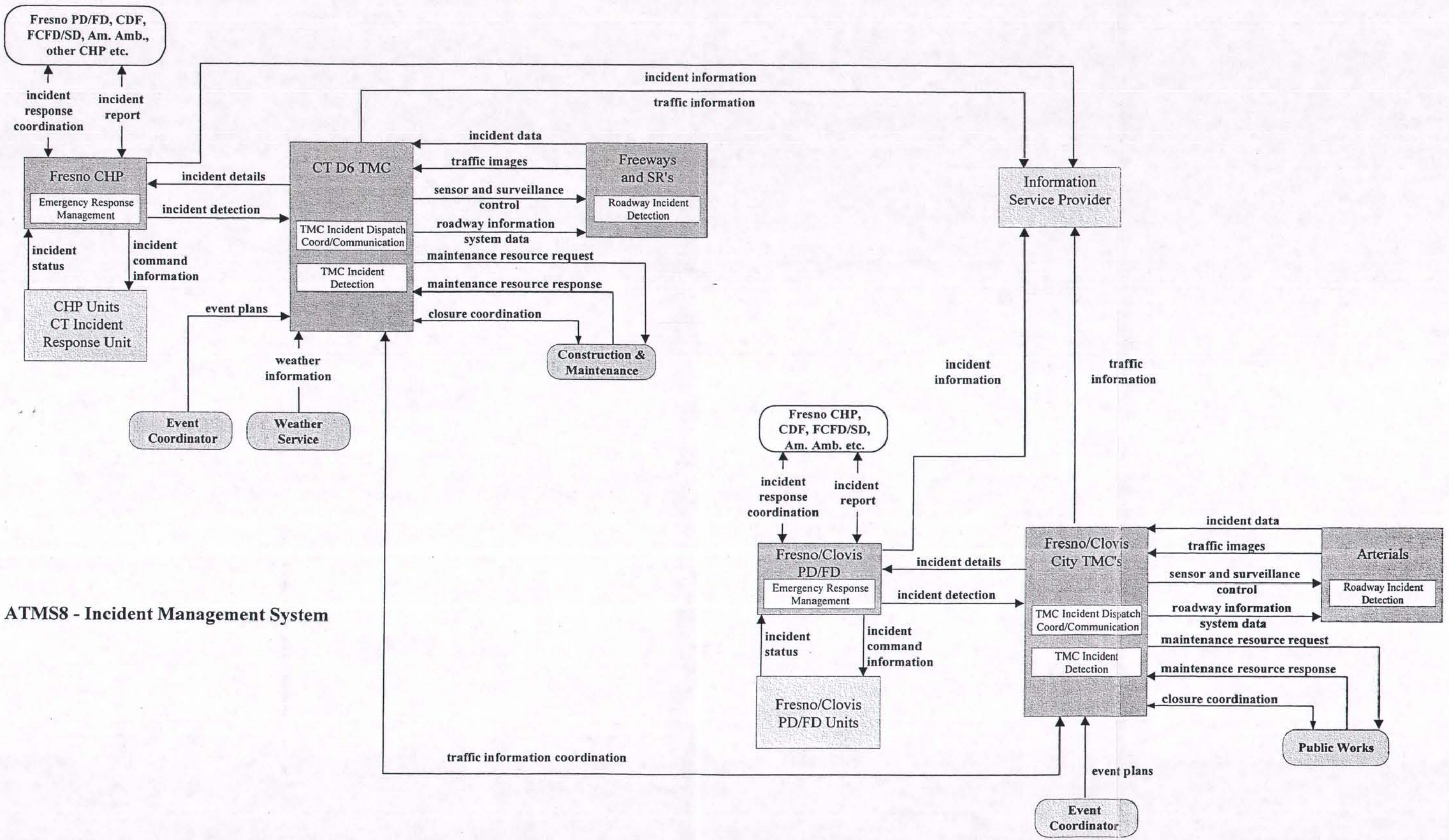


Figure 5-4
Incident Management Market Package



ATMS8 - Incident Management System

ATMS14 - Advanced Railroad Grade Crossing
ATMS15 - Railroad Operations Coordination

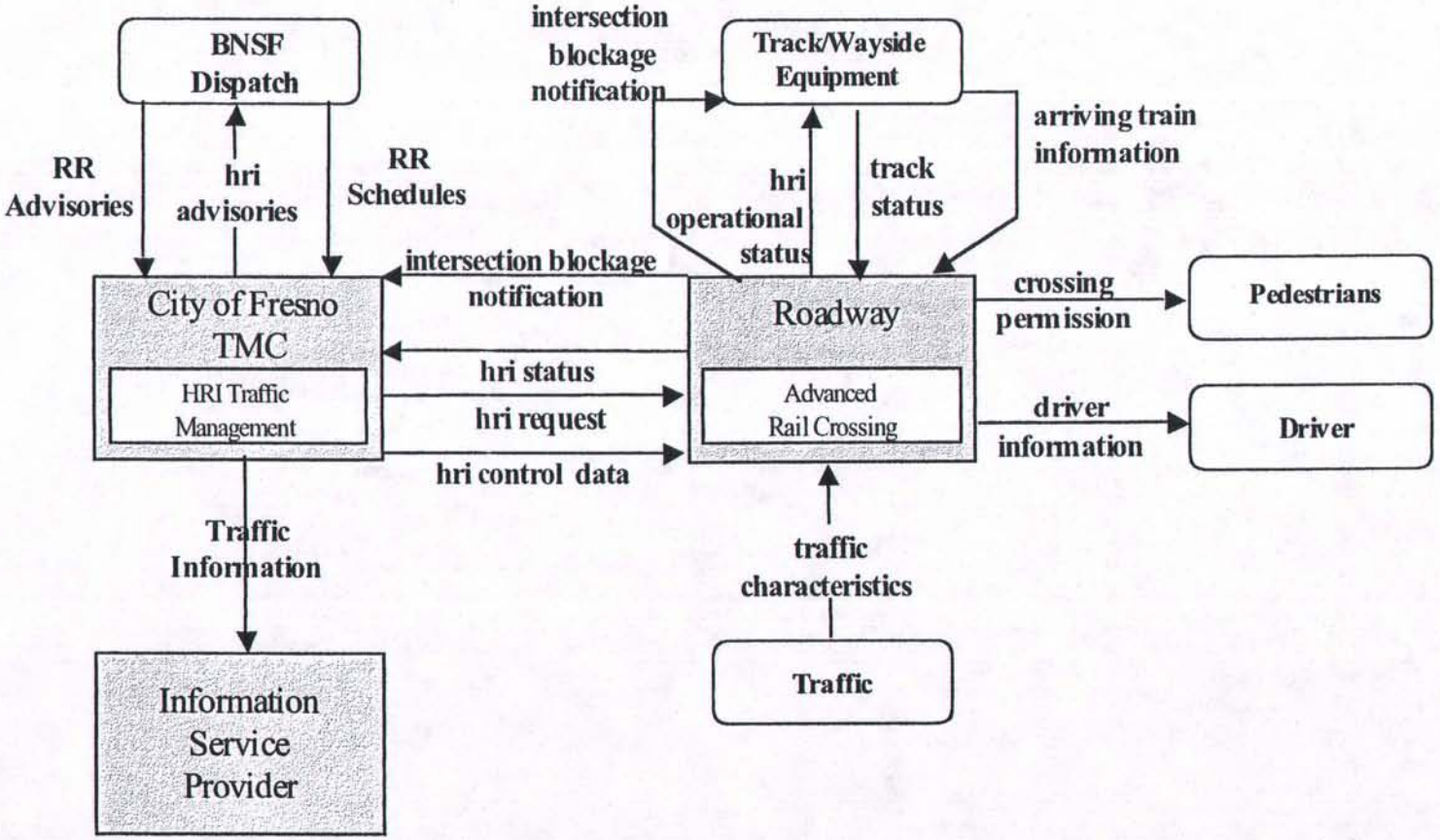


Figure 5-5
Highway/Rail Interface
Market Packages

Figure 5-6
Transit Management Market Packages

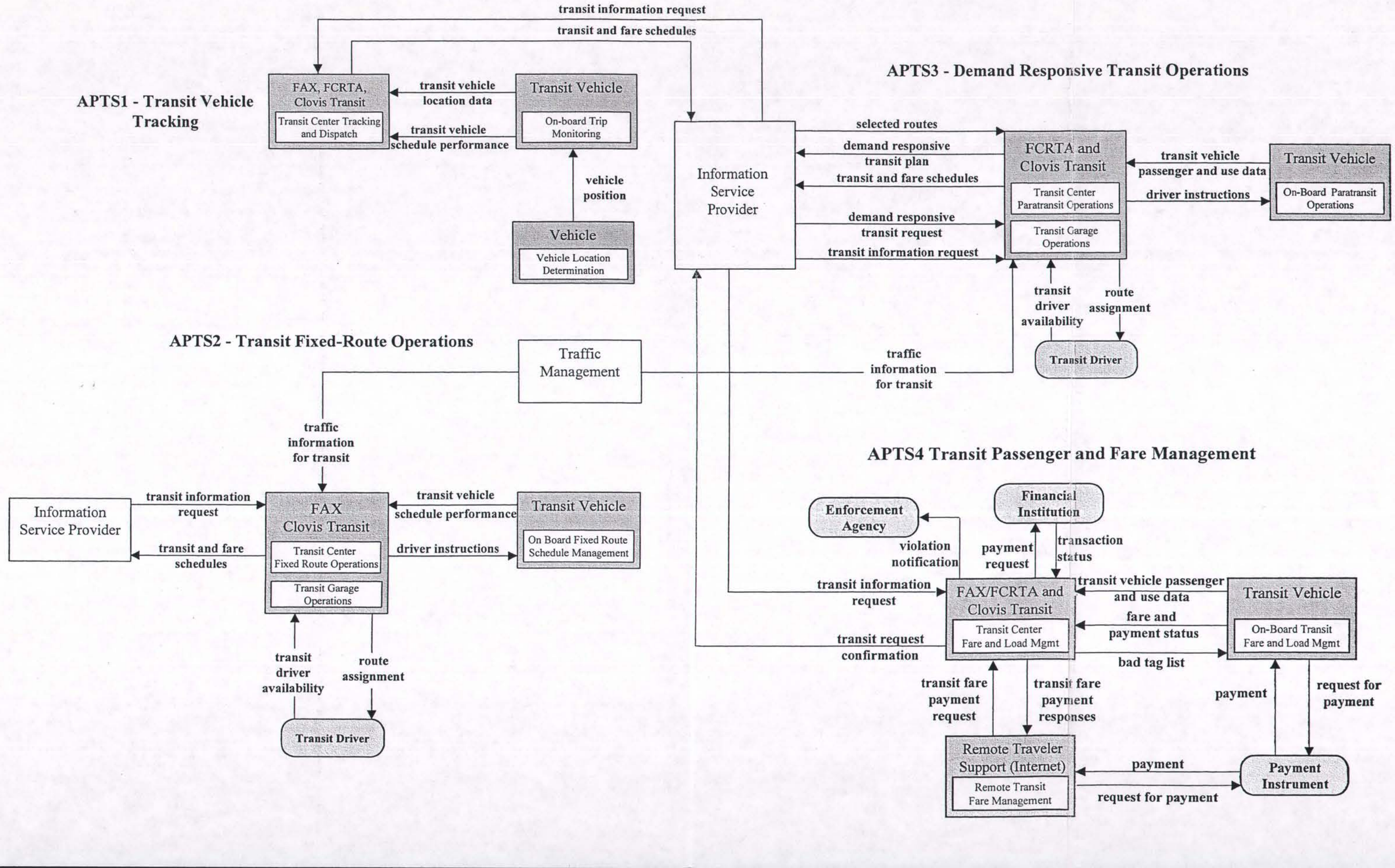


Figure 5-7
Transit Traveler Information and Basic ATIS Market Packages

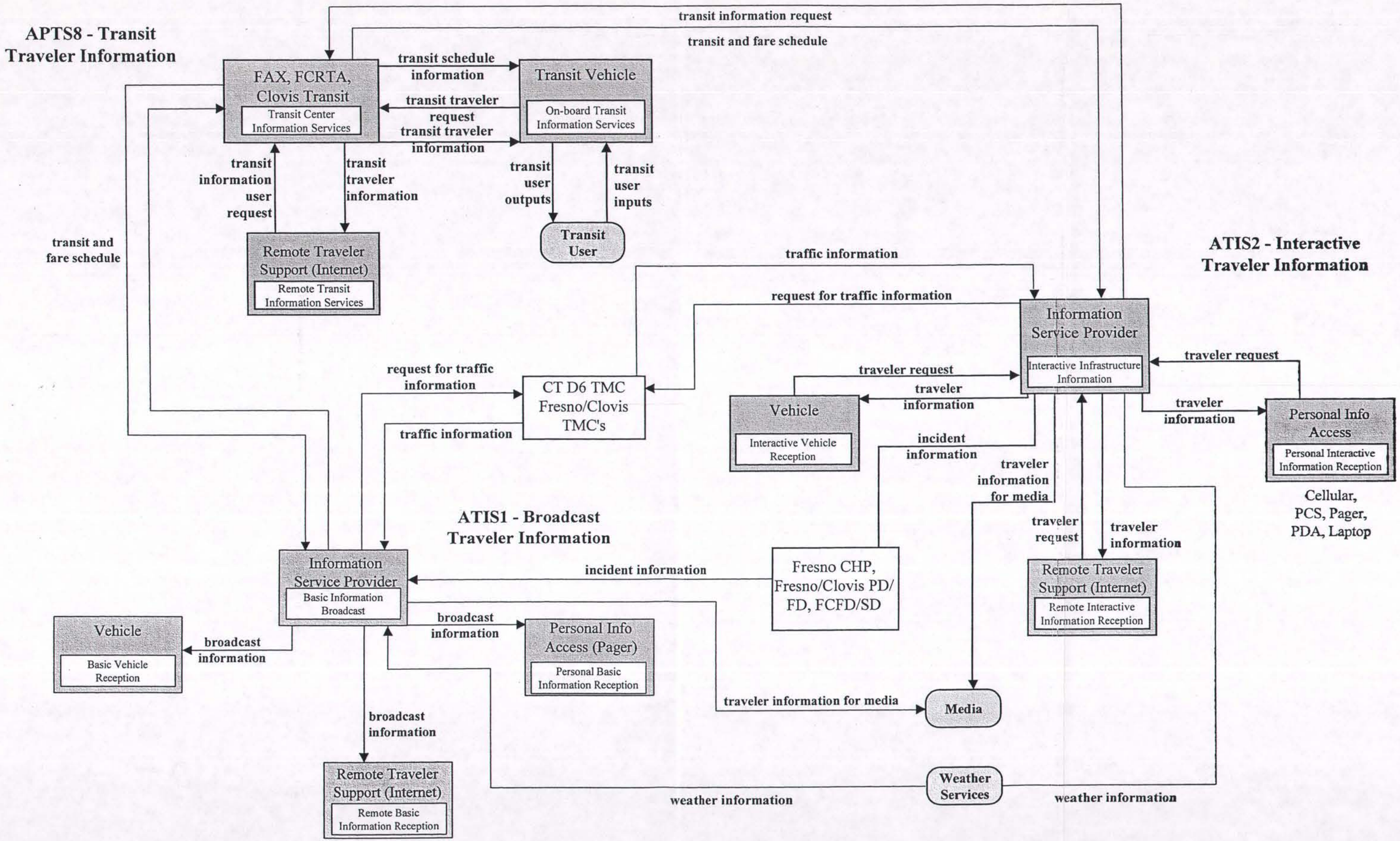
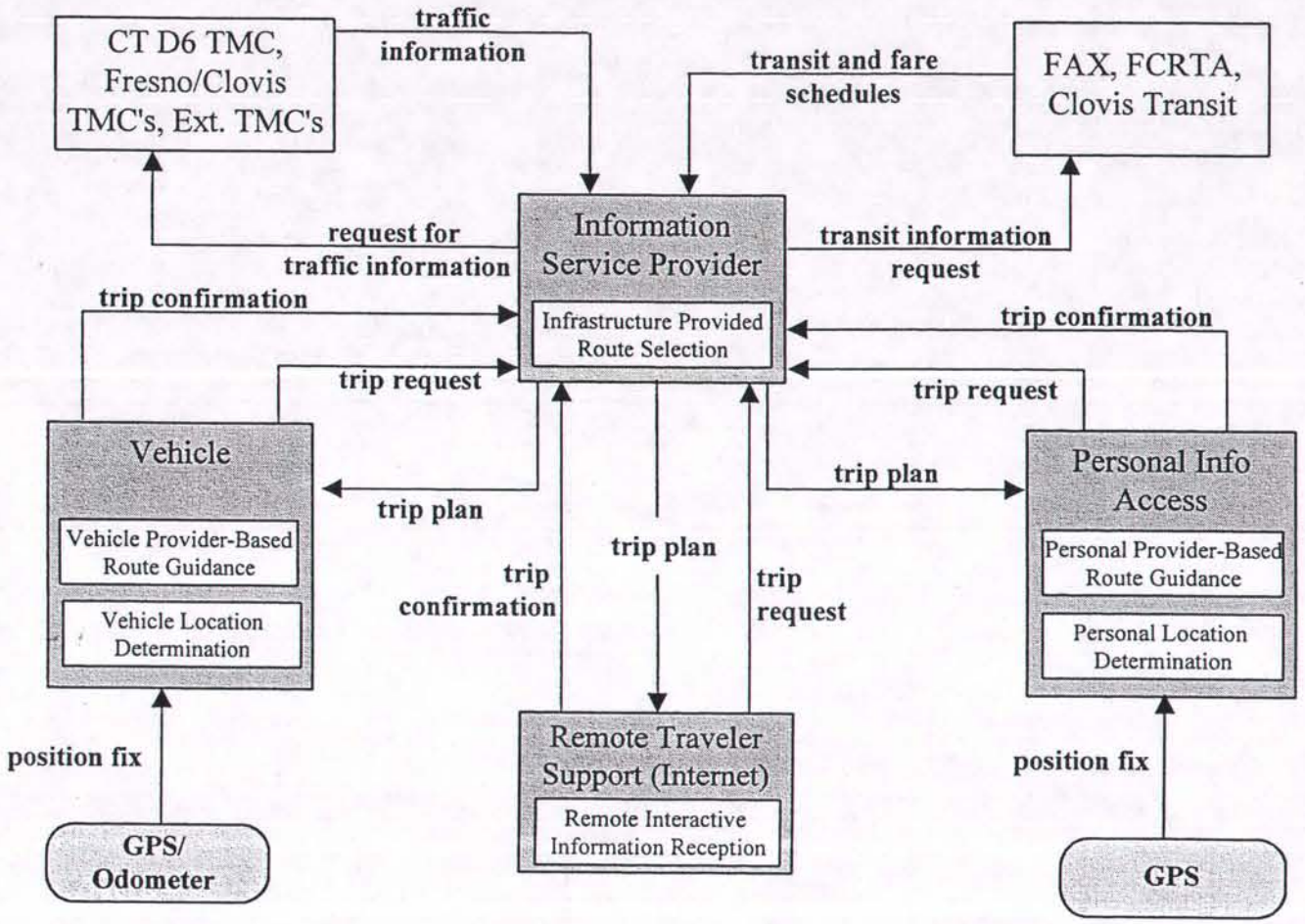
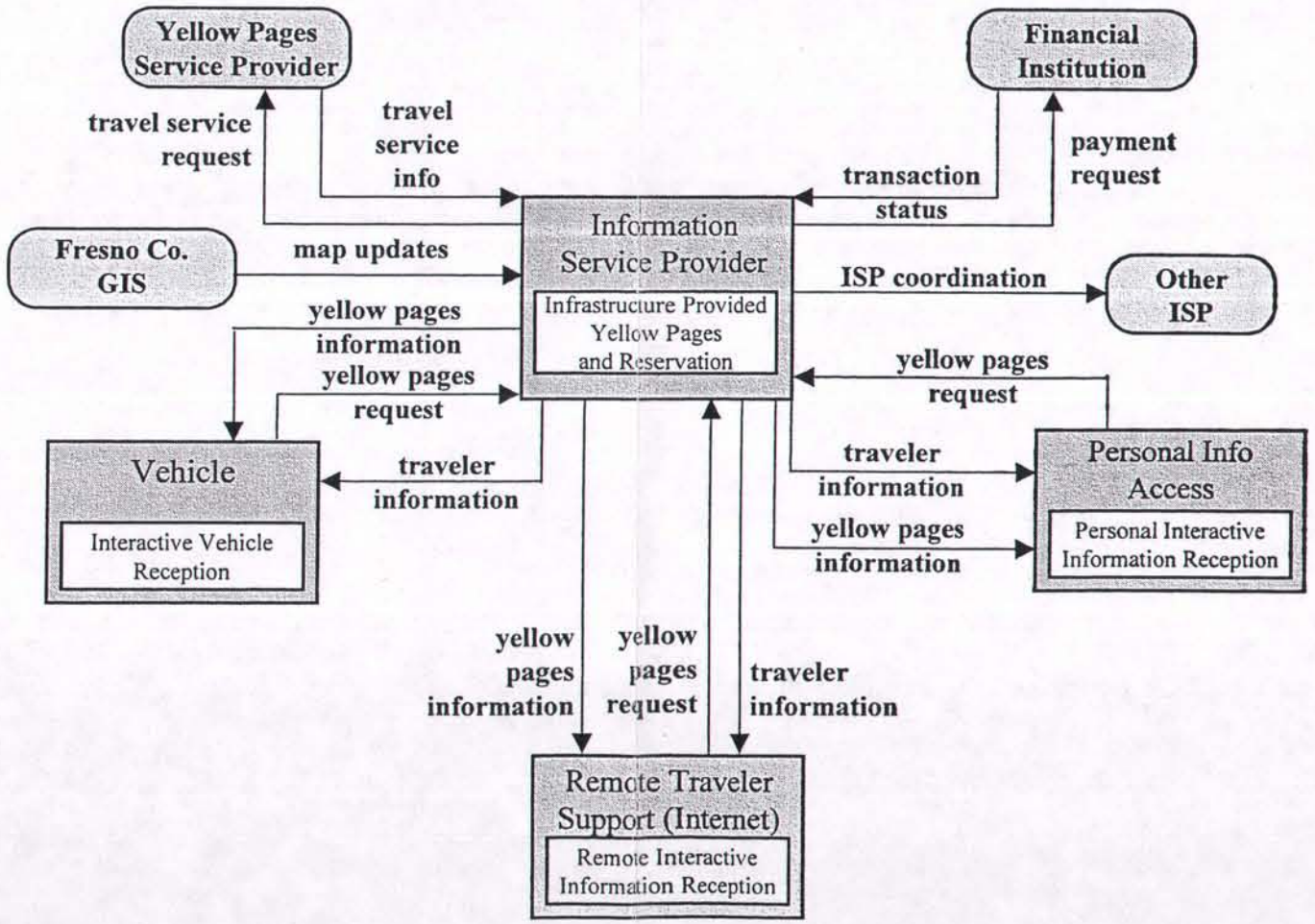


Figure 5-8
Longer Term ATIS Market Packages

ATIS5 - ISP Based Route Guidance



ATIS7 - Yellow Pages and Reservation



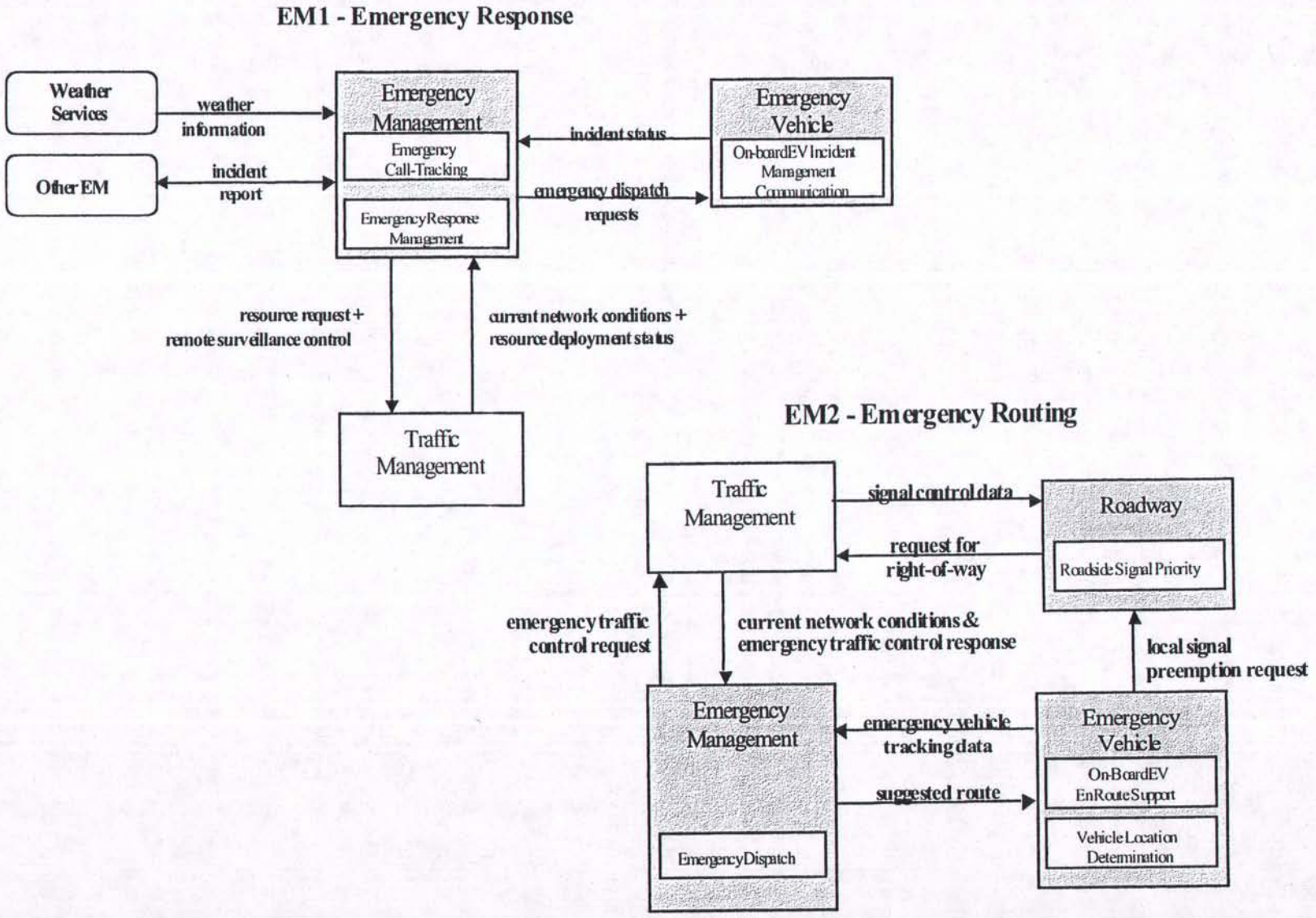


Figure 5-9
Emergency Management Market Packages

between Transit Traveler Information, Broadcast Traveler Information and Interactive Traveler Information services. Figure 5-8 depicts the more advanced ISP and Yellow Page/Reservations market packages. These two market packages assume that a minimum level of in-vehicle device market penetration has occurred in the Fresno/Central Valley region. Figure 5-9 encompasses the region's high priority Emergency Management functions. And finally, Figure 5-10 shows the first of three new Market Packages for the Archived Data User Service, ITS Data Mart. Since there is no project identified for this function, the simpler of the two Market Packages is recommended for adoption.

Several of the Market Package diagrams identify a node called Information Service Provider. There is no specific project in Section 6 that addresses this traveler information node, however it is assumed that this function will be embedded in either the regional TMC or a private sector entity that markets the entire Central Valley. The function is also implicit in generally available dissemination media such as the Internet, although several providers may be needed to perform all the activities shown.

5.4.3 PHYSICAL ARCHITECTURE

Entity Classes

As previously noted, the physical architecture consists of recognizable entity classes such as communications links, traffic signal systems, vehicles, TMCs and emergency dispatch centers. Figure 5-11 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 5-11 shows the major elements in the physical architecture: centers, roadside devices, vehicles, remote access and communications links. The Fresno Region entities consist of (not necessarily all-inclusive, with ITS National Architecture Subsystem abbreviated notation in parenthesis):

- Centers
  - District 6 TMC (TMS)
  - CHP Fresno Communications Center (EM)
  - Local TMC's (Cities of Fresno and Clovis) (TMS)
  - Independent Service Provider (none identified in projects) (ISP)
  - Other Information Service Providers (none identified in projects) (ISP)
  - Transit Management Centers (FAX, FCRTA and Clovis Transit) (TRMS)
  - Private freight company dispatch centers (external user of CVO ATIS data)
  - Planning agencies (COFCG, Caltrans District 6) (PS)
- Roadway
  - Arterial traffic systems (Fresno, Clovis, Caltrans, County)
  - Arterial management system elements (CCTV, DMS, HAR)

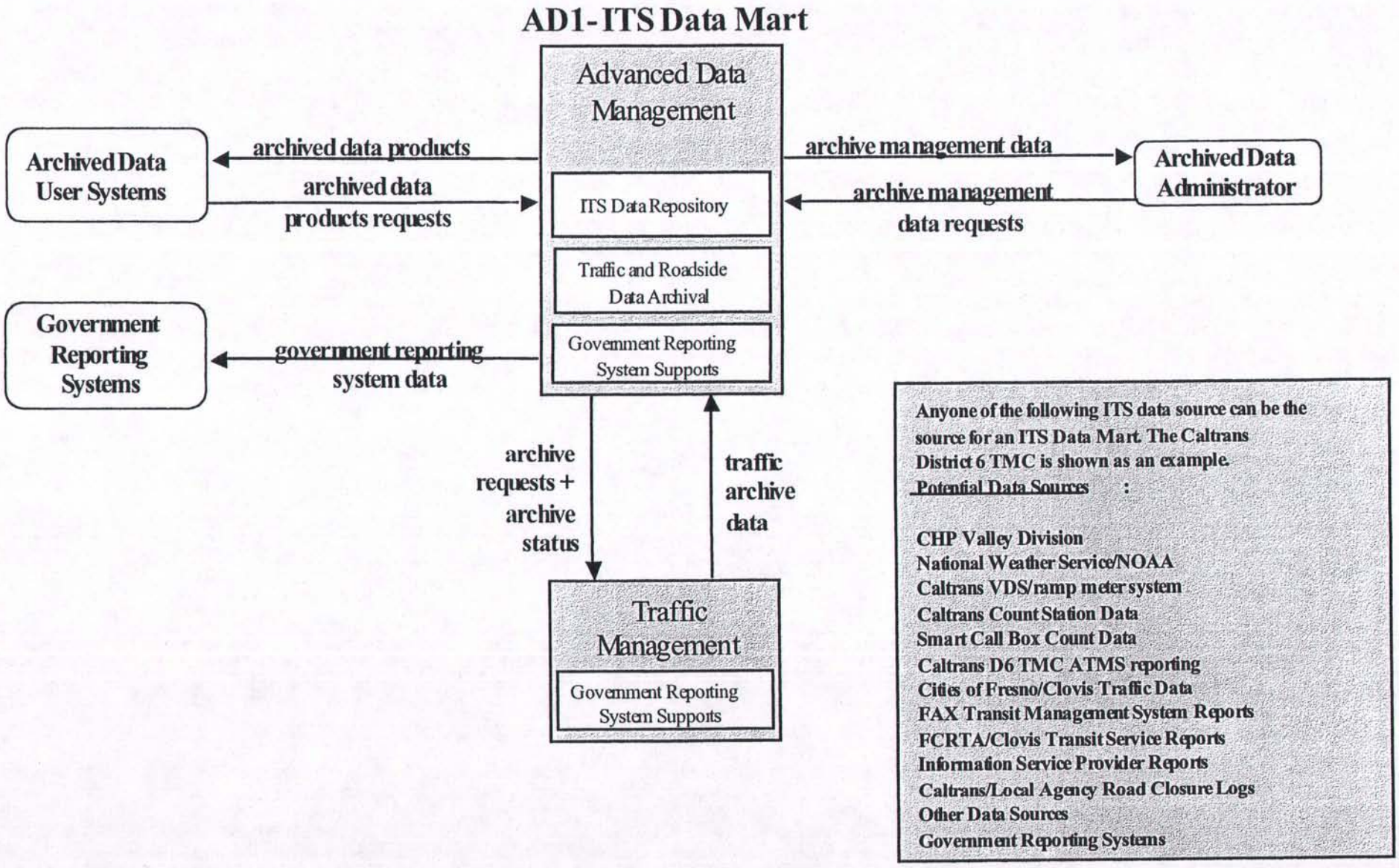
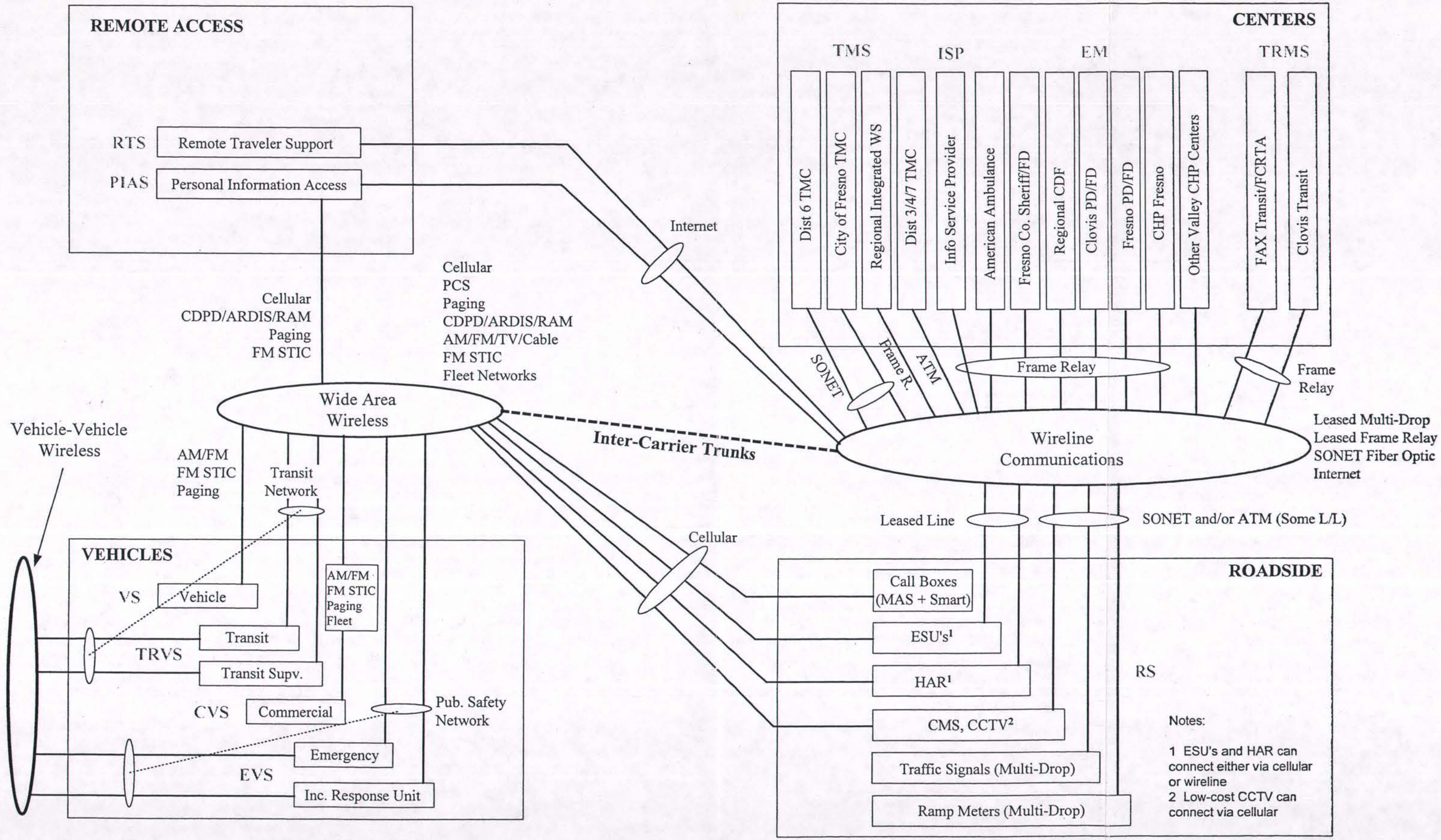


Figure 5-10
Archived Data Market Package

Figure 5-11
Fresno Region Physical ITS Architecture



- Freeway management system elements (CCTV, loop detectors, CMS, ramp meters, HAR)
- Motorist aid call boxes (future)
- Smart Call Boxes (future)
- Environmental Sensing Units
- Railroad grade crossings
- Commercial Vehicle Weigh Stations

- Vehicles
  - Freeway Service Patrol
  - Caltrans Traffic Management Team and Incident Response 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)
- 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
- Remote Access
  - Internet
  - Public Switched Telephone Network
  - Analog cellular

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 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 Fresno Region.

5.4.4 RELATIONSHIP TO EXTERNAL ARCHITECTURES

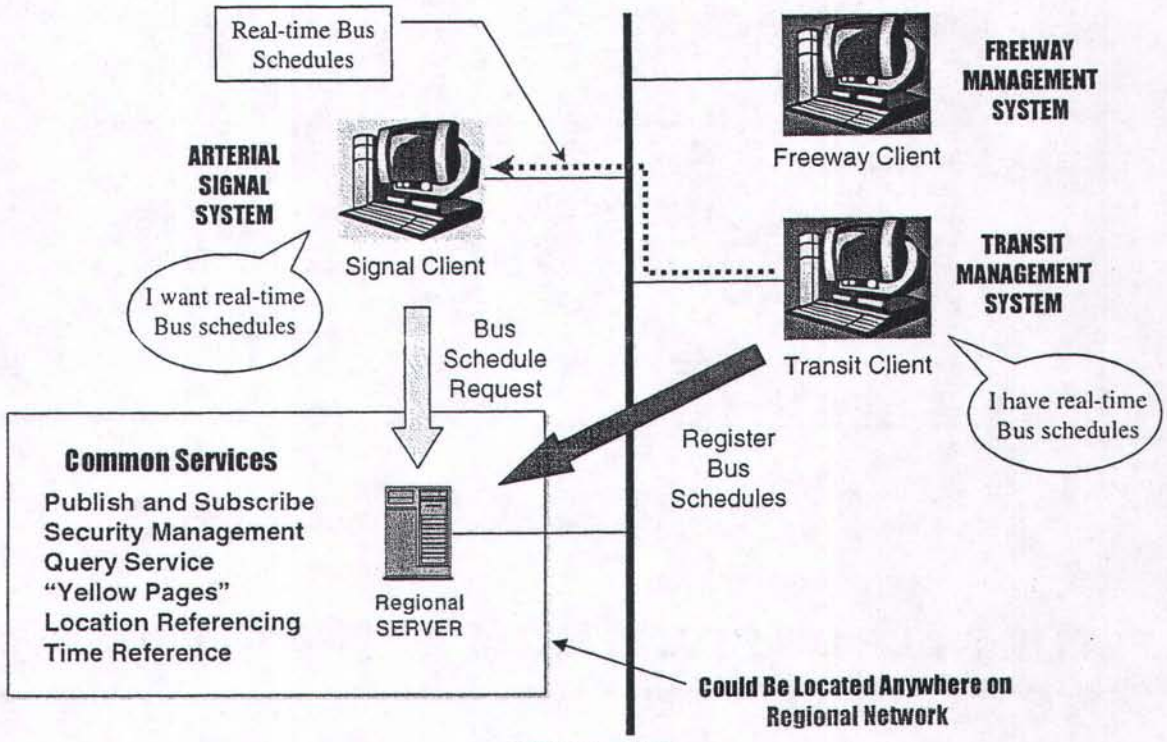
Background and Terminology

Although the Fresno 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

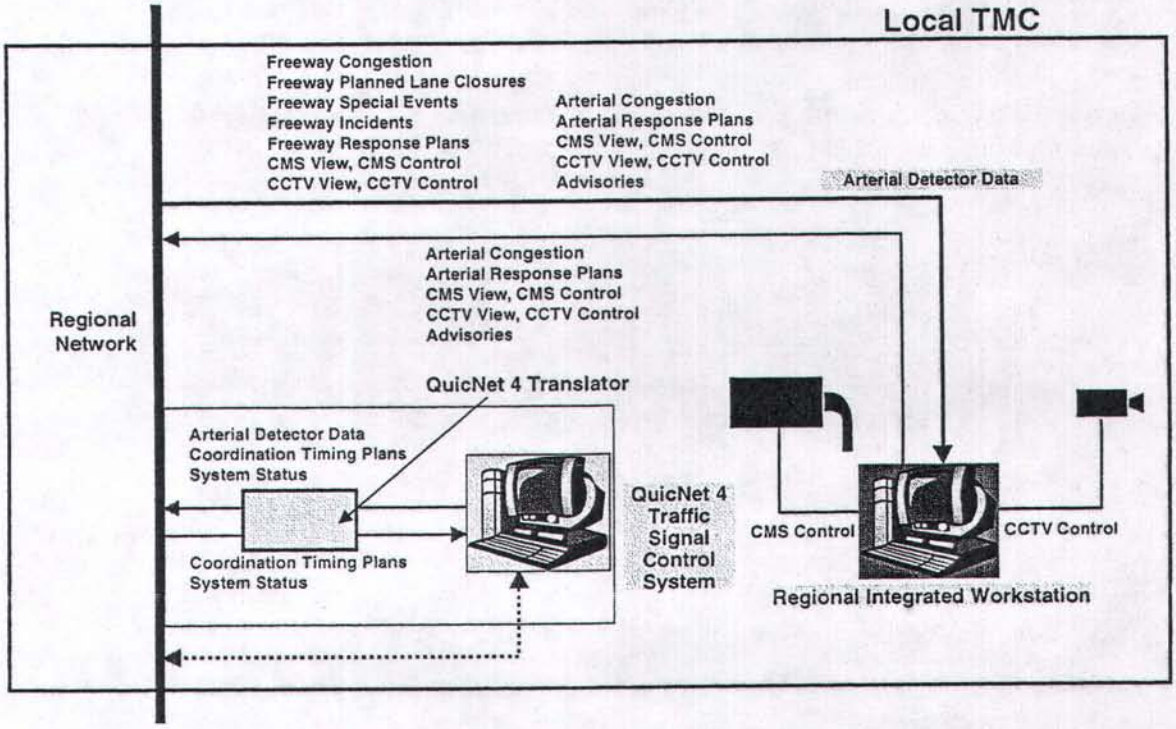
SHOWCASE is a near-term effort to integrate deployed core components into an advanced traffic management and traveler information system over the next four years (1999–2003). The SHOWCASE program includes an architecture development project that culminated in a prototype TMC demonstration in March 1998. 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 5-12 for a transit data example.



▲Figure 5-12
Regional Network Management Architecture using National Architecture.

An Example of Regional Integration in SHOWCASE

The regional traffic signal integration project in San Diego is a good example of the data translator approach to integrating a **legacy** system into SHOWCASE. Traffic signal systems are considered **legacy** systems because they are generally proprietary and typically can't be easily modified to directly accommodate regional object definitions. In this case, we need a data translator, which on one side connects to a traffic signal control system, and on the other side connects to the regional network using approved standards. This translator would take raw intersection signal data and provide it in standard form to other services on the network such as an arterial congestion reporting service. This concept is shown in Figure 5-13. In this case, each distinct signal control system would require its own translator. We can now see the benefit of having a common traffic signal control standard within a region or of having a national standard for connecting field controllers to a central control system. Such a standard will soon exist and is based on the National Transportation Communications Interface Protocol, or NTCIP.



▲Figure 5-13
Converting legacy traffic signal control data to a common format.

5.5 THE ROLE OF STANDARDS IN THE REGIONAL ITS ARCHITECTURE

This section will provide a brief overview of the current standardization trends that are evolving that are relevant for regional Intelligent Transportation Systems (ITS) Architectures. 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) 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 below.

5.5.1 STANDARDS DEVELOPMENT ORGANIZATIONS

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 Web site 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): 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 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.

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.

5.5.2 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 below.

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 data dictionaries associated with the Transit Communications Interface Protocols (TCIP), also developed by ITE. The latter include definitions for incident management, scheduling and run-cutting and customer information business areas, among others.

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 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 as a message in itself. Second, the use of multiple location message options (termed profiles) within an expandable framework. Finally, the use of a set of well-known ground control points 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.

Object Definitions

The analogy to message sets in the world of object oriented software is object definitions. Under the Common Object Request Broker Architecture protocol, object definitions are known 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 are gradually evolving 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 degrade the value of the National Architecture in the definition of a regional architecture containing object oriented systems.

Communications Protocol

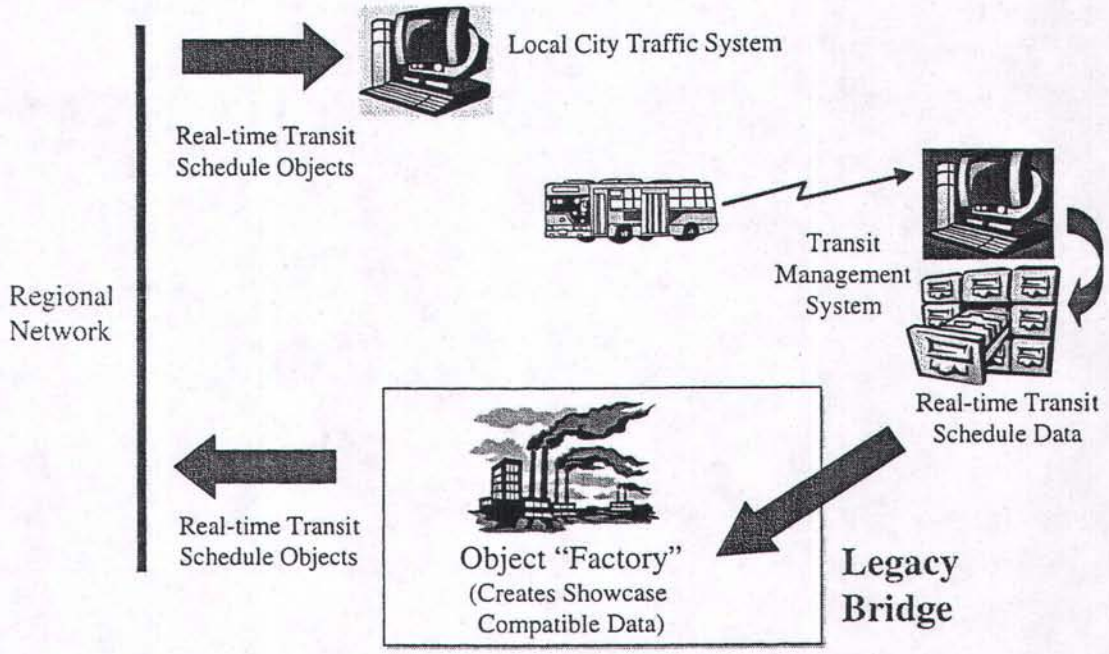
Communications protocol is the set of data exchange rules that tie together the message set and data dictionary definitions. One could imagine having a language alphabet and word dictionary but no grammar. This would be the situation if no communications protocol existed to allow interoperation between transportation management centers, for example. One of the more critical developments affecting a regional ITS architecture has been the evolving process of the NTCIP Center to Center Communications standards originally known as the NTCIP Class E standard. Currently, the NTCIP Center-to-Center (C2C) Communications Standard consists of two options: TS 3.CORBA for object-oriented systems, and TS 3.DATEX-ASN for non-object-oriented systems. 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 since it is currently the protocol of choice for the Southern California Priority Corridor, and the only such protocol being implemented anywhere in California at this time. 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. 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" systems may connect to a CORBA network through the Legacy Bridge function. The operation of this

function in the case of transit data is illustrated in Figure 5-14. The proper operation of a Legacy Bridge assumes that a standard set of object definitions exists for a specific regional architecture.

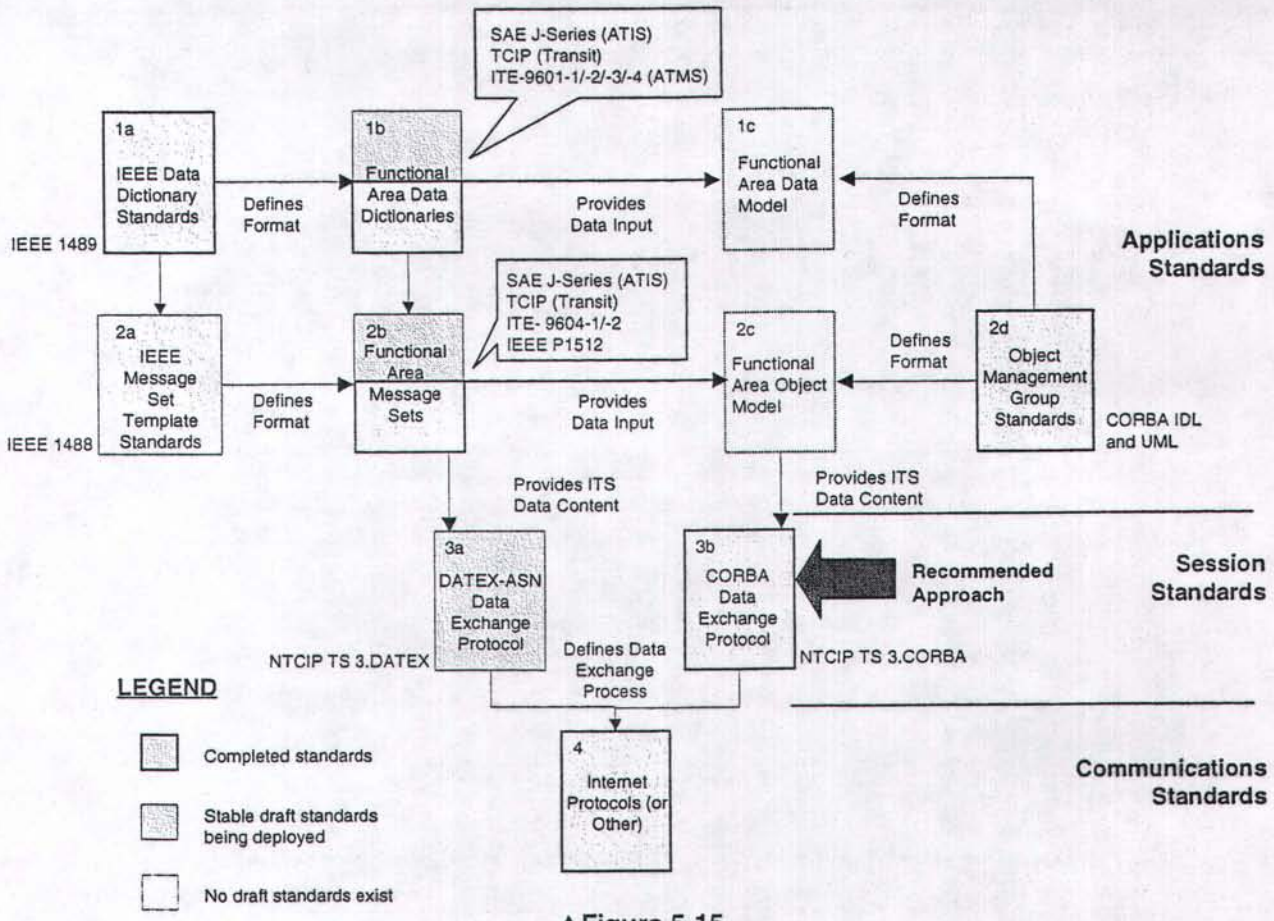


▲Figure 5-14
Converting legacy data into standard CORBA-compatible object definitions.

Figure 5-15 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 5-15) 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.

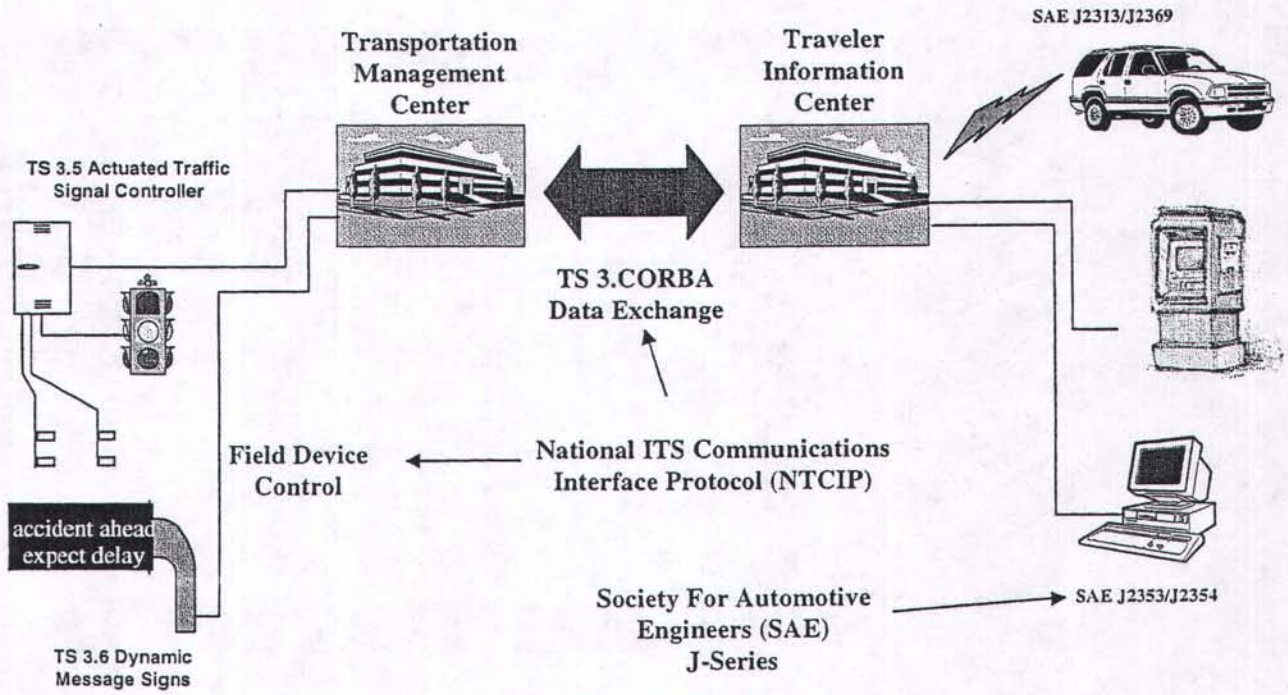


▲Figure 5-15
ITS standards architecture using currently defined standards.

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 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 Fresno 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 TS 3.CORBA standard.

In a more specific context, Figure 5-16 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 TS 3.CORBA or TS 3.DATEX-ASN (Data Exchange – American Standard Notation). For the Fresno architecture, the TS 3.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 mapping of U.S. DOT Critical Standards to recommended Fresno regional projects is listed in Figure 5-17. 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.



▲Figure 5-16
Operational use of standards in a transportation architecture.

5.6 SUMMARY

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

FIGURE 5-17

MATRIX OF FRESNO COUNTY ITS PROJECTS AND EXISTING/EMERGING STANDARDS

Key: x = The indicated standard may apply to all or parts of this project.

PRELIMINARY PROJECT DEFINITIONS	Field Device Standards (ITE - NTCIP)	TS 3.RMC Ramp Meter Control	TS 3.VCC Video Camera Control	TS 3.HAR Highway Advisory Radio	TS 3.7 Environmental Sensor Stations	TS 3.5 Actuated Traffic Signal Controllers	TS 3.6 Dynamic Message Signs	TS 3.TSS Transportation Sensor Systems	TS 3.DCM Data Collection and Monitoring	Center-to-Center (NTCIP and IEEE)	TS 3.CORBA	P1512 Emerg Mgmt Center-to-TMC	ATIS and In-Vehicle (SAE)	J2353/J2354 ATIS Data Dict./Msg Sets	J2313 Mayday Reporting Interface	J2364/J2365 Nav/Route Guidance	J2369 ATIS - Limited Bandwidth	J1764 ISP - Vehicle Location Referencing	Transit (ITE - TCIP)	tcip-cc/cpt/fc/im/ob/pi/sch/sp/tm	J1708 Serial Data Comm - Heavy Veh. Apps
1.0 Traffic/Freeway Management Systems																					
1.1 Ramp Metering & Communications Gap Closure	X																				
1.2 Multi-jurisdictional Interconnects					X					X											
1.3 Integrated Smart Corridors	X	X	X		X	X	X			X											
1.4 Railroad Highway Interface Technology for RR Crossings																					
1.5 Communications Interties																					
1.6 Integrated Surveillance Stations/Callbox Deployment																					
1.7 Regional Intersection Safety Systems																					
2.0 Incident Management/Emergency Services																					
2.1 Weather/ATMS Integration				X		X															
2.2 Variable Speed System				X		X															
2.3 Remote Surveillance and Incident Scene Mgmt.		X																			
2.4 Computer Aided Dispatch Integration											X										
2.5 Integration of Communications Channels																					
2.6 Incident Management Task Force/Team																					
3.0 Transit Systems																					
3.1 Coordinated Transit District Operations																			X		
3.2 Coordinated Transit Operations/Dispatch Centers										X									X		
3.3 Transit Information System																			X		
3.4 Transit Management System Completion/Expansion																			X	X	
3.5 Common Fare Equipment Deployment																			X	X	
4.0 Transportation User Information Systems																					
4.1 Regional Transportation User Info. Systems													X		X	X					
4.2 Coordination with Valleywide/Statewide Info. Systems													X		X	X					
5.0 Regional ITS Configuration Mgmt./Coordination/Planr																					
5.1 Valleywide/Statewide Communications Linkages																					
5.2 Regional Configuration Management																					
5.3 Common/Standard Regional/County Map																	X				

SECTION 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 Fresno County 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 Fresno County Region. 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 Fresno County Region. 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 Region.

6.2 PROJECT DEVELOPMENT PROCESS

The program areas and projects outlined in this Section were developed based on input from the Fresno County ITS Subcommittee and regional transportation stakeholders. Throughout the development of the SDP, the ITS Subcommittee 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 Region, 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 ITS Subcommittee, 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 Region. User services were discussed in greater detail in Section 3.0 of this Plan.

- **Preliminary Project Concepts** – Based on the priority transportation problems and user services identified by transportation stakeholders, the ITS Subcommittee held a one day workshop to develop ITS project concepts. The Subcommittee was split into three groups (Traffic, Transit, and Incident Management) based on areas of interest. Each group worked together to develop a series of project concepts that best matched the identified problems and needs.
- **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 four program areas initially:
  - Traffic/Freeway Management Systems
  - Incident Management/Emergency Services
  - Transit Systems
  - Transportation User Information Systems
- A fifth program area was added to deal with projects that touched on multiple transportation modes.
  - Regional ITS Configuration Management/Coordination/Planning
- **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 Fresno County Region was a cooperative consensus based process. Open discussion and input was invited from regional transportation stakeholders at each ITS Subcommittee meeting.

6.3 PROGRAM AREAS AND PROJECT ORGANIZATION

Twenty-three projects were defined within five program areas during the development of the SDP. Figure 6-1 displays the overall organization of these program areas and projects. 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 Fresno County Region are as follows:

- **1.0 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 Region. Sponsorship, operation, and ownership of these systems tends 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.

Fresno County Region ITS Program

1.0 Traffic/Freeway Management Systems (ATMS)

- 1.1 Ramp Metering & Communications Gap Closure
- 1.2 Multi-Jurisdictional Interconnects
- 1.3 Integrated Smart Corridors
- 1.4 Railroad Highway Interface Technology for RR Crossings
- 1.5 Communications Interties
- 1.6 Integrated Surveillance Stations/Callbox Deployment
- 1.7 Regional Intersection Safety Systems

2.0 Incident Management Emergency Services (ATMS-EMS)

- 2.1 Weather/ATMS Integration
- 2.2 Variable Speed System
- 2.3 Remote Surveillance and Incident Scene Mgmt.
- 2.4 Computer Aided Dispatch Integration
- 2.5 Integration of Communications Channels
- 2.6 Incident Management Task Force/Team

4.0 Transportation User Information Systems (ATIS)

- 4.1 Regional Transportation User Info. System
- 4.2 Valleywide/Statewide Transportation User Info. System Connections

3.0 Transit Systems (APTS)

- 3.1 Coordinated Transit District Operations
- 3.2 Coordinated Transit Operations/Dispatch Centers
- 3.3 Transit Information System
- 3.4 Transit Management System Completion/ Expansion
- 3.5 Common Fare Equipment Deployment

5.0 Regional ITS Configuration Management Coordination/Planning (System Architecture/ Standards)

- 5.1 Valleywide/Statewide Communications Linkages
- 5.2 Regional Configuration Management
- 5.3 Common/Standard Regional/County Map

Figure 6-1
Basic Program Areas and Project Organization

- **2.0 Incident Management/Emergency Management Services (IC-EMS)** – 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 Region. 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 Incident Management Task Force/Team has been created to address interagency institutional and training issues. To date, this Team has held a couple of meetings and a two-day workshop on incident management issues and needs. It is a primary component of this Plan, that this Team would continue to meet to enhance interagency incident management in the Region. This group will handle coordinating multiple agency training, critiquing critical incidents, assisting in resolution of interagency concerns, and setting standards for incident management performance.
- **3.0 Transit Systems (TS)** – Known nationally as Advanced Public Transportation Systems (APTS), this program area focuses on the public transit components of the transportation network. FAX has taken the lead regionally in this area with the deployment of a Transit Management System. Other significant players in this program area include FCRTA and Clovis Transit. Projects included in this Plan focus on enhancing cooperation and coordination of transit agencies in the Region by building on previous efforts, as well as expanding on the established ITS capabilities.
- **4.0 Transportation User Information Systems (TUIS)** – The ITS Subcommittee chose to rename this program area from Advanced Traveler Information Systems (ATIS) to Transportation User Information Systems (TUIS) in order to emphasize the provision of transportation conditions information to residents in the Fresno Region. There are some basic forms of TUIS already operating in the Region, including: CMS, HAR, and commute period radio and television broadcasts. Deployment of many of the proposed ATMS and IC-EMS projects will enhance the timeliness, accuracy, and extent of transportation conditions information available for TUIS efforts. The planned level of TUIS deployment focuses on two primary areas: (1) deployment of simple/expanded information dissemination capabilities within the Region; (2) development of connections with traveler information deployment efforts throughout the Central Valley and the State. There are generally no specific sponsors for TUIS projects, however it is expected that Caltrans, CHP, and COFCG will take the lead in supporting this program area.
- **5.0 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 COFCG and County of Fresno GIS group will provide leadership in this area in cooperation with ITS stakeholders.

The ITS Subcommittee 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 valleywide, State, and federal efforts. The Region chose to provide support to the CVO area by the provision of more accurate, timely, and comprehensive transportation user information or traveler information.

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.

As displayed in Figure 6-2, 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.

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 Transportation User Information Systems and Transit Systems program areas. Mostly data flows from the Traffic/Freeway Management systems to the TUIS and TS 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, TS, and/or TS functions and operators to achieve better integrated operations.

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

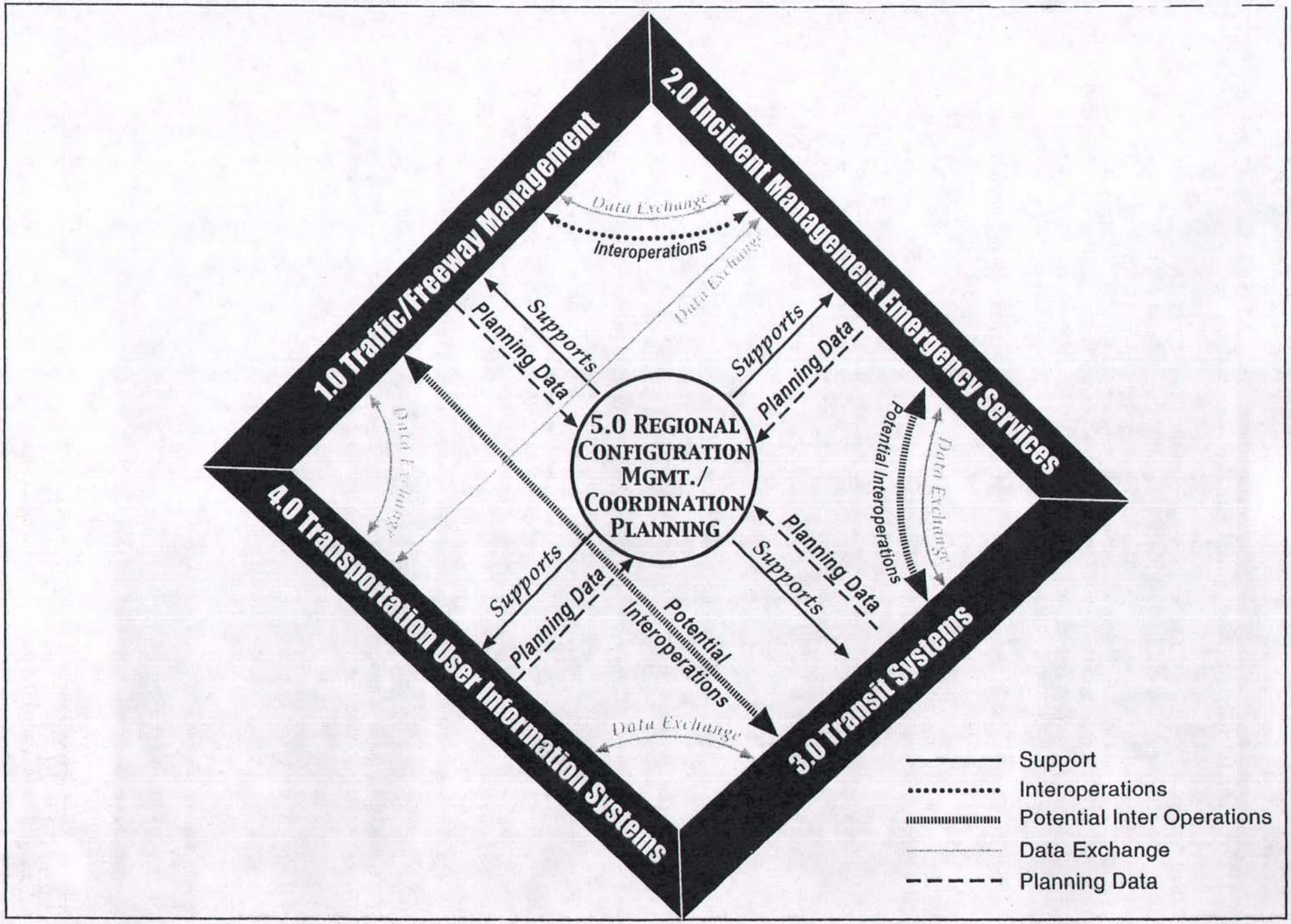


Figure 6-2
Relationships Between Program Areas

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 TUIS program area is generally one-way (input to the TUIS) only, however once broader ITS deployments take hold in the Central Valley and the State, projects in the TUIS area may become a tool for providing useful information to the Fresno Region from other regions.

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 Regional 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

Section 6.4 contains the specific ITS project definitions organized by program areas. 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:

- **Statement of Purpose** – A single sentence statement of why the project should be deployed within the Region.
- **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 Region 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 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: Transportation User 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.

6.4.1: PROGRAM AREA 1.0: TRAFFIC/FREEWAY MANAGEMENT SYSTEMS

1.1 Ramp Metering and Communications Gap Closure

Statement of Purpose: Deploy additional communications and ramp-metering capabilities along the freeway system within the Fresno County Region.

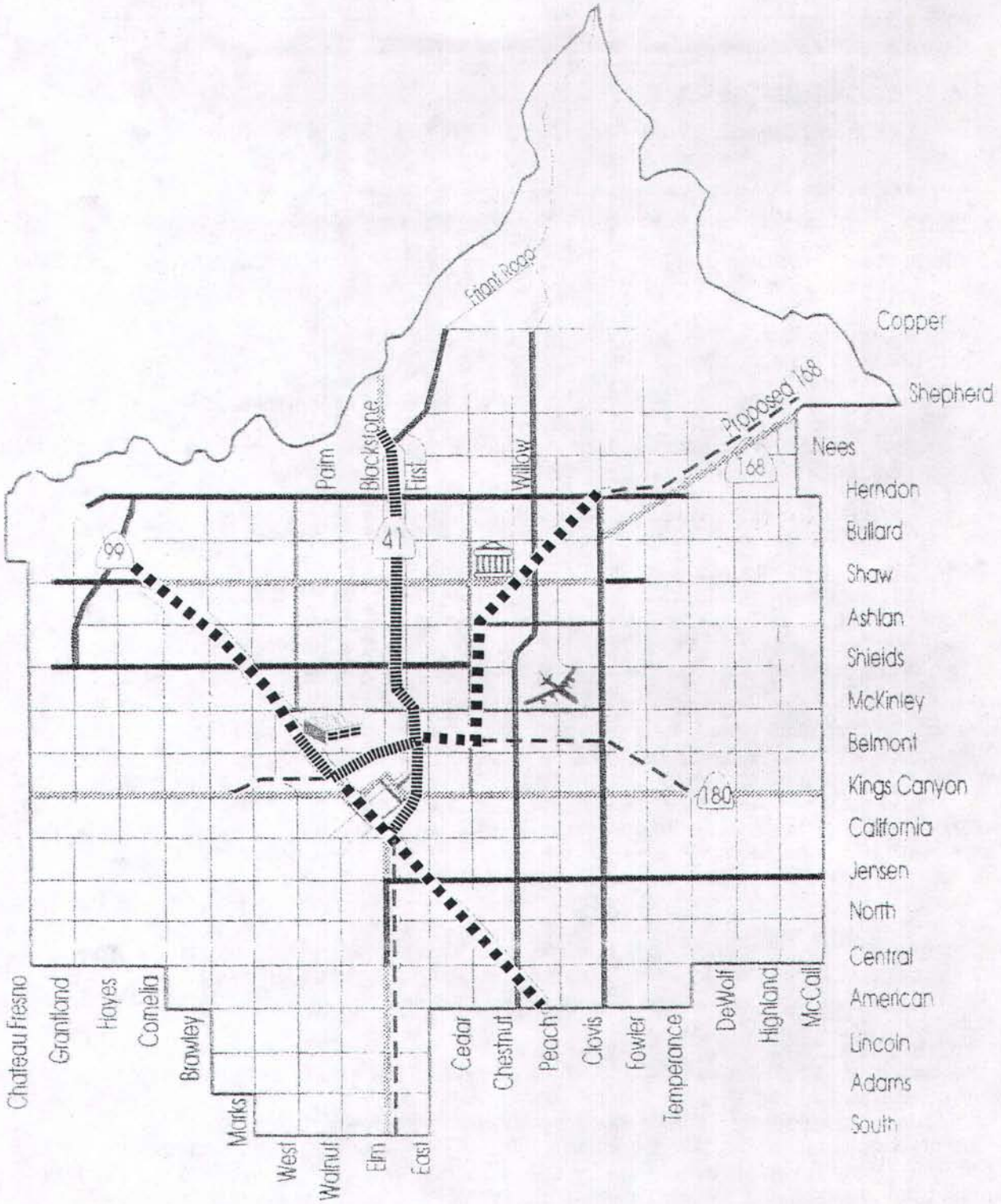
General Description:
There are three principle components to this project:

- 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 Regional Integrated Workstation (RIW) proposed in project 1.5 for the interim period.



Source: BRW, October 1998

Figure 6-
Project Concept
1.1 Ramp Metering
and Communications Ga

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 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:

	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 proceeded by the appropriate studies and design documentation consistent with Caltrans standards.

Deployment Locations: Reference Figure 6-3.

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	$4.48 million	$0.2 million
Phase 2	$10.92 million	$0.4 million
Phase 3	$1.30 million	$0.05 million
Totals	$16.70 million	$0.65 million

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).

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.

1.2 Multi-jurisdictional Interconnects

Statement of Purpose: Provide the communications linkages and systems necessary to support information sharing and coordinated signal operations between local agencies within the Region.

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.

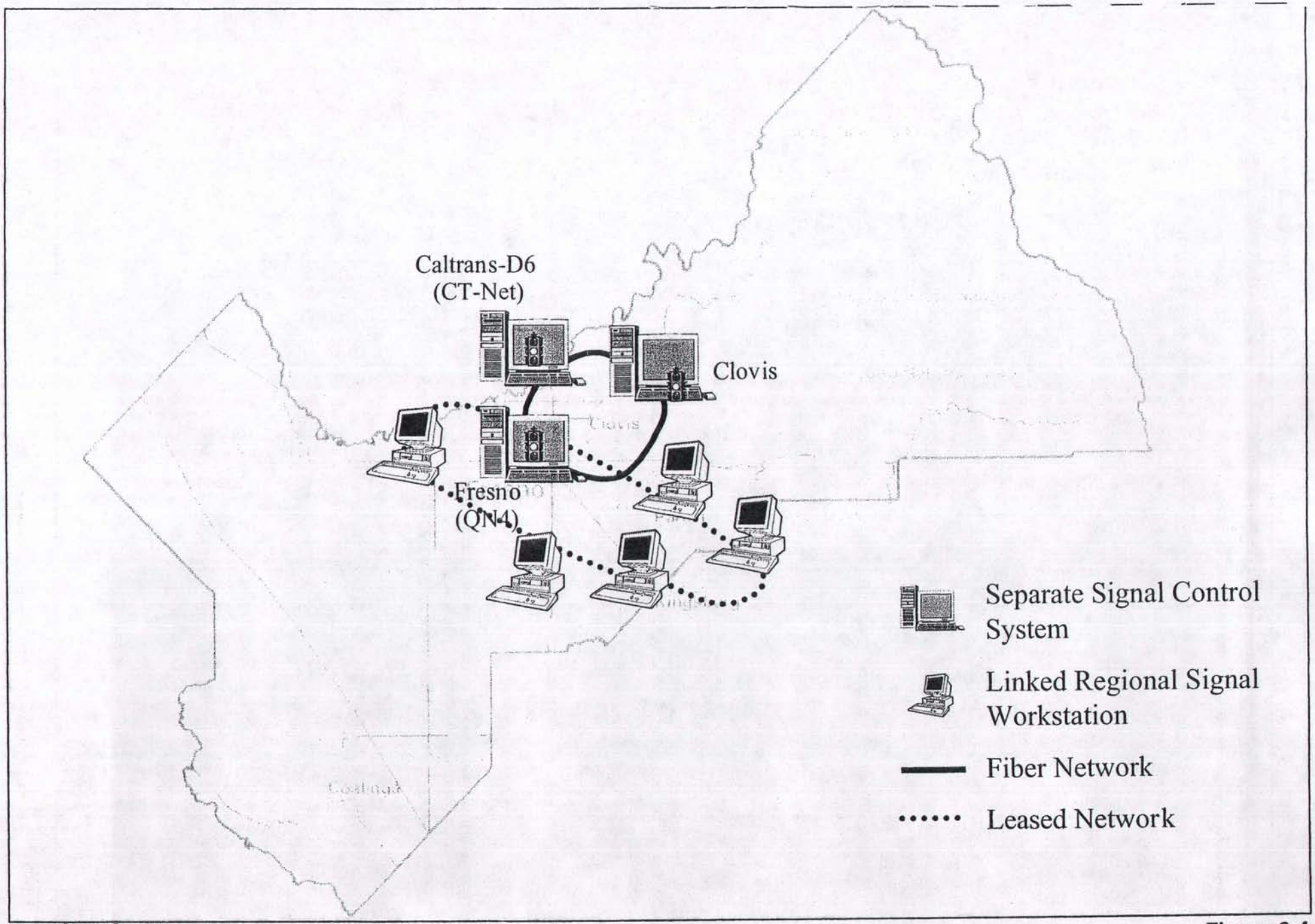


Figure 6-4
Project Concept:
1.2 Multi-jurisdictional Interconnects

- 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. As displayed in Figure 6-4, 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: Reference Figure 6-4

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	$2.19 million	$0.10 million
Phase 2	$1.91 million	$0.06 million
Totals	$4.10 million	$0.16 million

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. Refer to Section 6.0, System Architecture, for additional information.

  Reference should be made to Figures 5-2 and 5-3 of the system architecture in order to gain a better understanding of potential project interrelationships. Reference should be made to market package ATMS 3 in the National Architecture.

1.3 Integrated Smart Corridors (SR41/168/180)

Statement of Purpose: Deploy enhanced surveillance and management systems along SR41/168/180 to better manage traffic conditions, provide improved information to drivers and improve responses to congestion causing situations.

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 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	$3.63 million	$0.22 million
Phase 2	$5.27 million	$0.32 million
Phase 3	$1.37 million	$0.09 million
Totals	$10.78 million	$0.63 million

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 1.1, 1.2, and 1.5 as discussed in this section of the Plan.

To better understand potential project interrelationships, readers should refer to Figures 5-2, 5-3, and 5-4 of Section 5.0 of this Plan. It may also prove helpful to review market packages ATMS 1, 3, 4, 6, and 7, as well as ATMS 8.

1.4 Railroad/Highway Interface Technology for Railroad Crossings

Statement of Purpose: Increase safety at key railroad crossings while providing information on approaching trains to drivers.

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 which enhance safety at high activity railroad crossings.
- Develop transportation user 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:

	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 location 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	$0.98 million	$0.09 million
Totals	$0.98 million	$0.09 million

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.

1.5 Communications Interties

Statement of Purpose: Provide backbone communications between the largest transportation agencies in the County.

General Description:

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.

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 as displayed in Figure 6-5. 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.

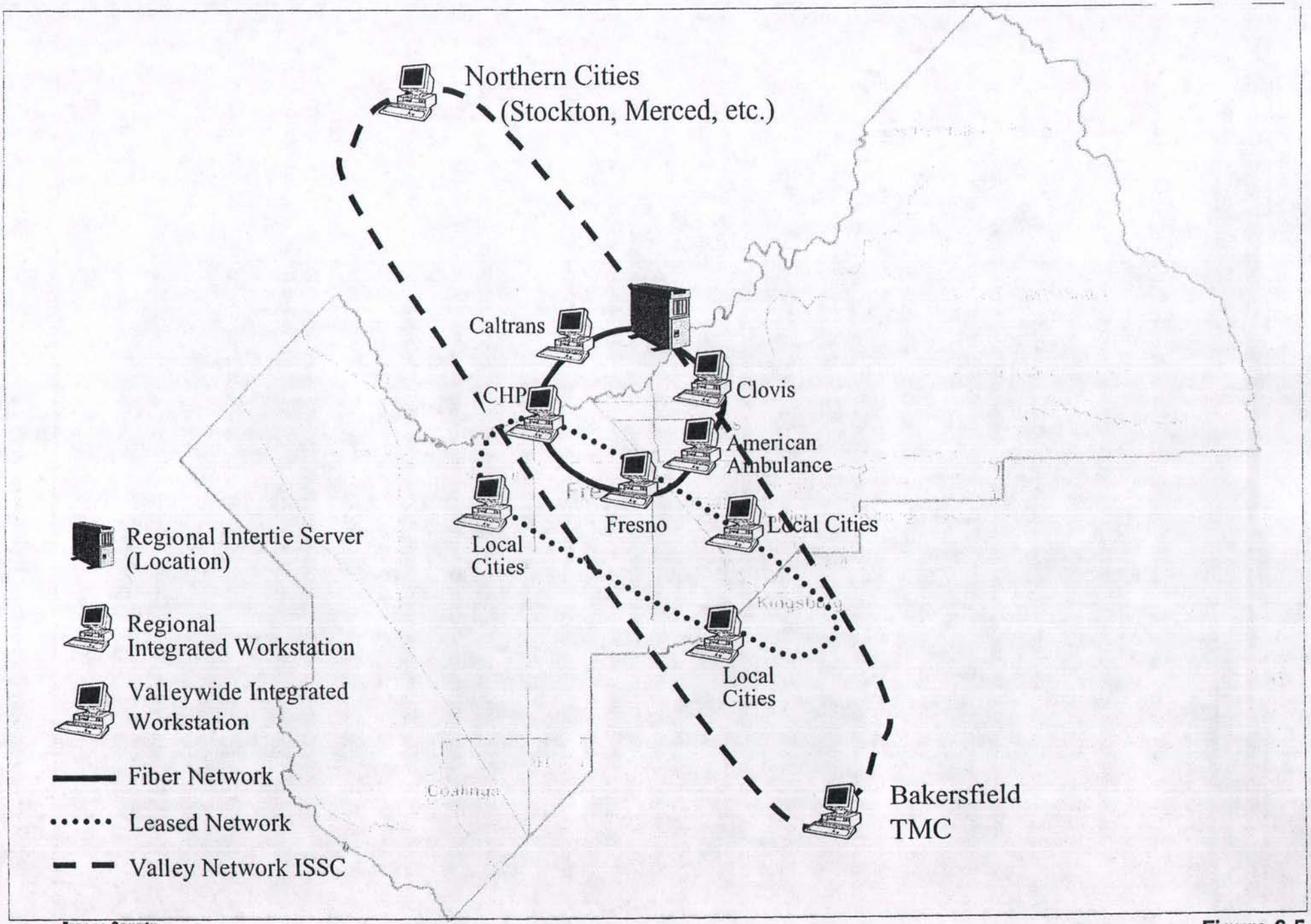


Figure 6-5
Project Concept:
1.5 Communications Interties

- 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: See Figure 6-5. 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	$3.38 million	$0.16 million
Phase 2	$0.16 million	$0.02 million
Totals	$3.54 million	$0.18 million

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: Specific considerations are discussed in Sections 6.0. As noted above, the Region should consider building off of another region's efforts in developing an integrated workstation. Readers should refer to potential project relationships outlined in Figures 5-2, 5-3, and 5-4.

1.6 Integrated Surveillance Stations/Callbox Deployment

Statement of Purpose: Provide surveillance and incident notification capabilities to the outlying areas of the Fresno County Region, as well as establish a regional motorist aide (Callbox) system.

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 project 1.5: Communications Interties. The RIS could be utilized as a common workstation to monitor and control both systems.

Figure 6-6 displays the basic logical architecture for this project. 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.** A strong emphasis should be the deployment of visibility sensors to support projects 2.1 and 2.2 in the IC-EMS 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

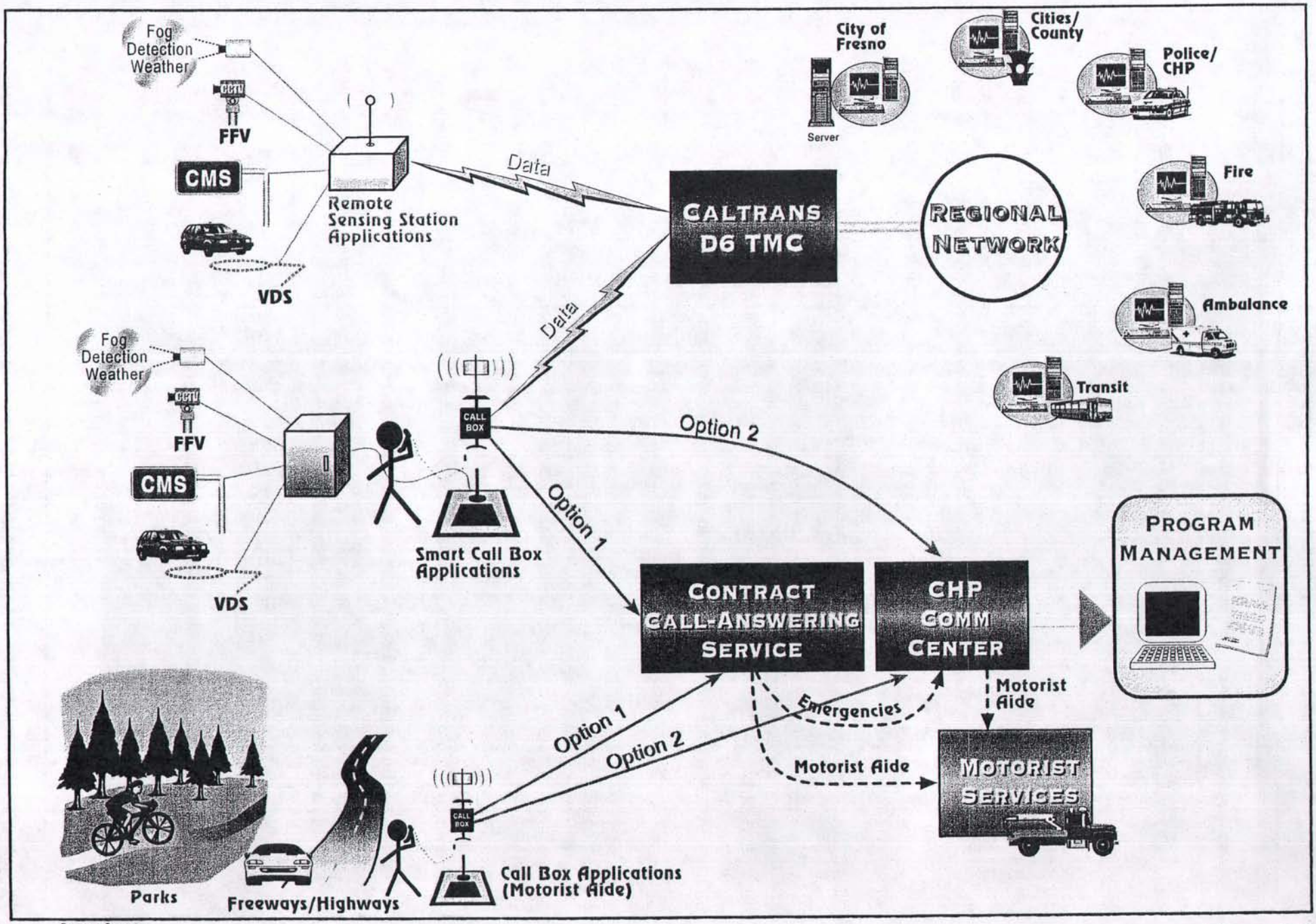


Figure 6-6
Remote Sensing / Smart Call Box/ Callbox Basic Logical Architecure

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 displayed in Figure 6-7, 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 along the highlighted facilities in Figure 6-7. 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.

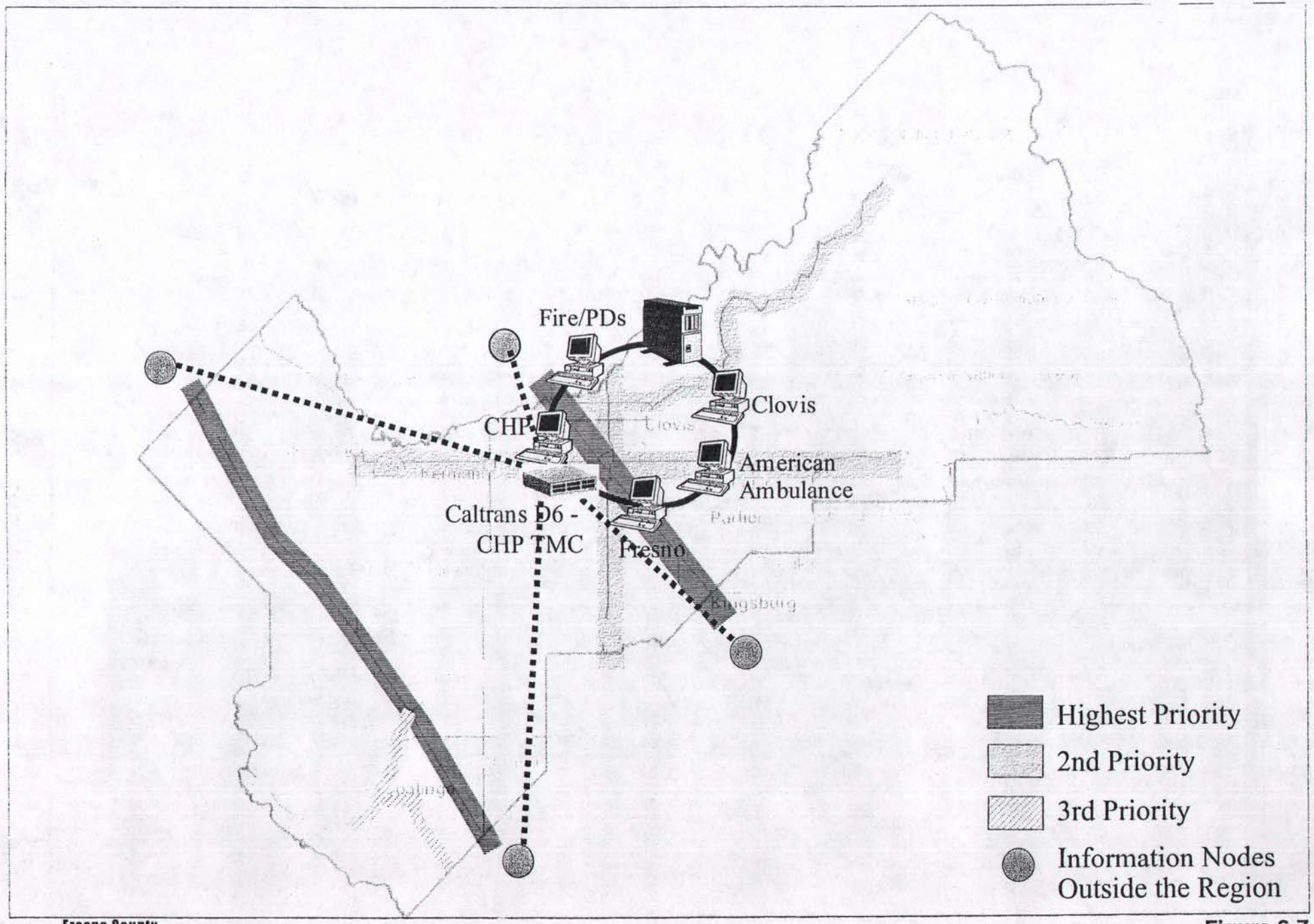


Figure 6-7
Project Concept:
1.6 Integrated Surveillance Stations/ Callbox Deployment

	Phase Components
Phase 1	➢ Study for location of remote sensors, Smart Callboxes, and callboxes. ➢ Answering center start-up & support. ➢ Callbox program support. ➢ Deployment of 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: Reference Figure 6-7.

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	$4.58 million	$0.89 million
Phase 2	$6.55 million	$0.72 million
Phase 3	$1.69 million	$0.19 million
Totals	$12.8 million	$1.8 million

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: See Figure 6-6. Also refer to market package ATMS 1 in the National Architecture and the Fresno County Region specific version of this market package displayed in Figure 5-3.

1.7 Regional Intersection Safety and Enhancement Program

Statement of Purpose: Enhance the safety of motorists and pedestrians at problem intersections.

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:

- 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 night-time 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	$3.05 million	$0.33 million
Totals	$3.05 million	$0.33 million

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.

Architecture Considerations: None

6.4.2: PROGRAM AREA 2.0: INCIDENT MANAGEMENT/EMERGENCY SERVICES

A large percentage of ITS Subcommittee discussions on the Incident Management/Emergency Services (IC-EMS) 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 Central Valley. The Region is well know for having had numerous very large multiple car accidents along major freeways and highways. This problem was identified and received a high priority from the ITS Subcommittee as discussed in Section 3.0. Figure 6-8 displays the general problems areas for the entire Central Valley for fog and dust conditions. Improving interagency coordination and communications were also identified as very high-priority needs by the ITS Subcommittee. Figure 6-9 displays five types of ITS projects identified for the Fresno County Region by the ITS Subcommittee to address these problems and needs. The sixth project, not shown in the Figure, is the creation and maintenance of an Incident Management Team/Task Force including support for interagency training by emergency service providers.

It should be noted that all stakeholders felt that emergency services were doing a good job in the management and clearance of incidents and the implementation of the Incident Command System (ICS) as needed. 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.

2.1 Weather Sensing/ATMS Integration

Statement of Purpose: Upgrade the regional weather information system (RWIS) and provide for integration of this information with transportation management and information functions.

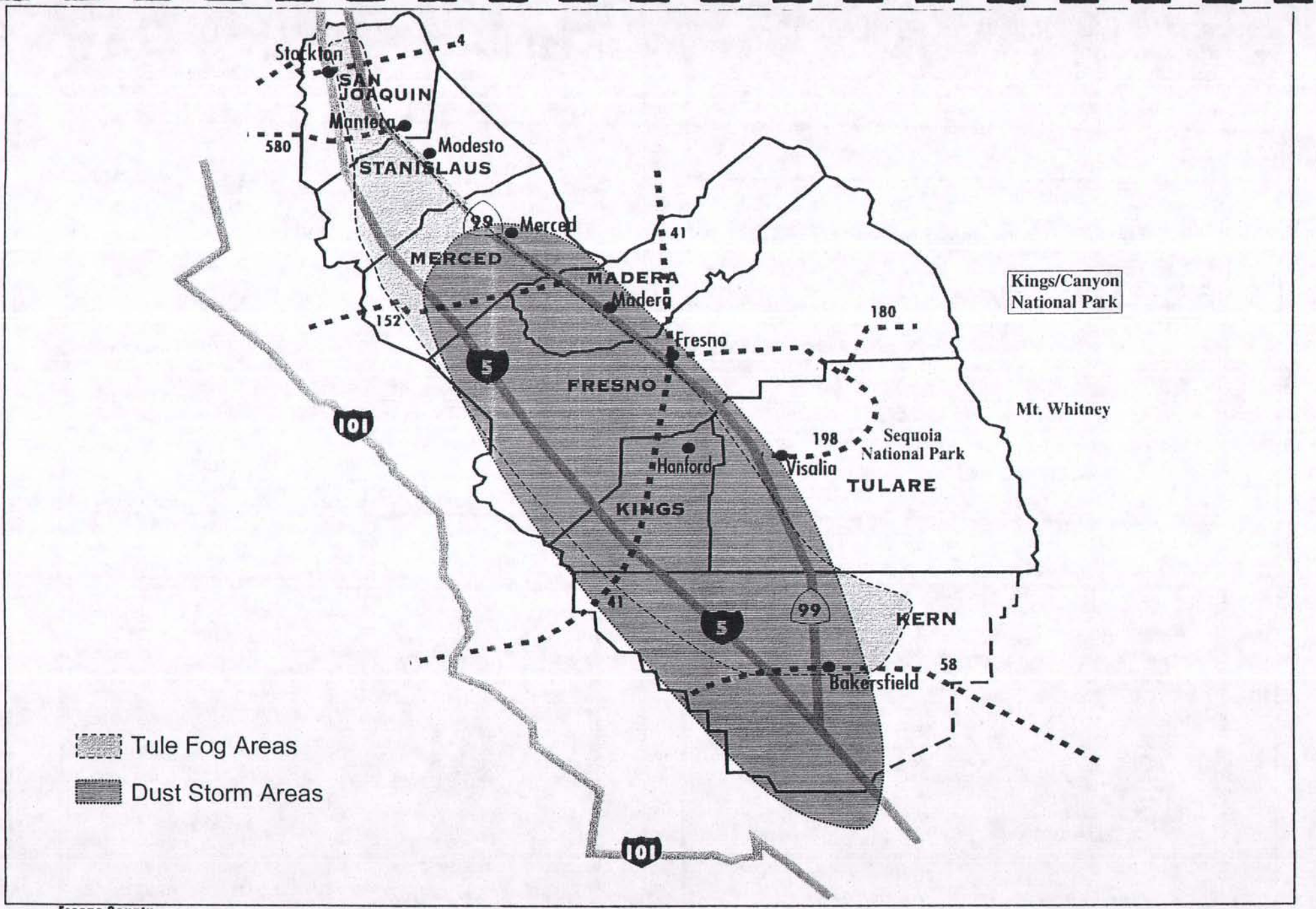
General Description:

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 identified in projects 1.1 and 1.5 respectively.

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.

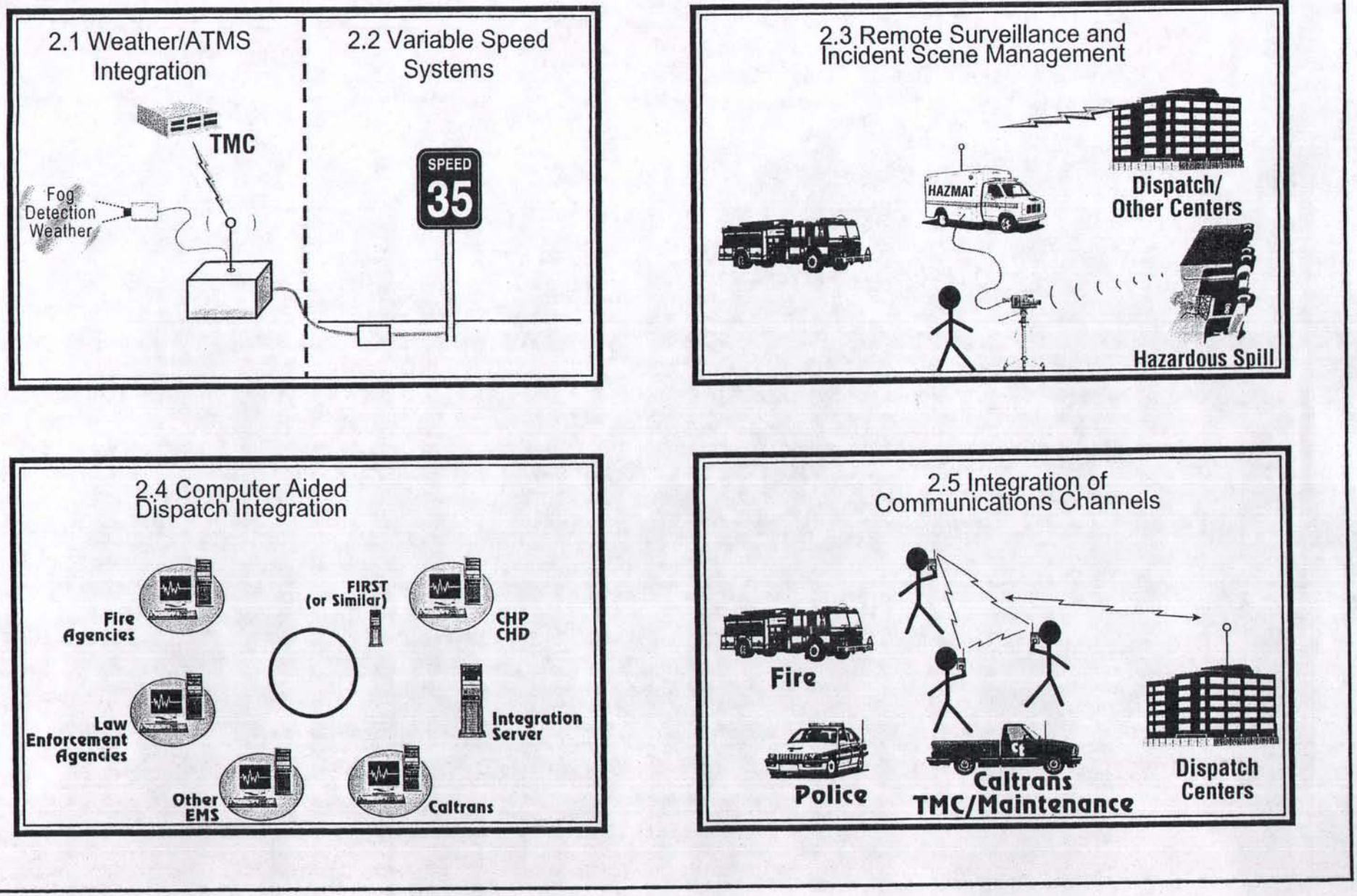
Caltrans, District 6, currently maintains a series of existing weather sensors in the Fresno County Region. However, deployment of these sensors is currently too sparse to provide accurate and timeline information on low visibility conditions. Fog, dust, and high-winds are highly mobile weather phenomenon 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



Fresno County ITS Strategic Deployment Plan

Fresno County Strategic Deployment Plan **COFCG**

Figure 6-8
Fog/Dust Problem Areas Valleywide



Fresno County Strategic Deployment Plan

Fresno County Strategic Deployment Plan **COFCG**

Figure 6-9
Project Concepts: 2.0
Incident Management/Emergency Services

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 project 2.2 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.

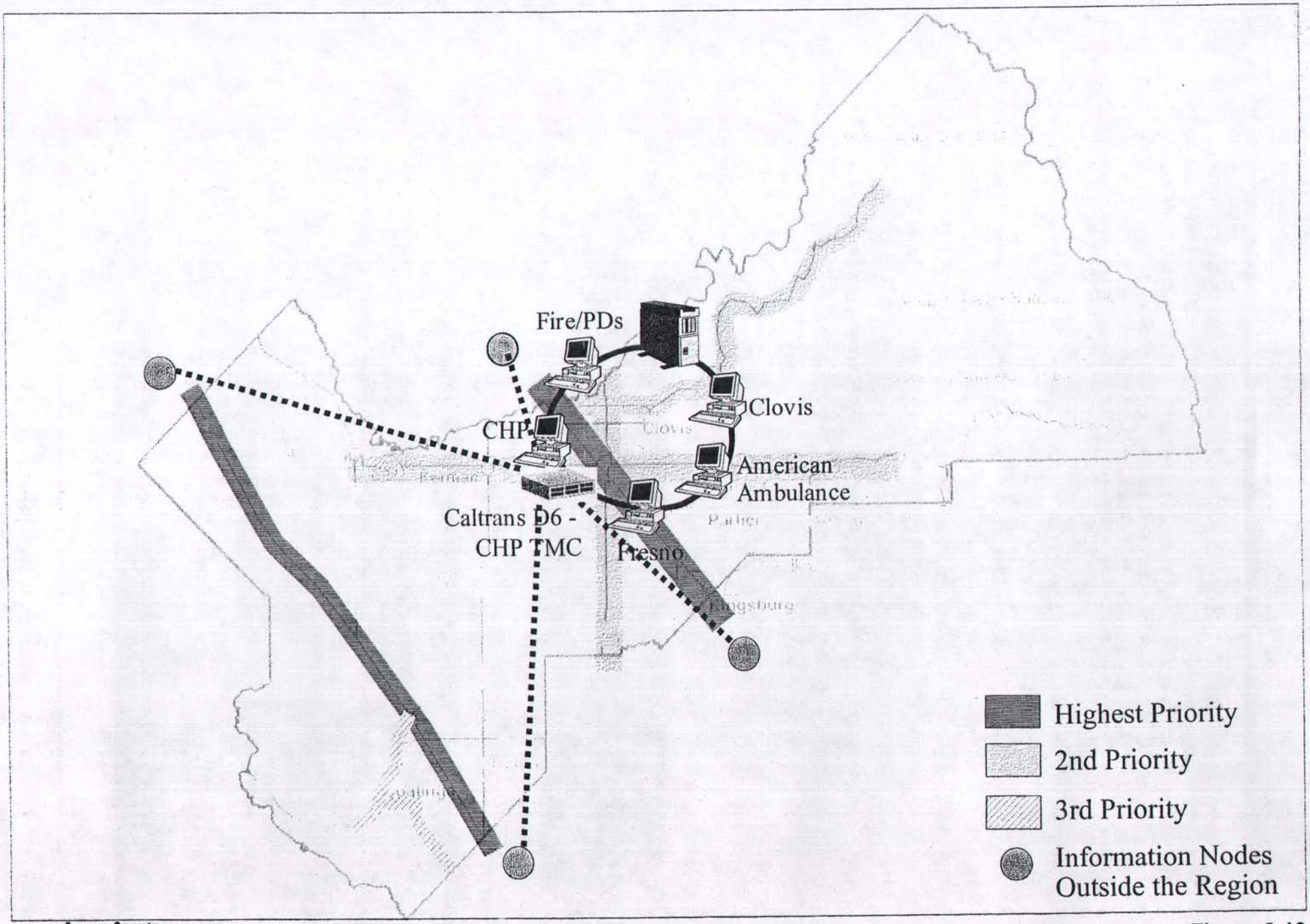
Sponsorship: Caltrans with support from CHP, COFCG and other regional agencies.

Deployment Phasing: This project has been broken down into three basic phases. Refer to Figure 6-10.

	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


Fire/PDs
Clovis
CHP
American
Ambulance
Caltrans D6 -
CHP TMC
Fresno
Highest Priority
2nd Priority
3rd Priority
Information Nodes
Outside the Region

Actual deployment should be based on the findings of the preliminary device location study proposed in this project.

Deployment Locations: Reference Figure 6-10 and the Deployment Phasing discussion.

Deployment Timeframes: This project is the only IC-EMS project identified for near-term deployment in this Plan besides project 2.6 Incident Management Team/Task Force. 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	$1.5 million	$0.12 million
Phase 2	$1.79 million	$0.16 million
Phase 3	$0.65 million	$0.01 million
Totals	$3.94 million	$0.29 million

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. Reference should be made to Figures 5-3 and 5-4 in the System Architecture section of this Plan.

2.2 Variable Speed System/Smart or Intelligent Roadway Studs

Statement of Purpose: Enhance motorist safety in poor weather conditions by providing speed advisories and intelligent roadway markings.

General Description:

Figure 6-10, included with project 2.1, serves to identify phasing and priorities for this project as well as 2.1. 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. Refer to Figure 6-10.

	Phase Components
Phase 1	➢ Study of the locations of VSS and IRS deployments should stem from efforts conducted in project 2.1. ➢ 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: Reference Figure 6-10 and the Deployment Phasing discussion.

Deployment Timeframes: This project requires that certain elements of project 2.1 Weather/ATMS Integration be in place prior to deployment. The project is slated to begin in the near-term.

	Phase Timelines
Phase 1	Years 5-9
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 project 2.1.
- Reduced number of accidents at deployed locations, and reduced number of major incidents during poor weather conditions.

Emissions Reductions:

- See project 2.1. 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	$0.68 million	$0.04 million
Phase 2	$0.92 million	$0.06 million
Phase 3	$0.28 million	$0.02 million
Totals	$1.88 million	$0.12 million

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.

2.3 Remote Surveillance and Incident Scene Management

Statement of Purpose: Enhance incident scene management capabilities through improved mobile remote surveillance and communications between incident commanders in the field and specialists at fixed locations.

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	$0.28 million	$0.03 million
Totals	$0.28 million	$0.03 million

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.

2.4 Computer Aided Dispatch Integration

Statement of Purpose: Enhance incident response and coordination activities in situations where multiple emergency service agencies are involved.

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 project 1.5: 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 a CAD systems 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	$1.2 million	$0.16 million
Totals	$1.2 million	$0.16 million

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 Figure 5-4 of Section 5.0 of this Plan, as well as market package ATMS 8 in the National Architecture.

2.5 Integration of Communications Channels

Statement of Purpose: Provide a common communications channel for all emergency service agencies which would be involved in a large scale incident.

General Description:

The ITS Subcommittee has noted that 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.

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	$0.74million	$0.63 million
Totals	$0.74 million	$0.63 million

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.

2.6 Incident Management/Response Coordination Task Force

Statement of Purpose: Establish a multi-agency institutional structure for dealing with incident management and transportation agency/emergency service agency coordination issues.

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.

An Incident Management Task Force/Team has been suggested as a part of this Plan, and is discussed in detail in Sections 7.0 and 9.0. A preliminary Incident Management Task Force has held two meetings in the Fresno Region so far: (1) a simple kick-off meeting; and (2) a two-day workshop on incident issues and needs. The response to these efforts so far has been positive. It is important that this effort continue in order to provide an effective and formal forum for enhancing the cooperation and communication between regional incident response agencies.

Incident management 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 associations 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 Incident Management 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	$0.13 million	$0.06 million
Totals	$0.13 million	$0.06 million

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.

6.4.3: PROGRAM AREA 3.0: TRANSIT SYSTEMS

The Fresno County Region has already begun deployment of its transit ITS capabilities with the implementation of the FAX Transit Management System. However, the ITS Subcommittee did identify several other desirable activities that represent a combination of institutional and technical solutions to enhance the coordination of transit operations within the Region. The overall deployment concept for the Transit Systems program area is displayed in Figure 6-11, and each project is discussed separately below.

3.1 Coordinated Transit District Operations

Statement of Purpose: Improve transit agency coordination throughout the Region to provide more seamless service to patrons and maximize economies of scale.

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 identified and discussed in Section 9.0 of the Plan. 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.

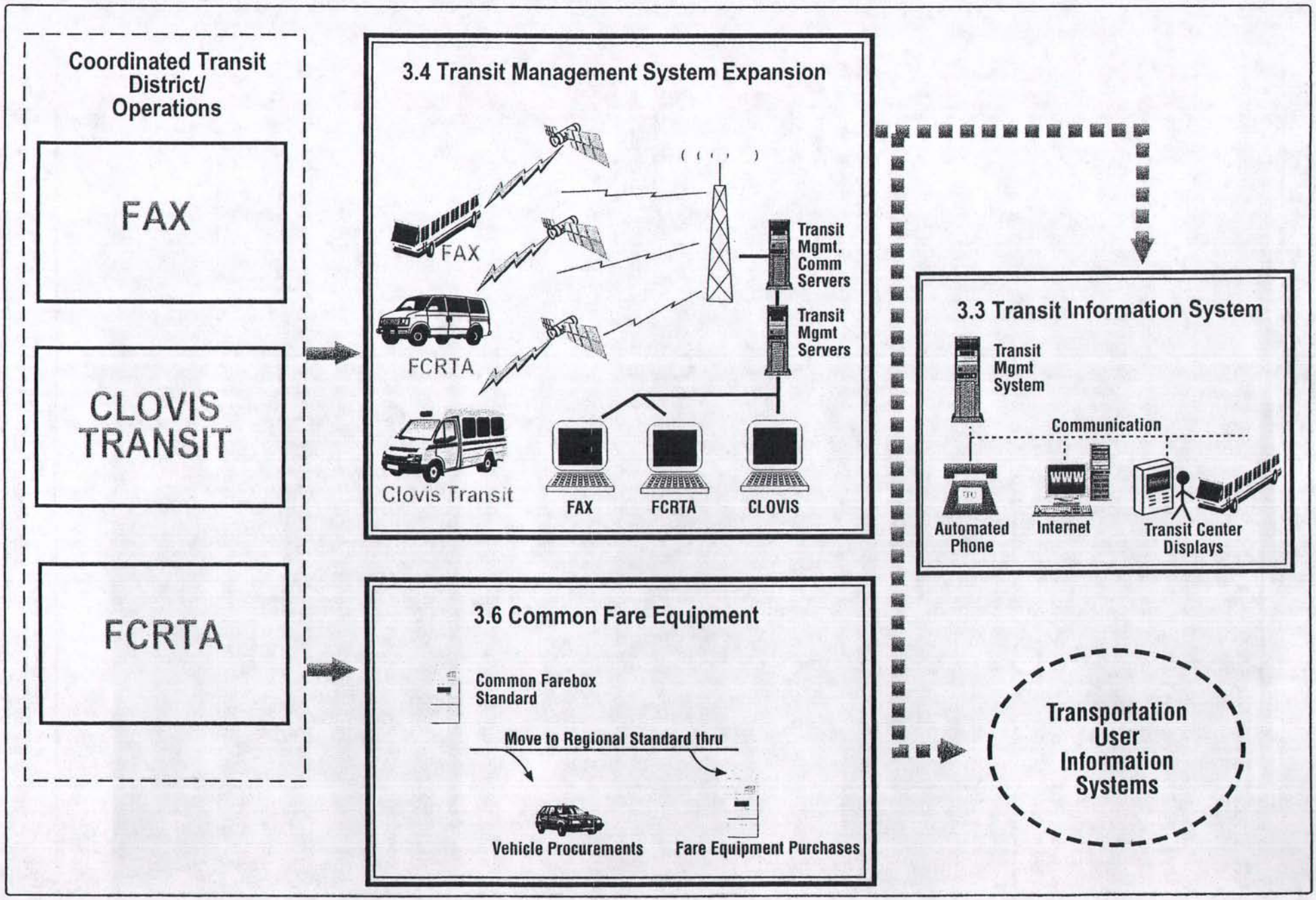


Figure 6-11
Project Concepts: 3.0 Transit Systems

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	$0.08 million	$0.02 million
Totals	$0.08 million	$0.02 million

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.

3.2 Transit Operations/Dispatch Centers Integration

Statement of Purpose: Enhance interagency coordination of transit operations through integrated dispatching and transit information services.

General Description:

In conjunction with project 3.1, 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 project 3.4: Transit Management System Completion/Expansion 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	$1.63 million	$0.01 million
Totals	$1.63 million	$0.01 million

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. In addition, readers may wish to refer to Figure 5-6 of Section 5.0 of this Plan to better assess the relationships between various ITS projects in the Fresno County Region. Readers may also want to review market packages APTS 1, 2, and 3 of the National Architecture.

3.3 Transit Information System

Statement of Purpose: Utilize the capabilities provided by FAX's transit management system and provide real-time transit information to patrons at major transit/activity centers.

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 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.

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	$0.85 million	$0.07 million
Totals	$0.85 million	$0.07 million

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 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.

3.4 Transit Management System Completion/Expansion

Statement of Purpose: Expand the deployment and functionality of FAX's transit management system for deployment to all regional transit services.

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, 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 10-12

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	$1.59 million	$0.16 million
Phase 2	$0.68 million	$0.07 million
Totals	$2.27 million	$0.23 million

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 Section 6.0 System Architecture on relevant standards). Reference should be made to Figure 5-6 of this Plan, as well as to APTS 1 of the National Architecture.

3.5 Common Fare Equipment Deployment

Statement of Purpose: Simplify and enhance the accuracy of regional transit fare collection and management.

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	$1.50 million	$0.09 million
Phase 2	$0.32 million	$0.02 million
Totals	$1.82 million	$0.11 million

Evaluation Criteria:

- Number of units deployed and mean time between failure.

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 5-6 of this Plan, as well as market package APTS 4 of the National Architecture.

6.4.4: PROGRAM AREA 4.0: TRANSPORTATION USER INFORMATION SYSTEMS

Figure 6-12 displays the basic concept for deployment of Transportation User Information Systems (TUIS) in the Fresno County Region. There are three key portions of the overall TUIS program area displayed in the Figure:

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

4.1 Regional Transportation User Information System

Statement of Purpose: Enhance the accuracy, timeliness, and level of relevant information available to users of the transportation 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 will 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.

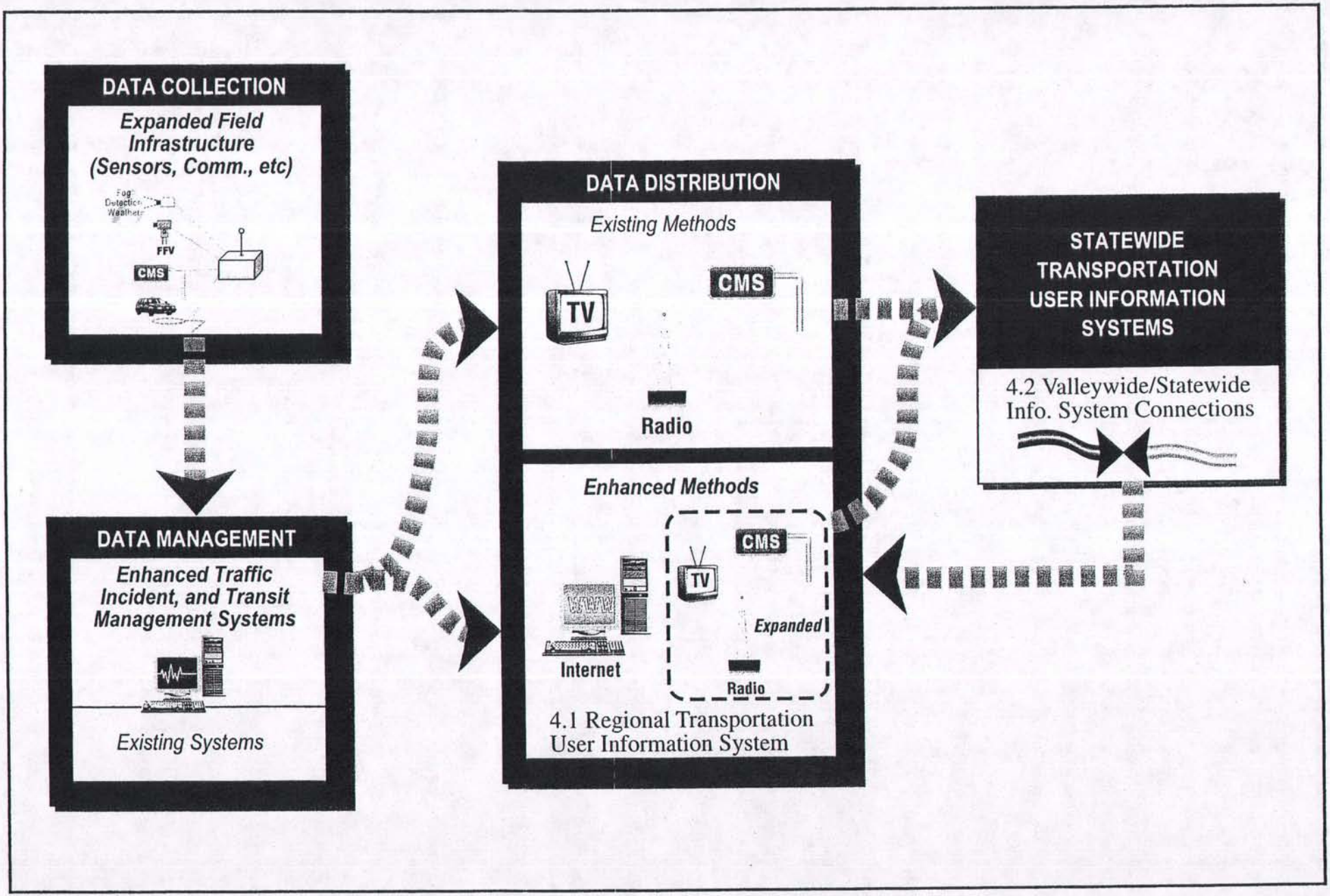


Figure 6-12
Project Concepts: 4.0 Transportation User Information Systems

- 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	$3.92 million	$0.37 million
Totals	$3.92 million	$0.37 million

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: See Section 5.0 and Figures 5-7 and 5-8 of this Plan. 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.

4.2 Coordination with Valleywide/Statewide Information Systems

Statement of Purpose: Ensure compatibility and involvement of the Fresno County Region in any significant valleywide or Statewide transportation user information system deployment.

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	$0.26 million	$0.04 million
Totals	$0.26 million	$0.04 million

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.

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 6-13, 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.

5.1 Valleywide/Statewide Communications Linkages

Statement of Purpose: Coordinate and provide for communications linkages between the Fresno County Region, neighboring regions, as well as the State.

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:

	Phase Timelines
Phase 1	Year 10 (w/continued support)

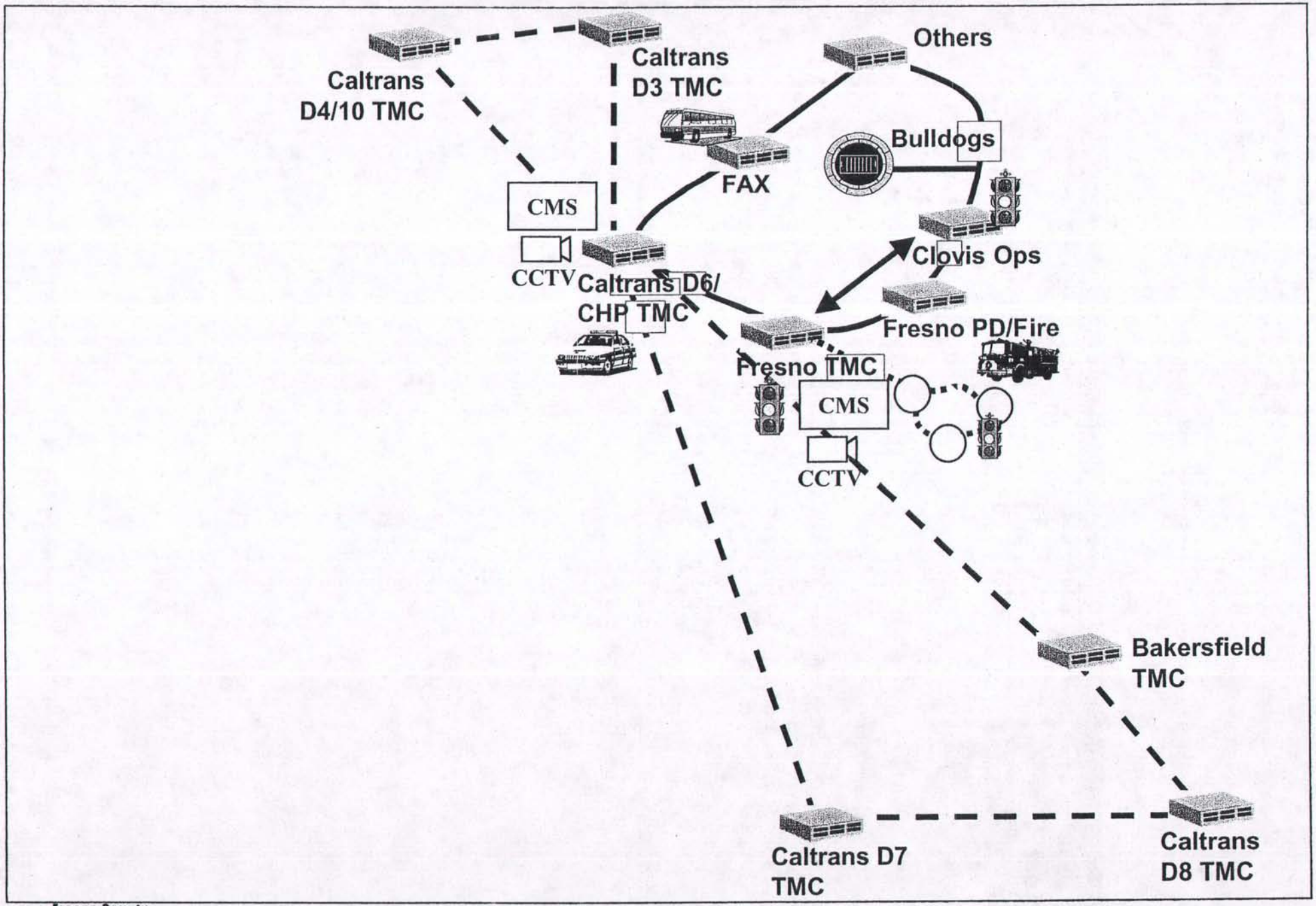


Figure 6-13
Project Concept:
5.1 Valleywide/Statewide Connections

Benefits:

- N/A – requirement for communication outside of the Region.

Budget Estimate:

	Phase Budget Estimates	
	Capital Costs	Operations and Maintenance Per Year
Phase 1	$0.07 million	$0.02 million
Totals	$0.07 million	$0.02 million

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 as discussed in Section 9.0 of this Plan will be critical.

5.2 Regional Configuration Management

Statement of Purpose: Provide for a coordinated and integrated ITS deployment effort within the Region that follows the standards systems development process resulting in lower overall costs.

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.

For additional discussion on configuration management issues make reference to the operations and maintenance discussion in Section 7.0 and the management discussion in Section 9.0.

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:

	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	$0.03 million	$0.01 million
Totals	$0.03 million	$0.01 million

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.

5.3 Common/Standard Regional/County Map

Statement of Purpose: Provide an accurate and effective regional map for ITS and automatic vehicle location uses.

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:

	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	$0.36 million	$0.15 million
Totals	$0.36 million	$0.15 million

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.

SECTION 7.0 DEPLOYMENT ELEMENT

7.1 PURPOSE

The purpose of this Section is to provide an overall view of ITS deployment in the Fresno County Region. 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 SDP should not weigh against it in any programming or funding criteria.

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 Message Signs (CMS)
  - Extinguishable Message Signs (EMS)
  - Highway Advisory Radio (HAR)
  - Ramp metering

- Fiber-optics and wireless communications
- 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 Fresno County Region, 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 Fresno Region has begun deployment of some systems, and has a handful of others in place. The City of Fresno is installing a centralized signal control system. 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. FAX has deployed a Transit Management/Vehicle Tracking system. 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.

But 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 Fresno County Region 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 Fresno County Region. 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 Fresno County Region 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.

- **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 Fresno 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 Fresno County Region 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, COFCG should take the lead in the distribution of information on ITS deployments throughout the Region, Central Valley, and state.

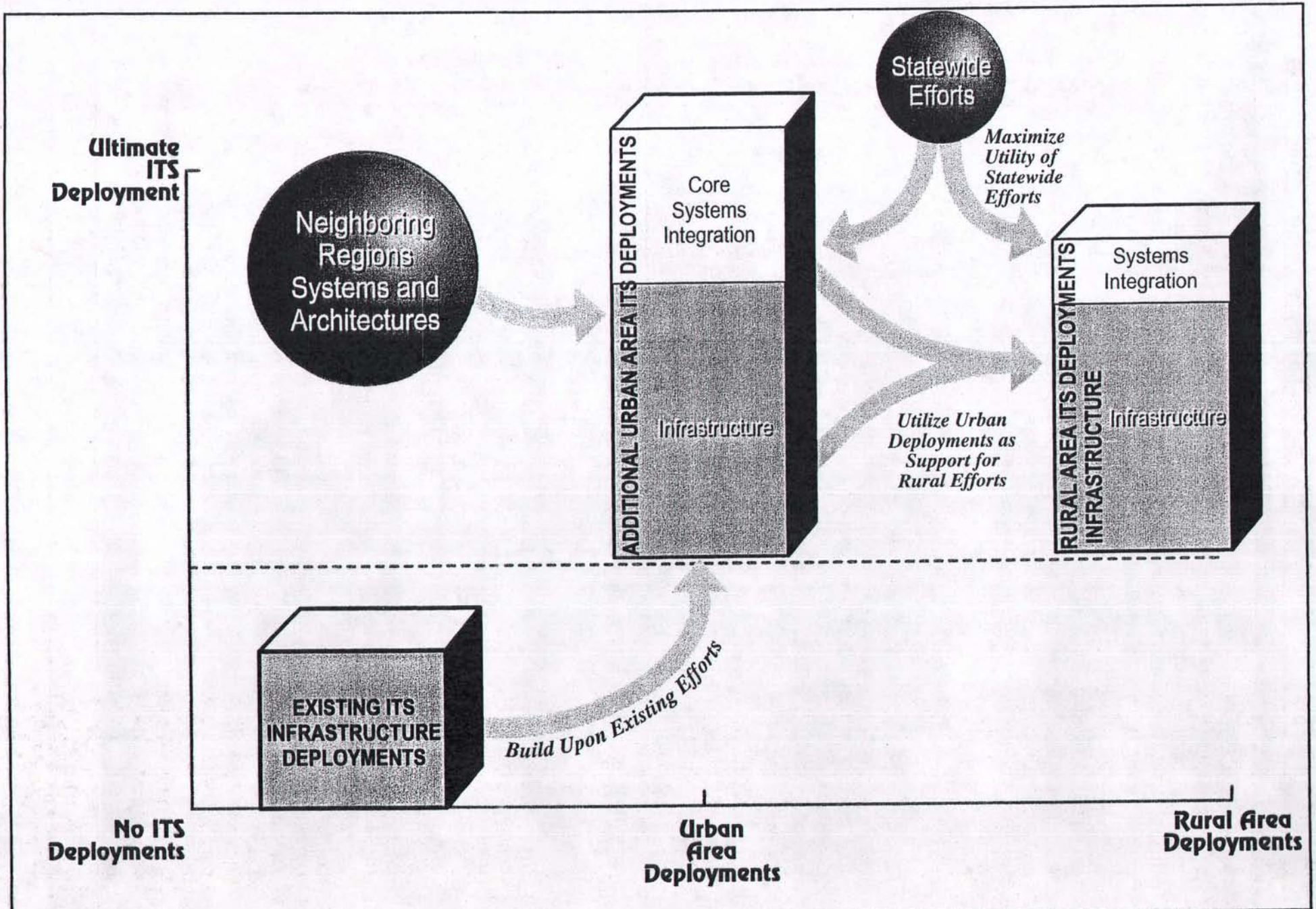


Figure 7-1
Fresno County Region Deployment Concept

- **Rural Area Deployments** – The Fresno County Region is dominated by rural areas with widespread agricultural uses. Cutting through the County are the important state corridors of SR99 and I-5. Regional stakeholders identified the lack of remote sensing, incident detection, and traffic/freeway management in the rural areas of the County 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 County 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 Fresno County 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 is slated to eventually receive the 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. Another option is for the Fresno County Region 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 Fresno 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.

    - Statewide Efforts – Through the Statewide ITS Deployment Initiatives project, a statewide system architecture is being developed. It is likely to focus on transportation user information 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.

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 regional** - 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 being 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 Fresno County Region. 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. **Fresno County 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

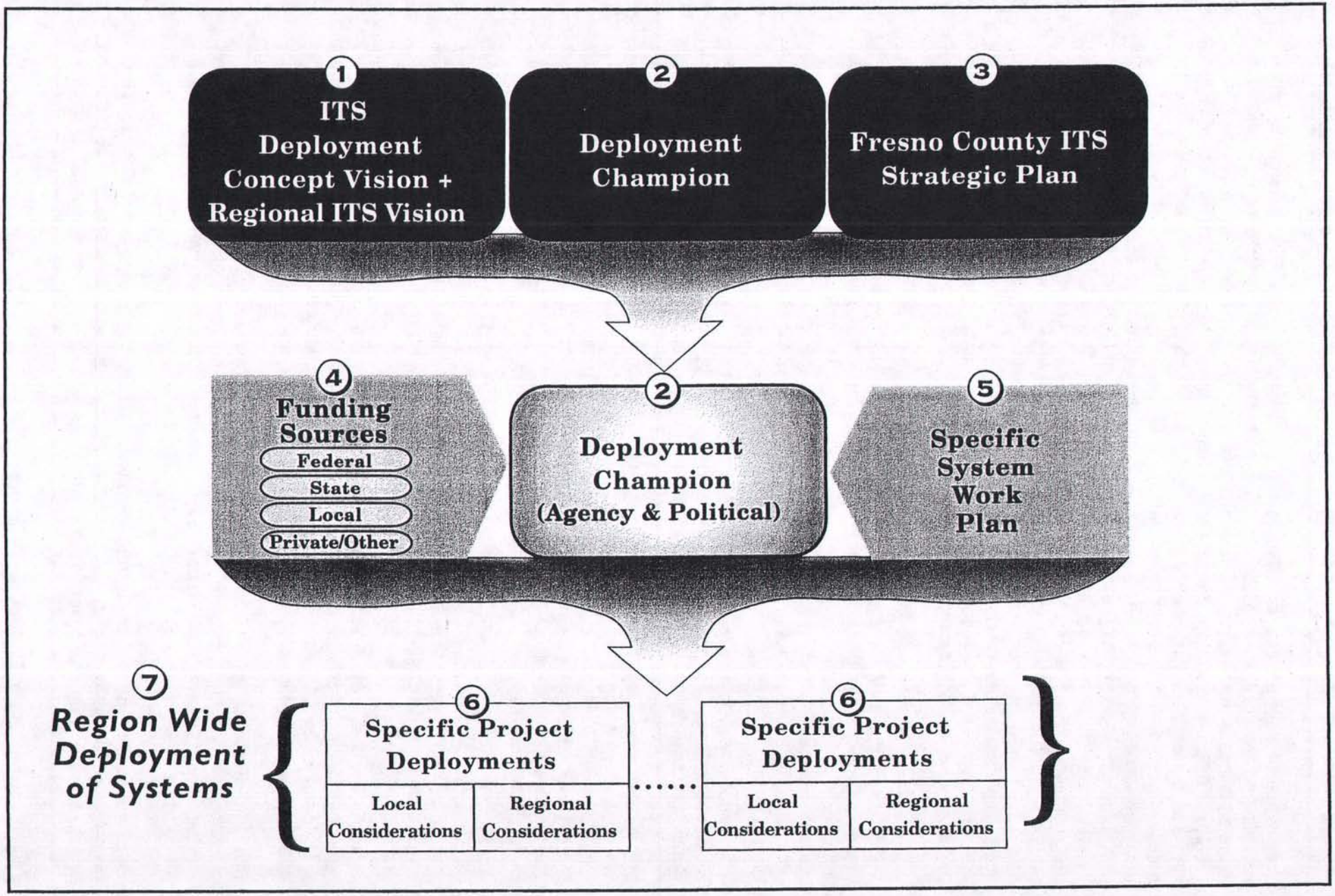


Figure 7-2
Suggested ITS System Deployment Process

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 COFCG to outline existing and projected transportation conditions and improvement projects. Most regions have incorporated ITS as a special section in the RTP, however the Fresno Region 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 COFCG 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.

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 Subcommittee 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 7-4 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 Subcommittee, 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 1999 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 and 7-4 provide a comprehensive picture of planned ITS deployment within the Region. 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.

It becomes apparent that the majority of the projects are planned for deployment in the near-term. The total estimated capital costs for the Year 1 is over **$5.3 million**. The capital cost for deployment in Year 2 is approximately **$3.8 million**. Annual capital expenditures increase in the mid-term (Years 5-10), and then slowly drop-off over time. The total capital cost for deployment of all projects within the 20-year time frame is approximately **$70 million**.

Figure 7-3
FRESNO COUNTY REGION ITS DEPLOYMENT TIMELINE

Program Areas/Projects	TOTAL COSTS
1.0 Traffic/Freeway Management Systems	
1.1 Ramp Metering & Communications Gap Closure	$ 16,710,000
1.2 Multi-jurisdictional Interconnects	$ 3,270,000
1.3 Integrated Smart Corridors	$ 10,240,000
1.4 Railroad Highway Interface Technology for RR Xing	$ 1,000,000
1.5 Communications Interties	$ 3,540,000
1.6 Integrated Surveillance Stations/Callbox Deploy.	$ 12,790,000
1.7 Regional Intersection Safety Systems	$ 3,050,000
2.0 Incident Management/Emergency Services	
2.1 Weather/ATMS Integration	$ 3,930,000
2.2 Variable Speed System/Smart Studs	$ 1,870,000
2.3 Remote Surveillance and Incident Scene Mgmt.	$ 280,000
2.4 Computer Aided Dispatch Integration	$ 1,290,000
2.5 Integration of Communications Channels	$ 760,000
2.6 Incident Management Task Force/Team	$ 140,000
3.0 Transit Systems	
3.1 Coordinated Transit District Operations	$ 80,000
3.2 Coordinated Transit Operations/Dispatch Centers	$ 880,000
3.3 Transit Information System	$ 850,000
3.4 Transit Management System Completion/Expansion	$ 2,450,000
3.5 Common Fare Equipment Deployment	$ 1,830,000
4.0 Transportation User Information Systems	
4.1 Regional Transportation User Info. Systems	$ 3,930,000
4.2 Coordination with Valleywide/Statewide Info. Systems	$ 250,000
5.0 Regional ITS Config. Mgmt./Coord./Planning	
5.1 Valleywide/Statewide Communications Linkages	$ 70,000
5.2 Regional Configuration Management	$ 280,000
5.3 Common/Standard Regional/County Map	$ 580,000

TOTAL ESTIMATED UNCONSTRAINED EXPENDITURES																				
Capital Costs w/Est. Design & Contingencies by Year	$5,320,000	$3,850,000	$3,650,000	$4,840,000	$10,280,000	$7,690,000	$9,390,000	$7,420,000	$3,740,000	$2,740,000	$2,400,000	$1,790,000	$1,410,000	$2,710,000	$1,020,000	$710,000	$430,000	$430,000			**$70,070,000**
Operations & Maintenace Costs by Year (all projects)		$530,000	$900,000	$1,420,000	$1,870,000	$2,450,000	$3,180,000	$4,070,000	$4,770,000	$5,220,000	$5,390,000	$5,560,000	$5,690,000	$5,810,000	$6,000,000	$6,010,000	$6,040,000	$6,080,000	$6,110,000	$6,110,000	

Legend:

Phase 1 Deployment

Phase 2 Deployment

Phase 3 Deployment

Notes:

**1 All values are displayed in uninflated 1999 Dollars*

**2 Timeline does not reflect operations and maintenance timeframes.*

**3 All budget estimates are preliminary and should be utilized for planning purposes only.*

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Figure 7-4
SUMMARY OF ESTIMATED UNCONSTRAINED CAPITAL AND OPERATIONS & MAINTENANCE EXPENDITURES
(in 1999 Dollars: rounded to 10,000's: estimates provided for planning purposes)

Program Areas/Projects	Total Est. Capital Costs	Costs by Year																				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															$1,300,000							$ 16,710,000
1.1 Ramp Metering & Communications Gap Closure	$12,780,000	$1,500,000	$990,000	$990,000	$990,000	$3,680,000	$2,420,000	$2,420,000	$2,420,000													
Operations & Maintenance			$50,000	$100,000	$150,000	$200,000	$320,000	$440,000	$560,000	$680,000	$680,000	$680,000	$680,000	$680,000	$680,000	$740,000	$740,000	$740,000	$740,000	$740,000	$740,000	$ 3,270,000
1.2 Multi-jurisdictional Interconnects	$2,610,000	$680,000	$500,000	$500,000	$500,000	$340,000	$250,000	$250,000	$250,000													
Operations & Maintenance			$30,000	$50,000	$80,000	$100,000	$120,000	$130,000	$150,000	$160,000	$160,000	$160,000	$160,000	$160,000	$160,000	$160,000	$160,000	$160,000	$160,000	$160,000	$160,000	$ 10,240,000
1.3 Integrated Smart Corridors	$7,880,000						$420,000	$800,000	$800,000	$800,000	$800,000	$1,540,000	$930,000	$930,000	$930,000	$930,000	$640,000	$360,000	$360,000			
Operations & Maintenance									$60,000	$110,000	$170,000	$220,000	$310,000	$390,000	$470,000	$550,000	$550,000	$580,000	$610,000	$640,000	$640,000	$ 1,000,000
1.4 Railroad Highway Interface Technology for RR Xing	$750,000				$250,000	$250,000	$250,000	$250,000														
Operations & Maintenance						$20,000	$20,000	$20,000	$20,000	$20,000	$20,000	$20,000	$20,000	$20,000	$20,000	$20,000	$20,000	$20,000	$20,000	$20,000	$20,000	$ 3,540,000
1.5 Communications Interties	$2,650,000	$1,020,000	$860,000	$750,000	$750,000	$160,000																
Operations & Maintenance			$40,000	$80,000	$120,000	$160,000	$170,000	$170,000	$170,000	$170,000	$170,000	$170,000	$170,000	$170,000	$170,000	$170,000	$170,000	$170,000	$170,000	$170,000	$170,000	$ 12,790,000
1.6 Integrated Surveillance Stations/Callbox Deploy.	$10,220,000	$1,420,000	$1,050,000	$1,050,000	$1,050,000	$1,730,000	$1,200,000	$1,200,000	$1,200,000	$1,200,000	$450,000	$310,000	$310,000	$310,000	$310,000							
Operations & Maintenance			$220,000	$450,000	$670,000	$890,000	$1,040,000	$1,180,000	$1,330,000	$1,470,000	$1,620,000	$1,650,000	$1,690,000	$1,730,000	$1,760,000	$1,800,000	$1,800,000	$1,800,000	$1,800,000	$1,800,000	$1,800,000	$ 3,050,000
1.7 Regional Intersection Safety Systems	$2,350,000				$610,000	$610,000	$610,000	$610,000	$610,000													
Operations & Maintenance						$70,000	$130,000	$200,000	$260,000	$330,000	$330,000	$330,000	$330,000	$330,000	$330,000	$330,000	$330,000	$330,000	$330,000	$330,000	$330,000	
2.0 Incident Management/Emergency Services																						$ 3,930,000
2.1 Weather/ATMS Integration	$3,100,000	$500,000	$330,000	$330,000	$330,000	$470,000	$330,000	$330,000	$330,000	$330,000	$290,000	$180,000	$180,000									
Operations & Maintenace			$30,000	$60,000	$90,000	$120,000	$150,000	$180,000	$210,000	$240,000	$280,000	$300,000	$310,000	$330,000	$330,000	$330,000	$330,000	$330,000	$330,000	$330,000	$330,000	$ 1,870,000
2.2 Variable Speed System/Smart Studs	$1,460,000					$190,000	$120,000	$120,000	$120,000	$120,000	$220,000	$170,000	$170,000	$170,000	$170,000	$90,000	$70,000	$70,000	$70,000			
Operations & Maintenace							$10,000	$20,000	$30,000	$30,000	$40,000	$60,000	$70,000	$80,000	$90,000	$100,000	$110,000	$110,000	$120,000	$120,000	$120,000	$ 280,000
2.3 Remote Surveillance and Incident Scene Mgmt.	$200,000					$220,000	$60,000															
Operations & Maintenace							$20,000	$30,000	$30,000	$30,000	$30,000	$30,000	$30,000	$30,000	$30,000	$30,000	$30,000	$30,000	$30,000	$30,000	$30,000	$ 1,290,000
2.4 Computer Aided Dispatch Integration	$950,000					$370,000	$230,000	$230,000	$230,000	$230,000												
Operations & Maintenace							$30,000	$70,000	$100,000	$130,000	$160,000	$160,000	$160,000	$160,000	$160,000	$160,000	$160,000	$160,000	$160,000	$160,000	$160,000	$ 760,000
2.5 Integration of Communications Channels	$510,000					$250,000	$170,000	$170,000	$170,000													
Operations & Maintenace							$160,000	$320,000	$480,000	$640,000	$640,000	$640,000	$640,000	$640,000	$640,000	$640,000	$640,000	$640,000	$640,000	$640,000	$640,000	$ 140,000
2.6 Incident Management Task Force/Team	$100,000	$70,000	$70,000																			
Operations & Maintenace			$60,000	$60,000	$60,000	$60,000	$60,000	$60,000	$60,000	$60,000	$60,000	$60,000	$60,000	$60,000	$60,000	$60,000	$60,000	$60,000	$60,000	$60,000	$60,000	
3.0 Transit Systems																						$ 80,000
3.1 Coordinated Transit District Operations	$60,000	$80,000				$20,000																
Operations & Maintenace			$20,000	$20,000	$20,000	$400,000	$240,000	$240,000														$ 880,000
3.2 Coordinated Transit Operations/Dispatch Centers	$650,000						$30,000	$50,000	$70,000	$70,000	$70,000	$70,000	$70,000	$70,000	$70,000	$70,000	$70,000	$70,000	$70,000	$70,000	$70,000	
Operations & Maintenace						$320,000	$300,000	$230,000														$ 850,000
3.3 Transit Information System	$640,000						$20,000	$50,000	$80,000	$80,000	$80,000	$80,000	$80,000	$80,000	$80,000	$80,000	$80,000	$80,000	$80,000	$80,000	$80,000	
Operations & Maintenace						$600,000	$640,000	$480,000			$330,000	$200,000	$200,000									$ 2,450,000
3.4 Transit Management System Completion/Expansion	$1,810,000						$50,000	$110,000	$160,000	$160,000	$160,000	$190,000	$210,000	$230,000	$230,000	$230,000	$230,000	$230,000	$230,000	$230,000	$230,000	
Operations & Maintenace						$660,000	$420,000	$420,000			$330,000											$ 1,830,000
3.5 Common Fare Equipment Deployment	$1,430,000						$40,000	$70,000	$100,000	$100,000	$100,000	$120,000	$120,000	$120,000	$120,000	$120,000	$120,000	$120,000	$120,000	$120,000	$120,000	
Operations & Maintenace																						$ 3,930,000
4.0 Transportation User Information Systems								$1,610,000	$1,260,000	$1,060,000												
4.1 Regional Transportation User Info. Systems	$3,050,000								$120,000	$210,000	$310,000	$310,000	$310,000	$310,000	$310,000	$310,000	$310,000	$310,000	$310,000	$310,000	$310,000	
Operations & Maintenace											$250,000											$ 250,000
4.2 Coordination with Valleywide/Statewide Info. Systems	$100,000										$40,000	$40,000	$40,000									
Operations & Maintenace																						$ 70,000
5.0 Regional ITS Config. Mgmt./Coord./Planning										$70,000												
5.1 Valleywide/Statewide Communications Linkages	$50,000									$20,000	$20,000	$20,000	$20,000	$20,000	$20,000	$20,000	$20,000	$20,000	$20,000	$20,000	$20,000	
Operations & Maintenace																						$ 280,000
5.2 Regional Configuration Management	$200,000	$50,000	$50,000	$30,000	$30,000	$30,000	$30,000	$30,000	$30,000													
Operations & Maintenace			$80,000	$80,000	$80,000	$80,000	$80,000	$80,000	$80,000	$80,000	$80,000	$80,000	$80,000	$80,000	$80,000	$80,000	$80,000	$80,000	$80,000	$80,000	$80,000	$ 580,000
5.3 Common/Standard Regional/County Map	$250,000			$330,000																		
Operations & Maintenace				$150,000	$150,000																	
TOTAL ESTIMATED UNCONSTRAINED EXPENDITURES																						$70,070,000
Capital Costs w/Est. Design & Contingencies by Year		$5,320,000	$3,850,000	$3,650,000	$4,840,000	$10,280,000	$7,690,000	$9,390,000	$7,420,000	$3,740,000	$2,740,000	$2,400,000	$1,790,000	$1,410,000	$2,710,000	$1,020,000	$710,000	$430,000	$430,000			
Operations & Maintenace Costs by Year			$530,000	$900,000	$1,420,000	$1,870,000	$2,450,000	$3,180,000	$4,070,000	$4,770,000	$5,220,000	$5,390,000	$5,560,000	$5,690,000	$5,810,000	$6,000,000	$6,010,000	$6,040,000	$6,080,000	$6,110,000	$6,110,000	

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Given the information provided in Figures 7-3 and 7-4 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 Fresno County 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
Program Area 1.0: Traffic/Freeway Management Systems					
1.1 Ramp Metering & Communications Gap Closure	•	•			
1.2 Multi-jurisdictional Interconnects	•	•		•	
1.3 Integrated Smart Corridors	•	•		•	
1.4 Railroad/Highway Interface Technologies		•			•
1.5 Communications Interties	•	•		•	
1.6 Integrated Surveillance Stations/Callbox Deployment		•		•	
1.7 Regional Intersection Safety Systems	•	•		•	
Program Area 2.0: Incident Management/Emergency Services					
2.1 Weather/ATMS Integration	•	•	•	•	
2.2 Variable Speed System	•	•		•	
2.3 Remote Surveillance & Incident Scene Mgmt.		•	•	•	
2.4 Computer Aided Dispatch Integration		•	•	•	
2.5 Integration of Communications Channels		•	•	•	
2.6 Incident Management Task Force/Team *	•	•			
Program Area 3.0: Transit Systems					
3.1 Coordinated Transit District Operations *	•	•			
3.2 Coordinated Transit Dispatch/Operations Centers *	•	•		•	
3.3 Transit Information System	•	•		•	•
3.4 Transit Management System Completion/Expansion	•	•	•	•	
3.5 Common Fare Equipment Deployment	•		•	•	
Program Area 4.0: Transportation User Information Systems					
4.1 Regional Transportation User Information System **		•	•	•	•
4.2 Valleywide/Statewide Transportation User Information System Connections **		•	•		•

TABLE 7.2
SUGGESTED PROCUREMENT OPTIONS

Projects	Engineer/ Contractor	System Manager	Sole Source	Design/ Builder	Public/ Private
Program Area 5.0: Regional ITS Configuration Management/Coordination/Planning					
5.1 Valleywide/Statewide Communications Linkages			•	•	
5.2 Regional Configuration Management		•			
5.3 Common/Standard Regional/County Map ***		•	•	•	•

Notes:
* Projects may not require any procurement process as efforts may be performed fully by agency staff. Some consulting/management support may be desirable.
** Traveler information efforts outside of the Region may drive the procurement process, and there is a strong potential that the procurement will involved multiple agencies/regions.
*** Project may be performed fully by agency staff.

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.

"Operations and Maintenance is a critical component of an ITS Plan to ensure that the system continues to provide benefits for years after implementation"

7.7.1 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 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.

Funding

The Fresno Region should develop a strategy to estimate and fund recurring costs related to operation and management by providing for these funds in the planning process. This strategy should be updated throughout the life of the system. Estimates should include recurring costs of communications systems and computer systems operations. In areas of rapid technology change that are subject to significant pricing variations, like communications, special attention should be directed to updating the technology of equipment.

Innovative funding sources should be explored within legal constraints. These potential funding sources could include:

- Public-private partnerships
- Resource sharing with public agencies both within and external to the organizational context of the O&M agency or agencies
- Revenue opportunities

System expansion plan costs should be developed and included in the system expansion plan. The system expansion plan should incorporate anticipated expansion of the system with respect to:

- Increased quantities of existing devices and services delivery components
- Extension of the system into additional geographic areas
- Added functionality and services
- Technology migration throughout the term of the system expansion plan

Any funding strategy should incorporate planned system and component replacements. This recommended practice related to replacement of existing components with products and services that deliver that same functionality as the deployed system. Driving forces in anticipating these "in-kind" replacements include the service life of the components, technology obsolescence, cost and availability of spares, and access to qualified operations and maintenance staffing resources. The impacts of acquisition, installation, activation, training, and operations of planned system and component replacements should be included in the strategy.

Management should consider the training requirements for all personnel when preparing plans and budgets. Personnel who require training regarding the system include the following:

- Those involved in the procurement phase responsible for reviewing and responding to potential suppliers and consultants
- Engineer, planners, and other agency personnel who will be users of the system (this includes emergency management, transit management, traffic management, and other ITS systems personnel)
- Technicians who will be responsible for operations

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.

The detailed design of each project should be specifically developed to support the operations needs and management practices identified for a particular system.

Generally, the design of each ITS project should:

- Follow generally accepted engineering practices
- Incorporate standards-based systems and components
- Involve everybody
- Follow a systems a engineering process

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 City of Fresno has followed this process admirably in developing their ATMS by preparing a Traffic Signal System Master plan and a ATMS Implementation Strategy. Other agencies in the County 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 Fresno 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 strongly recommended.

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 the existing Fresno ATMS functions into the 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 teams, incident response teams, and regional steering committees. 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 Fresno metropolitan region should be encouraged to share use of the wide area network infrastructure being implemented by the City 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 Fresno 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, District 6.

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 Fresno 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 7-5.

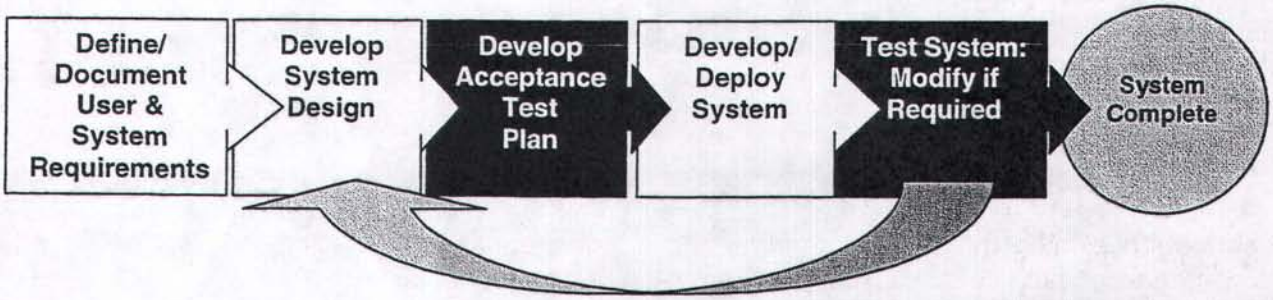

Figure 7-5
Acceptance Test Plans and the Overall System Deployment Process

- **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

Projects	Very Low	Low	Moderate	High	Very High
Program Area 1.0: Traffic/Freeway Management Systems					
1.1 Ramp Metering & Communications Gap Closure		•	•		
1.2 Multi-jurisdictional Interconnects	•	•	•	•	
1.3 Integrated Smart Corridors				•	•
1.4 Railroad/Highway Interface Technologies				•	•
1.5 Communications Interties		•	•		
1.6 Integrated Surveillance Stations/Callbox Deployment			•	•	
1.7 Regional Intersection Safety Systems				•	
Program Area 2.0: Incident Management/Emergency Services					
2.1 Weather/ATMS Integration			•	•	
2.2 Variable Speed System				•	•
2.3 Remote Surveillance & Incident Scene Mgmt.			•		
2.4 Computer Aided Dispatch Integration					•
2.5 Integration of Communications Channels			•	•	
2.6 Incident Management Task Force/Team	Not Applicable				
Program Area 3.0: Transit Systems					
3.1 Coordinated Transit District Operations	Not Applicable				
3.2 Coordinated Transit Dispatch/Operations Centers			•	•	
3.3 Transit Information System			•	•	
3.4 Transit Management System Completion/Expansion		•	•		
3.5 Common Fare Equipment Deployment			•		
Program Area 4.0: Transportation User Information Systems					
4.1 Regional Transportation User Information System			•		
4.2 Valleywide/Statewide Transportation User Information System Connections			•		

TABLE 7.3
SUGGESTED ACCEPTANCE TESTING LEVELS

Projects	Very Low	Low	Moderate	High	Very High
Program Area 5.0: Regional ITS Configuration Management/Coordination/Planning					
5.1 Valleywide/Statewide Communications Linkages			•		
5.2 Regional Configuration Management	Not Applicable				
5.3 Common/Standard Regional/County Map			•		

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 per 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 Fresno County Region held two special meetings 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 an Incident Management Task Force (see project 2.6) 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 Central California 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.

SECTION 8.0 FUNDING ELEMENT

8.1 PURPOSE OF THE FUNDING ELEMENT

The purpose of this Funding Element Section is to outline various funding opportunities and strategies for ITS deployment in the Fresno County Region. 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 Subcommittee 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 Fresno County Region take the more arduous path to obtain funds.

- **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 Fresno County Region, 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 it 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 Fresno County Region 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 the 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.

- **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 political and red-tape quagmires 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 COFCG 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:

- Fresno COG Member Agency Long-Range Transportation Planning (City, County, etc.)
- Fresno County Regional Transportation Plan (RTP)
- Future Federal Transportation Funding Legislation
- State of California's Statewide Transportation Plan
- California Transportation Commission (CTC) Annual Report to the Legislature
- Regional Transportation Improvement Program (TIP)
- State Transportation Improvement Program (STIP)
- Future Measure C Expenditure Plans

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 RTPs. Some regions simply include a special ITS section, while others have directly incorporated ITS into more traditional infrastructure projects.

The concept suggested for the Fresno County Region 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 Central 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 and the valley 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, District 6, 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 Fresno County Region, 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 COFCG, 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)

TABLE 8.1
LOCAL FUNDING SOURCES

Funding Source	Approximate Amount Available	Eligible Uses	Who Allocates	Other Comments
1. Measure C Program	$37.5 million annually	All multimodal transportation projects in the Region.	COFCG/Fresno 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. 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.	COFCG pass-thru to local agencies	

TABLE 8.3
STATE FUNDING SOURCES

Funding Source	Approximate Amount Available	Eligible Uses	Who Allocates	Other Comments
3.b. Article 4	N/A	Bus capital and operating costs for municipal operators, transit authorities, joint powers authorities.	COFCG pass-thru to local agencies	
3.c. Article 8	N/A	Transit and paratransit programs which fill unmet needs.	COFCG pass-thru to local agencies.	
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 COFCG.

TABLE 8.3
STATE FUNDING SOURCES

Funding Source	Approximate Amount Available	Eligible Uses	Who Allocates	Other Comments
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.

TABLE 8.4
FEDERAL FUNDING SOURCES (TEA-21)

Funding Source	Approximate Amount Available	Eligible Uses	Who Allocates	Other Comments
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.
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 (District 6)	District 6 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

TABLE 8.4
FEDERAL FUNDING SOURCES (TEA-21)

Funding Source	Approximate Amount Available	Eligible Uses	Who Allocates	Other Comments
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			
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	

TABLE 8.4
FEDERAL FUNDING SOURCES (TEA-21)

Funding Source	Approximate Amount Available	Eligible Uses	Who Allocates	Other Comments
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	

TABLE 8.5
SPECIFIC ITS FUNDING SOURCES IN TEA-21

Funding Source	Approximate Amount Available	Eligible Uses	Who Allocates	Other Comments
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.
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.

SECTION 9.0 PROGRAM MANAGEMENT

9.1 PURPOSE OF PROGRAM MANAGEMENT

This Section of the Fresno County ITS Strategic Deployment Plan provides suggested deployment guidelines, as well as ITS program procedures and policies to support the development of ITS in the Fresno County Region. There are three key actions which should be undertaken by the Region to promote successful ITS deployment:

- Appropriate components of the Fresno County Region ITS Strategic Deployment Plan should be incorporated into the regional transportation planning process and the 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.
- 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 Fresno County Region.

9.2 REGIONAL ADVANTAGES AND DISADVANTAGES

The Fresno County Region 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 Fresno Region 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 Fresno County 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 Fresno County Region 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
FRESNO COUNTY REGION ITS DEPLOYMENT ADVANTAGES AND DISADVANTAGES

Advantages	Disadvantages
➢ Transportation agencies in the Region have established a good basis for cooperation through past transportation efforts.	➢ Region is still relatively unfamiliar with many ITS concepts and additional promotion of ITS benefits may be necessary.
➢ Smaller size of the Region when compared with many areas simplifies communication and cooperation.	➢ Many agencies lack the staffing and resources to provide their own support for ITS deployment.
➢ Caltrans, City of Fresno, City of Clovis, and the County of Fresno have already begun deployment of some communications, traffic management, and signal system infrastructure.	➢ General public in the Region may be unfamiliar with the concept of ITS.
➢ Agencies have displayed a cooperative spirit in the development of the Strategic Deployment Plan, and recognize the need to work together.	➢ Some agencies may still view ITS as competition for traditional transportation projects as opposed to a complement to traditional projects.
➢ Projected growth in the Region should assist in promoting ITS applications.	➢ Relative to many of the larger urbanized areas of the State, the Region has a smaller funding pot available for transportation.

9.3 CONTINUED SPONSORSHIP OF THE ITS PROGRAM

Successful regional deployment of ITS in the Fresno area 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 Fresno County 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 Regional Strategic Deployment Plan. The Council of Fresno County Governments (COFCG), Caltrans District 6, 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 City of Fresno, County of Fresno, and City of Clovis 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.

- COFCG – In general, COFCG should be the keeper of the Fresno County ITS Strategic Deployment Plan and ensure that appropriate elements of the Plan are incorporated into the regional transportation planning process. COFCG should attempt to establish standards and supporting tools for cooperative deployments in the ITS area. COFCG should be a key player in the provision of ITS project/deployment champions. COFCG should take the lead in the regional promotion of ITS and in introducing political interests to the concept and benefits of ITS. COFCG 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, COFCG 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 should support and encourage agency staff to proactively champion ITS deployment efforts. Working with COFCG, Caltrans should promote and support cooperative deployment efforts and/or partnership opportunities among transportation stakeholders. The District 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.

- City of Fresno – The City of Fresno has played a prominent leadership role in the deployment of ITS within the City and between the Cities of Fresno, Clovis, and the County of Fresno. This leadership role should continue and be expanded if possible. The City of Fresno's efforts in the area of communications are important to Regional ITS deployment, and the City should assist in establishing regionwide communications standards. As the largest urban area in the Region, it is important that the City of Fresno participate in regional ITS activities. The City may also serve as an effective pool of potential project champions.

- City of Clovis – As the second largest urban area in the Region, the City of Clovis should play a role similar to that described for the City of Fresno. Due to its past ITS deployment efforts in the area of emergency vehicle signal preemption, the City of Clovis should work with other Cities in the Region to establish a common standard in this area. Together the Cities of Fresno and Clovis form the urban core of the Region, and these two jurisdictions should consider joint deployment of all significant transportation management system deployments.

- 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. Many of the smaller cities in the Region do not have the resources necessary for continuous involvement in ITS deployment. COFCG 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 Fresno County 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 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

Figure 9-1 describes the roles of a deployment champion. 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. COFCG 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.

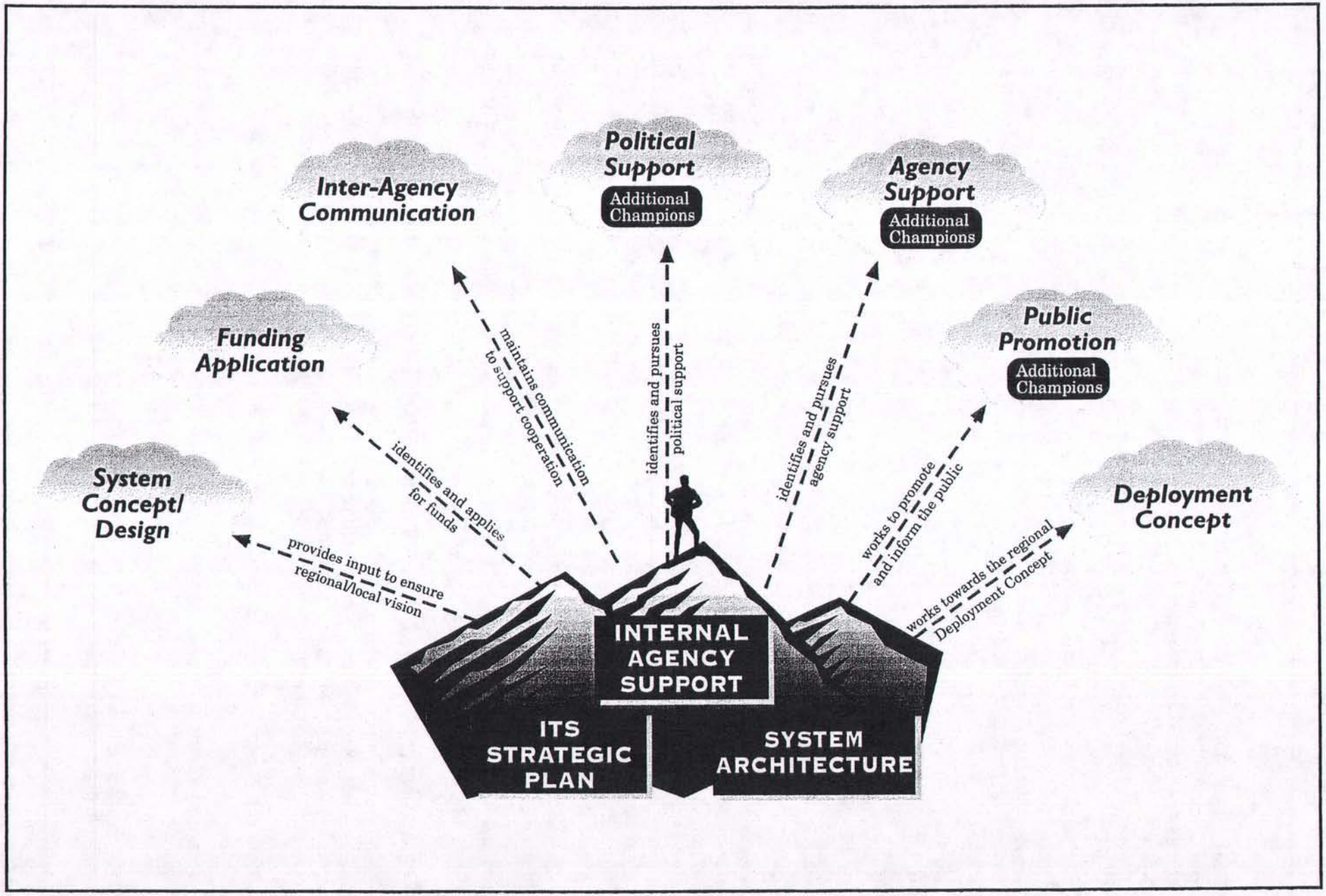

Figure 9-1
Roles for Deployment Champions

- **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 Fresno County 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. COFCG 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 Fresno County Region, 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.
- **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 9-2 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.
- **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 Fresno County 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 Fresno develops its systems in a manner compatible with statewide efforts, then much of the private sector investment in the statewide system may also benefit Fresno.
  - 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.

POLITICAL ARENA

Abilities/Skills:
- public promotion skills
- sensitivity to public demands
- funding connections
- strong source of valuable project support if convinced of project value
- decision promotion capability

Potential Barriers:
- lack of technical knowledge
- lack of time
- potential conflicting or more pressing political concerns

Promote Overall Public Benefits

AGENCY EXECUTIVE ARENA

Abilities/Skills:
- connections with political arena
- relationships with other agency executives
- decision making responsibility/ capability
- director of resources

Potential Barriers:
- lack of specific project/ technical knowledge
- lack of time
- potential conflicting or more pressing concerns

Promote Regional Benefits

PRIVATE MARKET ARENA

Abilities/Skills:
- market sensitivity
- production capabilities
- technical knowledge
- distribution capabilities

Potential Barriers:
- not always consistent with regional vision
- adverse to high risk opportunities
- requires clear path to market pay-off

Promote Market Opportunities

AGENCY STAFF ARENA

Abilities/Skills:
- technical skills/knowledge
- specific operations/systems knowledge
- detailed knowledge of problems/ issues
- ability to promote concepts
- coordination with other agency staff

Potential Barriers:
- lack of decision making authority
- conflicting responsibilities
- concerns over control

Promote Agency Benefits

Figure 9-2
Four Arenas of Deployment

- 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 Fresno County Region 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 9-3 displays the suggested institutional structure for ITS deployment in the Fresno County Region. 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 9-3 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.

➢ **Council of Fresno County Governments (COFCG) Board**

Status: Already established

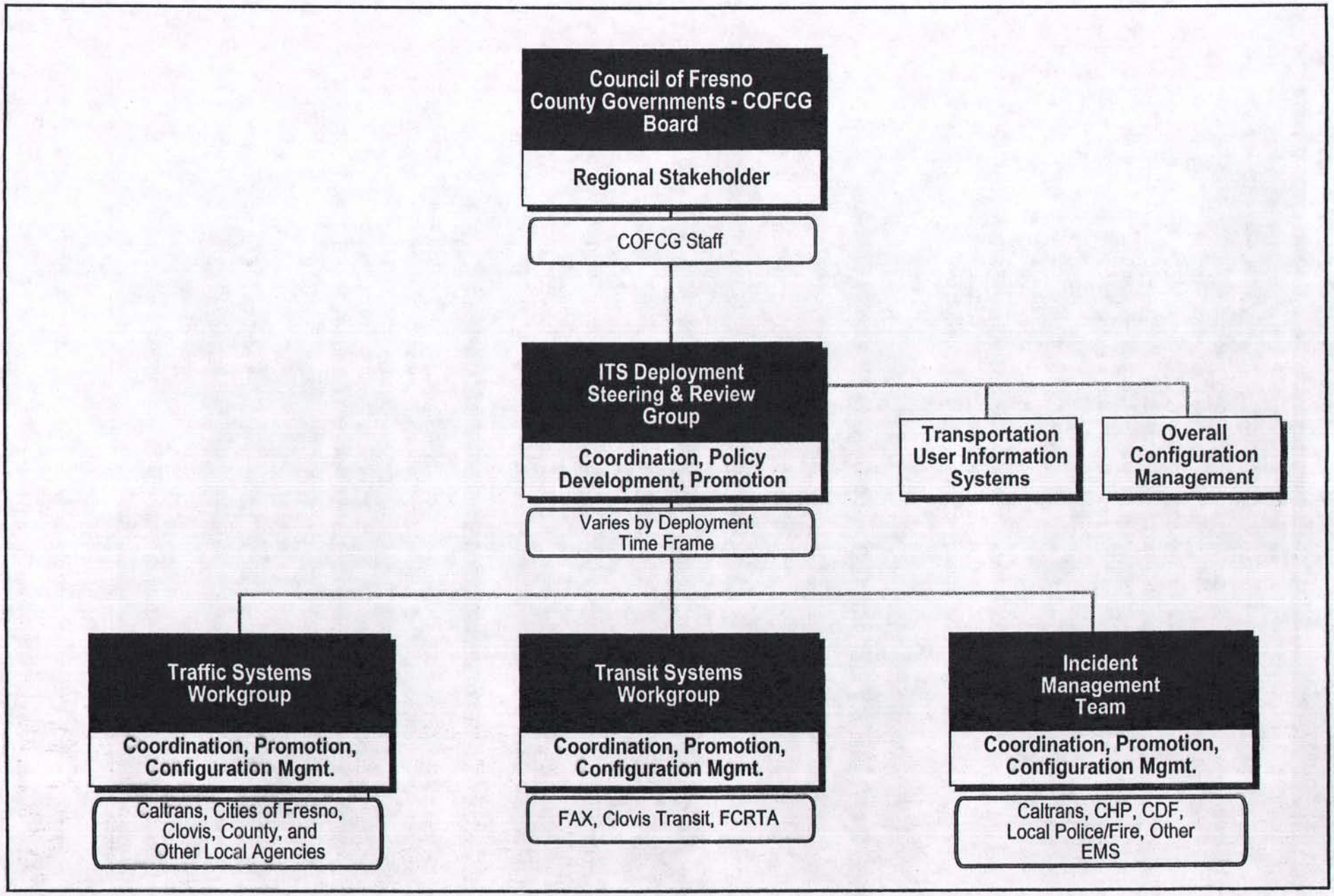

Figure 9-3
Suggested Institutional Structure for Fresno Region ITS Deployment Coordination

Role: The COFCG Board 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, COFCG 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: COFCG Board Members

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: Not applicable.

- **Fresno County Region ITS Deployment Steering & Review Group**

Status: This Group is already established as the Fresno County ITS Subcommittee, 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 COFCG 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 Incident Management Team. Each of these workgroups should occasionally report their activities back to the ITS Deployment Steering and Review Group. 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 Transportation User Information Systems, the Steering and Review Group should oversee this deployment area.

Participants: Same as existing ITS Subcommittee, 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:

- COFCG
- Cities of Fresno, Clovis, and County of Fresno
- Caltrans
- Transit agencies and/or representatives from the Transit Systems Workgroup
- Emergency service agencies and/or representatives from the Incident Management Team.

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 Steering and Review Group 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 City of Fresno, City of Clovis, and County of Fresno 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: City of Fresno, Caltrans, City of Clovis, County of Fresno, and other local agencies as appropriate.

Objectives:

- Promote the deployment of regional traffic system projects to the ITS Steering and Review Group, COFCG Board, 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 better 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 deployment in the Region is FAX's Transit Management System. 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 by FAX and American Ambulance, as well as GIS efforts by Fresno County, 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 Steering and Review Group. The Workgroup should also review and promote opportunities to provide improved real-time transit information to patrons throughout the Region.

  Participants: FAX, Clovis Transit, FCRTA.

  Objectives:

  - Promote the deployment of transit system projects to the ITS Steering and Review Group, COFCG 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.

- **Incident Management Team/Task Force**

  Status: Two meetings of regional incident management stakeholders were held as a part of the Strategic Deployment Planning effort. The second meeting comprised a two-day workshop on regional incident management issues and needs. This workshop was considered very successful in terms of initiating the concept of enhanced interagency communications and cooperation in the area of incident management.

  Role: More so than the other two Workgroups, the Incident Management Team must address both operations and systems deployment considerations. The Incident Management Team should work to promote inter-agency training, development of incident response guidelines for multiple agencies, clarification of on-scene responsibilities at incidents, and inter-agency procurement and operation of improved incident management and communications resources. A key issue identified by participants in the development of SDP is the need for a common mapping/coordinate system for emergency services in the Region. The Team should work with County of Fresno GIS staff and COFCG to improve the available maps and mapping systems. The Team should elect a Chairperson that will be responsible for coordinating meetings and occasionally reporting to the ITS Deployment Steering and Review Group. Incident management issues are discussed in greater detail in Section 7.0 of this Plan.

  Participants: CHP, Caltrans, CDF, Local Police, Local Fire, Sheriff, County EMS, Ambulance services, other emergency management services and agencies.

  Objectives:

  - Promote the deployment of incident management projects and training efforts to the ITS Steering and Review Group, COFCG Board, City Councils, and other appropriate entities.
  - Work to establish guidelines and a plan for enhanced cooperation and coordination between emergency services when and where multi-agency situations are likely to occur.
  - Promote interagency cooperation and communication.
  - Track incident related factors and statistics for the Region including: number of incidents, location of incidents, durations, clearance times, as well as problems encountered and successful methods for resolving those problems.
  - Improve incident management systems through cooperative programming and deployment efforts.
  - Receive input from and provide suggestions to deployment champions and project managers responsible for deploying incident management systems.
  - Provide a knowledge pool for incident management issues and systems for the Region including funding opportunities, specifications, new technologies, accepted standards, operating policies, and system capabilities.

  Frequency/Lifespan: The Incident Management Team has gained some momentum through the SDP and Incident Management Workshop efforts. This momentum should be maintained, and the Team should begin meeting to better define and resolve outstanding issues. Monthly meetings may be reasonable, and the Team should endeavor to establish interagency incident management training sessions.

9.5.2 SUGGESTED PROCEDURES AND POLICIES

There are a few suggested procedures and policies that should be considered by the Fresno County 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 - COFCG 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 – COFCG, 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 – COFCG should consider updating Sections 6.0, 7.0, and 9.0 of the SDP approximately once every two years. 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 COFCG.

Suggested Policies

The following suggested policies should be considered for adoption by agencies in the Fresno County Region to promote and support effective ITS deployment:

- Agencies in the Fresno County Region 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 transportation user 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 9-4 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 9.0 of this Plan, however a brief summary is provided as follows:

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.
- Fresno County 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 Fresno County 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.

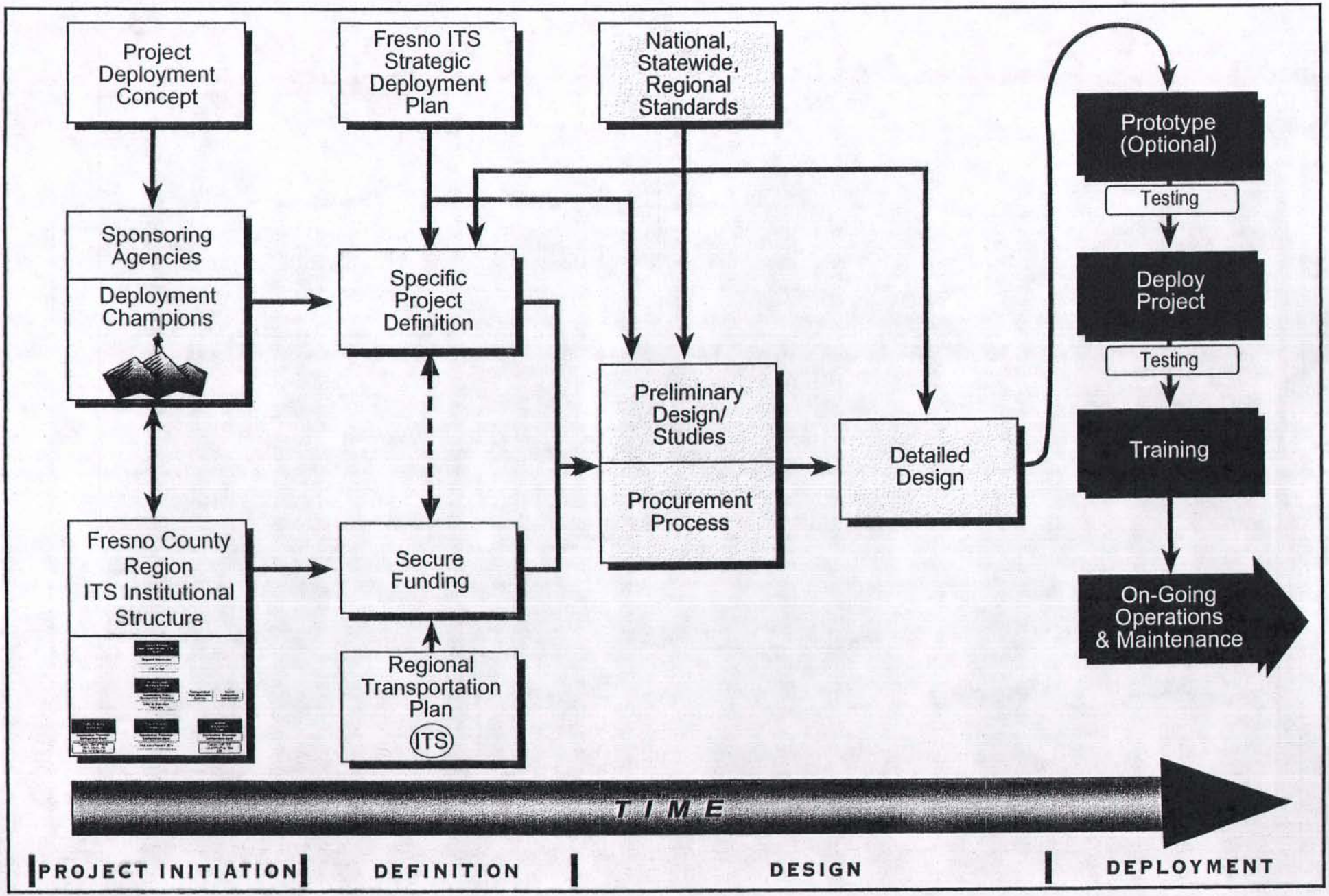

Figure 9-4
Moving Forward with Deployment of ITS Projects

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 Fresno County Region 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.

Fresno County ITS
Strategic Deployment Plan