Prepared for:

Fresno Council of Governments

November 2015

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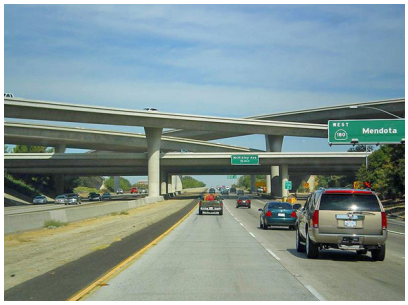
Fresno County
Intelligent Transportation System
Strategic Deployment Plan



FRESNO COUNTY INTELLIGENT TRANSPORTATION SYSTEMS (ITS) PLAN UPDATE

DELIVERABLE NO. 12

REGIONAL ITS ARCHITECTURE AND STRATEGIC DEPLOYMENT PLAN

FRESNO COUNTY, CALIFORNIA

Prepared for

Fresno Council of Governments
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November, 2015

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1.0 INTRODUCTION

The Fresno County Intelligent Transportation Systems (ITS) Plan update is a critical component of a coherent plan to address the transportation needs of the Fresno County Region. As travel demand on the freeway and arterial system increases, there is an increasing need to improve the surface transportation system through better management of existing capacity, rather than continuing to add capacity to the existing system. In recognition of this, the Fresno Council of Governments (FCOG) and the various local communities in the county continue to invest in ITS. This updated ITS Plan ensures that these investments address the important needs in the county and bring the maximum benefit to travelers, while developing an implementation plan for the county. The updated ITS Plan also reflects the changes in technology since the 1999 ITS Plan was completed.

1.1 PROJECT BACKGROUND

A comprehensive ITS Strategic Deployment Plan (SDP) was developed for Fresno County in 1999, led by the Fresno Council of Governments, which was then known as the Council of Fresno County Governments (COFCG). The SDP was developed in consultation with local Fresno County agencies, and reflected the input and priorities of the local agencies. Subsequent to the development of the 1999 ITS SDP, an ITS SDP was developed for the eight counties of the San Joaquin Valley: Fresno, Kern, Kings, Madera, Merced, San Joaquin, Stanislaus, and Tulare. Because of the short time between completion of the 1999 Fresno County Plan and the 2001 San Joaquin Valley Plan, these two documents are consistent with one another with regards to Fresno County inputs, needs, and plans.

While certain elements of the 1999 ITS Plan have been updated over time as necessary, a comprehensive update of the countywide Plan has not been completed since 1999. In the interim, Fresno Metropolitan area agencies have made significant investments in the planning, design, and implementation of ITS for the surface transportation network and transit systems. There is an expectation, documented in the 1999 Fresno ITS Strategic Plan and Architecture that investment in ITS strategies will continue with a focus at the local level. At the same time, it's important that investments be made in reliable technologies that deliver proven benefit in a cost effective manner. Toward this end, Fresno COG has led this countywide ITS Master Plan Update to guide ITS investments throughout the Fresno County Region over the next ten years and beyond.

The most current Regional Transportation Plan (RTP) for the Fresno County Region was adopted by Fresno COG in 2014. The updated RTP includes an updated project list for implementation using local and federal funding. ITS strategies, particularly those related to operational improvements to the arterial street system, and to enhancing transit service are important elements of the RTP and provide improvements that lend to the Sustainable Community Strategies (SCS). Updating the ITS Plan at this time provides an opportunity to maintain consistency among the ITS Plan, the RTP and the SCS.

1.2 ITS PLANNING PROCESS

The ITS planning process is much like any other transportation planning activity, with the primary difference being the focus on technological solutions. One of the primary areas of

emphasis of ITS planning is the extensive involvement and participation by the stakeholders of the region. This is especially important to ensure interagency systems integration, address potential institutional issues early, and to provide the necessary education and awareness of advanced technology transportation solutions.

Using the federal ITS planning process as a guideline, the overall approach to development of this ITS Plan update included performance of the following tasks, and development of accompanying deliverables:

- Task 1:Project Initiation
    - Deliverable 1: Project Plan
- Task 2:Data Gathering
    - Deliverable 2: Existing Data Report
- Task 3: Assessment of the 1999 ITS Strategic Plan
    - Deliverable 3: Assessment of the 1999 Fresno County ITS Strategic Deployment Plan
- Task 4: Update Regional ITS Inventories
    - Deliverable 4: System Inventory Summary Report
- Task 5: Stakeholder Consultation/Identify ITS Needs, Vision, Goals, and Objectives
    - Deliverable 5: Visions, Goals, Objectives and Needs Technical Report
- Task 6: Develop Key Regional ITS Strategies
    - Deliverable 6: Regional ITS Strategies Report
- Task 7: Determine Specific Needs, ITS Service Packages and Elements Based on Strategies
    - Deliverable 7: Regional Consolidated Needs Assessment Summary Technical Report
- Task 8: Define Operational Roles and Responsibilities Consistent with Regional Vision, Goals, Objectives, and Strategies
    - Deliverable 8: Regional ITS Operational Roles and Responsibilities Technical Report
- Task 9: Determine the Functional Requirements
    - Deliverable 9: Regional ITS Functional Requirements Technical Report
- Task 10: Prepare Regional ITS Architecture
    - Deliverable 10: Electronic Copy of the Turbo Architecture Database
- Task 11: Develop an Architecture Use Plan
    - Deliverable 11: Architecture Use and Maintenance Plan

- Task 12: Develop Regional Strategic Deployment Plan
    - Deliverable 12: Fresno County ITS Strategic Deployment Plan
- Task 13: ITS Website for Regional Stakeholders
    - Deliverable 13: Material for ITS Webpages
- Task 14: Presentations
    - Deliverable 14: PowerPoint Presentations

1.3 RELATIONSHIP TO 1999 FRESNO COUNTY ITS PLAN

As noted in Section 1.1, an ITS Strategic Deployment Plan (SDP) was completed for Fresno County in 1999. That Plan was comprehensive, in terms of both needs assessment and the development of recommendations. For this Plan update, the 1999 ITS Plan was reviewed and assessed. Fresno County ITS stakeholder agencies were contacted to discuss and document successes and lessons learned coming out of the 1999 ITS Plan. This assessment provided some insight and guidance in the project process when considering project and program prioritization, which was also be influenced to varying degrees by the changes in technology since 1999. The assessment provided a look back at prior ITS planning and implementation efforts and lessons learned from those efforts while moving forward with this most current ITS planning and implementation effort.

1.4 PURPOSE OF THE STRATEGIC DEPLOYMENT PLAN

The purpose of the Strategic Deployment Plan is to consolidate the pertinent Fresno County ITS Plan Update-related interim deliverables, as well as other project prioritization-related information, into one cohesive report that documents the process, technical work, and results of the Fresno County ITS Strategic Deployment Plan and ITS Architecture Development. The Strategic Deployment Plan and its appendices contain the required elements of a regional ITS architecture as outlined in the Regional ITS Architecture Guidance Document, dated July 2006. This Strategic Deployment Plan also contains other ITS related material that may be of interest and helpful to Fresno County ITS Stakeholders that are planning and deploying ITS.

1.5 HIGH-LEVEL ARCHITECTURE AND STRATEGIC DEPLOYMENT PLAN DEVELOPMENT SUMMARY

This project developed the Fresno County Regional ITS Architecture, as required by the Final Rule / Policy on ITS Architecture and Standards Conformity for federally funded Intelligent Transportation Systems projects. Initial project activities focused on development of a comprehensive list of project stakeholders that would be invited to participate in the project. Concurrent with development of the project stakeholder list was the development of an outreach plan that would guide the strategies to be used to communicate with, and encourage input from, the project stakeholders.

Then, activities turned to the development of a transportation systems inventory and the categorization of ITS elements in Fresno County as existing or planned for implementation. Each of the ITS elements was mapped to an entity within the Physical Architecture of the National ITS Architecture.

A needs assessment and several conversations with project stakeholders (both in group settings and one-on-one) led to the development of interagency operational concepts that describe agency roles and responsibilities in providing ITS services to the region.

In doing this, the stage was set for characterizing the current and planned level of interconnectivity between the ITS elements. For each ITS element, there is an expected set of interconnections with other ITS elements in the region, based upon what the National ITS Architecture suggests as typical within its standardized common framework. These results were then customized to ensure that the local / regional setting is properly reflected in the regional ITS architecture. Beyond the connections, a high-level set of functional requirements is provided for each ITS element in the region (except Terminators).

The entire process was performed with the advice and consent of the key stakeholders in the region. Once the interconnections were determined, a second analysis went to a level deeper in detail and determined what type of information does, or will, flow through the connections between each pair of ITS elements. This served to organize the current state and future states of ITS using a standardized framework and nomenclature.

The next step included working with the agencies and the architecture documentation to develop a list of ITS projects that would “build-out” the regional ITS architecture. This list of ITS projects was confirmed by the project stakeholders to establish the basis of the ITS Plan. These projects were sequenced according to a scenario based on previously identified needs and / or logical dependencies. With these understandings of how ITS will work when services are provided by multiple agencies, a list of suggested agency agreements that may be necessary to “build-out” the regional ITS architecture was then developed.

An overall methodology for updating and maintaining the regional ITS architecture was developed so that the project stakeholders can maintain integrity with the regional ITS architecture. An approach showing how new projects are compared to the current architecture and how modifications and updates will be introduced in the future was documented.

2.0 REGIONAL ARCHITECTURE TIMEFRAME AND LOCALE

The process of developing a regional ITS architecture for Fresno County began with a focus on the project stakeholders, architecture timeframe and architecture locale:

1. Stakeholders are the core set of agencies with transportation-related oversight, responsibility, and / or duties in the Fresno County Region.

2. Timeframe refers to the planning horizon that the regional ITS architecture will address.

3. Locale refers to the geographic area covered by the ITS architecture and describes the region.

The following subsections discuss the architecture timeframe and a description of the Fresno County Region, as it pertains to this project.

2.1 TIMEFRAME

The regional ITS architecture should project far enough into the future that it serves its primary purpose of guiding the efficient integration of ITS systems over time. While there is no required minimum, the Fresno County Region timeframe was established based on how the regional ITS architecture will be used moving forward. Making the timeframe too short reduces the value of the regional ITS architecture as a planning tool. Making the timeframe too long increases the effort involved since very long range forecasts are difficult to make and subject to reevaluation.

While a rough 5-, 10-, or 20-year approximation of the timeframe is enough to begin the process, the initial timeframe selected for the Fresno County ITS Architecture is twenty years. A twenty-year horizon is long enough to include most of the system integration opportunities that can be clearly anticipated by the region's Stakeholders. This timeframe is also sufficient to support Transportation Improvement Program (TIP) generation and guide project implementation. It also matches the timeframe set for the San Joaquin Valley ITS SDP.

This initial timeframe can be reevaluated and possibly even modified as the regional ITS architecture matures. As the architecture evolves, the timeframe is normally a secondary consideration when determining whether to include a particular system or interface. It is usually best to include the interfaces that are clearly supported by the Stakeholders, even if these consensus interfaces push the envelope of the timeframe beyond what was initially anticipated. In other words, the timeframe is flexible and can be adjusted as necessary to match the vision of the Stakeholders. It is not used to precisely constrain the Stakeholders to near-term options since it is difficult to anticipate exactly when a well-supported idea will be implemented. Viable integration opportunities will be included in the regional ITS architecture and then reevaluated periodically as the architecture is maintained over time.

2.2 REGIONAL ITS ARCHITECTURE SERVICE SCOPE

The previous ITS plan and architecture for Fresno County were completed in 1999 as part of the Fresno County ITS Strategic Deployment Plan (SDP) development. While elements of the original SDP may be reflected in this ITS plan and architecture, because they are still relevant, a majority of the ITS architecture is new based on existing and planned infrastructure and systems in the Fresno County Region. This Regional ITS Architecture was completed in conjunction with the update to the Fresno County ITS Strategic Deployment Plan in 2015, and is consistent with the list of future projects anticipated for stakeholder implementation within the Fresno County Region. This updated ITS plan and architecture captures all known existing and planned ITS services within the Fresno County Region. This ITS plan and architecture acknowledges adjoining and overlapping ITS architectures, but does not incorporate them into this architecture.

2.3 LOCALE

The study area for the Fresno County ITS Strategic Deployment Plan (SDP) is defined by the boundaries of Fresno County as shown in **Figure 2-1**. Fresno County is located in California's Central Valley and is the second largest county in the San Joaquin Valley. There are 15 cities in Fresno County: Clovis, Coalinga, Firebaugh, Fowler, Fresno, Huron, Kerman, Kingsburg, Mendota, Orange Cove, Parlier, Reedley, San Joaquin, Sanger, and Selma.

Figure 2-2 is a countywide map that shows the Regionally Significant Roads for the rural portions of the county. **Figure 2-3** Regionally Significant Roads, for the urban portion of the county.

Figure 2-1: Map of the Region

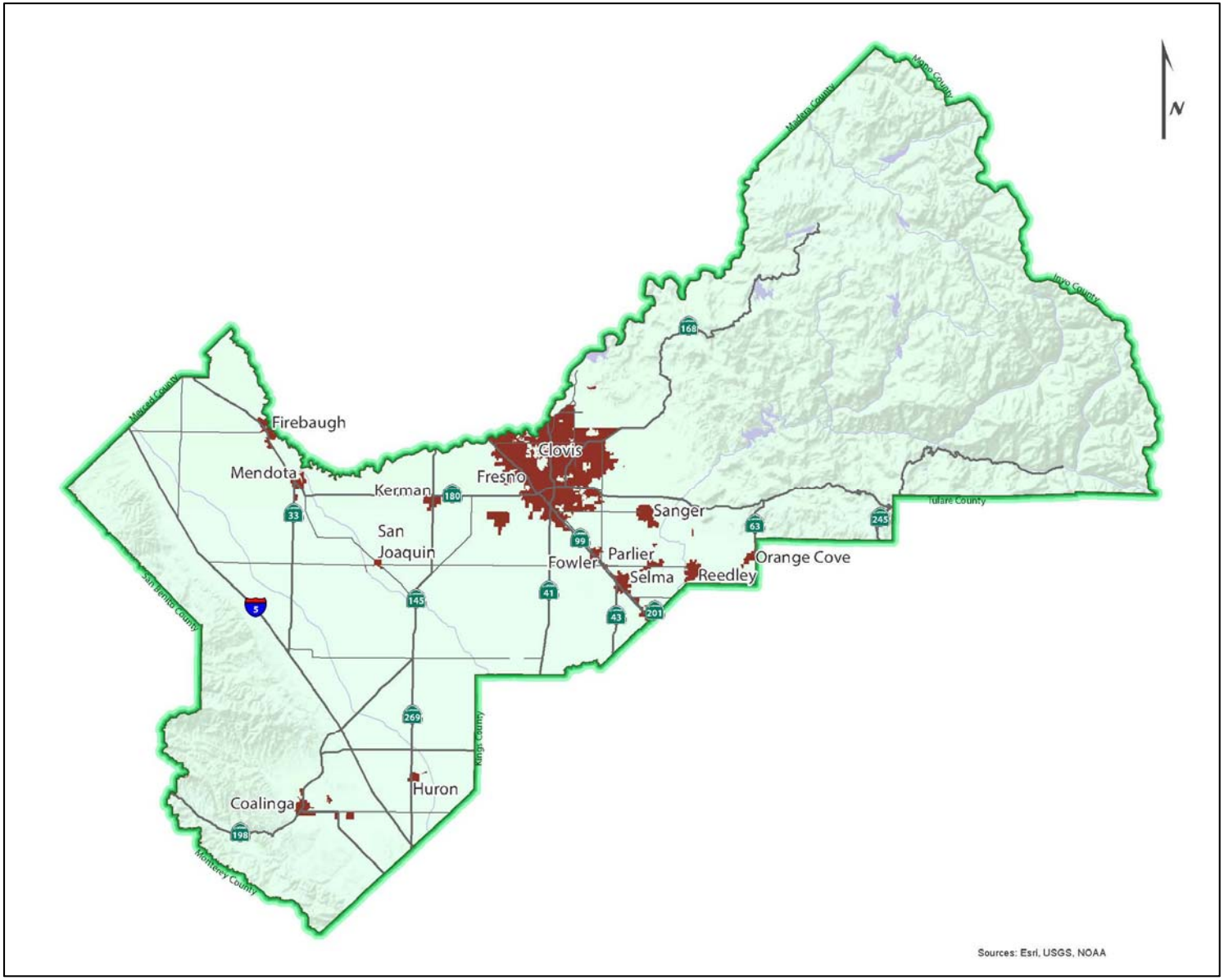


Figure 2-2: Regionally Significant Roads (Rural)

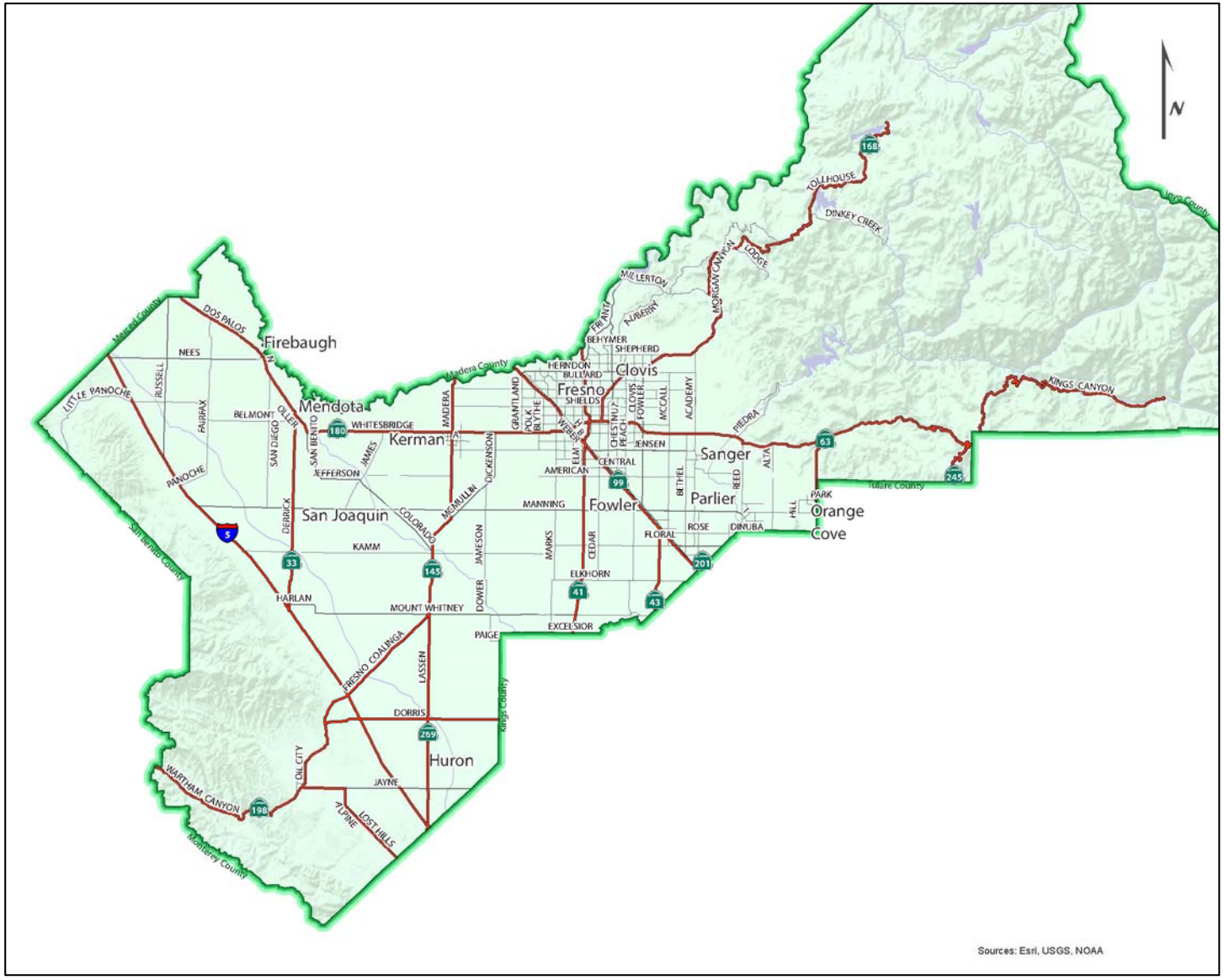


Figure 2-3: Regionally Significant Roads (Urban)

2.3.1 Population

The population of Fresno County is approximately 964,040. The two largest cities are Fresno (population 515,609) and Clovis (population 102,188). Together, Fresno and Clovis make up the Fresno-Clovis Metropolitan Area (FCMA), a federally recognized urbanized area. **Table 2-1** presents the population details of Fresno County.

Table 2-1: Fresno County Population

City	1999 SDP Population	Current Population
Clovis	66,500	102,188
Coalinga	10,300	16,467
Firebaugh	6,000	7,809
Fowler	3,800	5,883
Fresno	407,000	515,609
Huron	5,600	6,843
Kerman	7,000	14,339
Kingsburg	8,700	11,685
Mendota	7,500	11,225
Orange Cove	7,800	9,410
Parlier	10,400	15,019
Reedley	19,600	25,122
San Joaquin	3,000	4,056
Sanger	18,600	24,908
Selma	17,700	23,977
Unincorporated County	Not reported	169,500
Total Fresno County	Not reported	964,040

Source: State of California, Department of Finance, released April 30, 2014

Per the Fresno County 2014 Regional Transportation Plan and Sustainable Communities Strategy (RTP), the countywide population is projected to grow to over 1.3 million by the year 2040. The number of housing units provided is projected to be over 450,000 with employment projections at just under 450,000.

2.3.1 Regional Area

On the western edge of Fresno County lies the Coastal Range and the Sierra Nevada Range provides the eastern boundary. Fresno is bordered by eight counties: Kings, Tulare, Inyo, Mono, Madera, Merced, San Benito, and Monterey.

2.3.2 Regional Recreation Areas

Several recreation destinations are located in or adjacent to Fresno County. These areas attract travelers from within the County and also from around the state, country, and world. These areas include:

- Yosemite National Park
- Kings Canyon National Park

- Sequoia National Park
- Sequoia National Forest
- Sierra National Forest
- John Muir Wilderness Area
- Millerton Lake Recreation Area
- San Joaquin River
- Kings River
- Shaver Lake
- Huntington Lake and Kaiser Wilderness Area
- Pine Flat Reservoir
- Mendota Wildlife Area

The largest attractor of these is Yosemite National Park, which receives approximately 275 million visitors per year. This equates to approximately 2,600 and 4,000 vehicles per day outside of Yosemite Valley and between 4,500 and nearly 6,000 vehicles per day within the Valley in the peak summer season. The primary route to Yosemite National Park is from SR-41, which runs north from Fresno County and the City of Fresno.

The Yosemite Area Regional Transportation Strategy report was prepared in 2011 to address transportation issues in the area. Goals in this report include managing access, providing efficient services in the area within the existing footprint, and altering the capacity of the transportation system including parking.

3.0 PROJECT STAKEHOLDERS AND OUTREACH

3.1 FRESNO COUNTY REGION ITS STAKEHOLDERS

The success of a regional ITS architecture update depends on participation by a diverse set of regional Stakeholders. **Table 3-1** lists the agencies/organizations of approximately 54 key stakeholders that have been engaged to provide input for the Fresno ITS Plan Update. Input from the Stakeholders as well as others, was instrumental in the development of the information presented in the final Strategic Deployment Plan. These stakeholders were utilized to assist with development of the regional ITS architecture. The stakeholder list was updated periodically throughout the life of the Strategic Deployment Plan development.

Table 3-1: Fresno County ITS Plan Update Stakeholder List

American Ambulance	City of Mendota
California Highway Control (CHP)	City of Mendota Police Department
Federal Highway Administration	City of Orange Cove
Caltrans District 6	City of Orange Cove Fire Department
Caltrans Headquarters	City of Orange Cove Police Department
City of Clovis	City of Parlier
City of Clovis Fire Department	City of Parlier Police Department
City of Clovis Police Department	City of Reedley
City of Coalinga	City of Reedley Fire Department
City of Coalinga Fire Department	City of Reedley Police Department
City of Coalinga Police Department	City of San Joaquin
City of Firebaugh	City of Sanger
City of Firebaugh Fire Department	City of Selma
City of Firebaugh Police Department	City of Selma Fire Department
City of Fowler	City of Selma Police Department
City of Fowler Fire Department	Federal Highway Administration California Division
City of Fowler Police Department	Fresno Area Express (FAX)
City of Fresno	Fresno Council of Governments (Fresno COG)
City of Fresno Department of Airports	Fresno County
City of Fresno Fire Department	Fresno County Fire Department
City of Fresno Police Department	Fresno County Office of Emergency Services
City of Huron	Fresno County Rural Transit Agency
City of Huron Fire Department	Fresno County Sheriff's Office
City of Huron Police Department	Fresno County Transportation Authority
City of Kerman	Fresno Cycling Club
City of Kerman Fire Department	Kern Council of Governments (Kern COG)
City of Kingsburg	Mid Valley Fire Protection District (Mendota)
City of Kingsburg Fire Department	North Central Fire Protection District (Kerman)
City of Kingsburg Police Department	

Appendix A is a listing of the Fresno County Regional ITS Architecture stakeholders as they are represented in the Turbo Architecture database. It should be noted that not every one of the stakeholders identified in the table above are explicitly identified in the Turbo Architecture database. Some stakeholders are incorporated into one or more generic stakeholder names in order to maintain a certain level of simplicity in the Turbo Architecture database. For example, the smaller cities outside of the Fresno-Clovis Metropolitan area that do not own or operate ITS, and largely have no concrete plans to own or operate ITS have been incorporated into a generic stakeholder called, "Local Jurisdictions."

3.2 STAKEHOLDER OUTREACH AND ENGAGEMENT

This section summarizes the outreach plan and methods utilized for stakeholder engagement for the Fresno County ITS Plan Update. Eight large group Stakeholder meetings were conducted as part of the project, along with various in-person or over the phone contacts for the purposes of data gathering.

3.2.1 Outreach Plan

The mission of the Outreach Plan was to support the collaboration efforts of regional stakeholders in order to develop a comprehensive master plan for ITS in Fresno County. The involvement of stakeholders at various levels is typically a critical component of achieving the ITS vision for the region. The objective of outreach and education is to establish a process to collaborate with core stakeholders, consult and gain input from interested stakeholders, and provide information to the general public. This approach to outreach and education is summarized in **Table 3-2** below.

Table 3-2: High-level Outreach Approach

Stakeholder Groups	Levels of Involvement	Outreach Methods
Agency Stakeholders • Interdepartmental groups within Fresno COG • Caltrans • Other impacted urban and rural public agencies that own or operate surface transportation facilities or assets (cities, county, transit operators, etc.) • Public agencies in nearby regions • Groups or institutions impacted by or involved in the operation of surface transportation facilities	<u>Inform and Consult</u> • Explain the project and gain input regarding inventories, needs, and any related issues <u>Collaborate</u> • Work jointly to share information and reach consensus on key aspects of the project	Project Stakeholder Meetings Project Website Interviews Surveys

3.2.2 Outreach Methods

The following activities convey the toolset utilized by the Consultant Team to accomplish stakeholder outreach:

- Compile Stakeholder List.
- Develop and distribute survey forms to stakeholders.
- Conduct Project Stakeholder Workshops (8 planned).
- Attend local and regional meetings (as appropriate).
- Distribute, collect, and compile Inventory Surveys.
- Conduct one-on-one contacts (as required).
- Develop project identity and logo.
- Provide material for a Project Web Site, for dissemination of project background information, announcements, meeting materials, and deliverables.
- Send out email alerts (as needed).

4.0 ITS INVENTORY

The purpose of gathering an ITS Inventory is to document and summarize the existing and planned ITS elements in the Region. This is a required element of a Regional ITS Architecture. As defined in the FHWA Rule, and for purposes of this report, an ITS inventory is a list of ITS elements and the other elements that interface with them. In association with the ITS inventory, it is important to identify the ITS owners and/or operators, the presence of operation centers, and the connections between various system elements and externally to other systems. Identifying technological aspects of the ITS inventory is not necessary; rather, assessing the function and capabilities of the various systems is vital. The total number of various ITS elements (such as traffic signals, CCTV cameras, busses with automatic vehicle locators, etc.) that exist, and the location of all these elements, is not critical with respect to developing a Regional ITS Architecture.

4.1 INVENTORY COLLECTION METHODOLOGY

The methodology used to compile an ITS inventory for the Fresno County Region consisted of distributing a survey to appropriate Stakeholders, making phone calls, conducting a workshop, and reviewing documents that provided additional information concerning existing ITS elements in the region. The survey used to develop the ITS inventory for the Fresno County Region was sent to Caltrans, the cities of Fresno and Clovis, and Fresno County. Modified versions (created by removing irrelevant portions of the general survey) were sent to the rural cities outside the Fresno-Clovis Metropolitan Area and Transit Agencies. Telephone calls were made approximately one to two weeks after sending out the survey in order to supplement the information obtained from the survey. In addition, document research provided in the Data Report (Deliverable 2) and the findings from the 1999 Fresno COG SDP were used as information sources.

4.2 FRESNO COUNTY REGION ITS INVENTORY

Appendix B contains the Fresno County Region ITS Inventory, as it is represented in the Turbo Architecture database for the Fresno County Regional ITS Architecture. The Inventory is shown sorted by the Stakeholder Agencies and their ITS elements. The following subsections provide a narrative overview of the major ITS inventory elements in the Fresno County Region.

4.2.1 Regional Systems

The State of California (i.e. Caltrans and the California Highway Patrol (CHP)) is the primary owner/operator of regional intelligent transportation systems (ITS) within the Fresno County Region; however, the City of Fresno Public Works, the City of Fresno Public Transportation, and the Fresno County Rural Transit Agency (FCRTA) are also involved with some regional systems.

The California Department of Transportation (Caltrans District 6) and the California Highway Patrol (CHP) opened the Central Valley Transportation Management Center (CVTMC) in December 1992. This center is a joint operation between the two agencies, with the goal of reducing traffic congestion, improving motorists' safety, and conserving fuel on state highways

in Fresno and other counties in District 6. The CVTMC gathers information on state highways in the five counties that make up District 6.

Caltrans workers, CHP officers, and motorists provide first-hand information on traffic in the area. This information supplements data collected from electronic equipment deployed in the field, such as in-pavement inductive loop detectors, in-pavement magnetic sensors, and microwave vehicle detection systems. When an incident is detected a team of highway workers and public safety first-responders is sent to aid in the resolution of the incident by removing hazards from the roadway, and/or placing appropriate signage to inform motorists of the adverse conditions ahead. The CVTMC also uses closed-circuit television (CCTV) cameras to monitor highway incidents. This technology helps speed up the response time to incidents, and helps staff determine what equipment and personnel are needed at the incident scene.

Other technology in use in District 6 includes changeable message signs, radio transmitters, and road weather stations. Weather stations are used to monitor environmental conditions. The stations have sensors that measure highway visibility, wind speed and direction, humidity levels, precipitation, and moisture on the pavement. One application of this technology is the Fog Detection and Warning System, which detects dangerous fog conditions, during which travelers are warned of conditions via changeable message signs. This 13 mile pilot project is located on SR 99 between the cities of Fowler and Kingsburg. Travel information is also provided to motorists through the changeable message signs, television broadcasts, and through strategically placed Highway Radio Advisory (HAR) systems. Signs are posted along the roads notifying motorists to tune their radio to specific broadcast channels to receive information. In addition, daily television broadcasts are conducted from the CVTMC to local cable carriers and broadcast radio and TV stations to provide current peak period traffic conditions.

4.2.2 Fresno-Clovis Metropolitan Area

Within the Fresno-Clovis Metropolitan Area, traffic congestion has been noted along SR 180 and SR 41. In general, recurring traffic congestion is considered a general problem on urban arterials. Non-recurring traffic has been identified as being an occasional problem on those arterials.

The City of Fresno operates approximately 466 traffic signals, of which, approximately 134 are connected to the City's Advanced Traffic Management System (ATMS). The system is controlled from a traffic operations center located at a City of Fresno corporate yard, near downtown Fresno. Approximately 30 percent of the traffic signals utilize time-based coordination. Adaptive signal control using Synchro Green is provided at approximately 2 percent traffic signals with plans of expansion to about 8 percent of the signals. Video traffic detection, roadway loops, and a closed circuit television camera (approximately 140 signals) are deployed throughout the City. The traffic signal communications system utilizes a combination of fiber optic cable and wireless communications systems. The fiber network is connected with Caltrans, Fresno County, and City of Clovis fiber networks.

Fiber interconnect is provided along segments of Herndon Avenue, Shaw Avenue, Kings Canyon Road, Fresno Street, Ventura Avenue, Blackstone Avenue, Willow Avenue, Clovis Avenue, and G Street. Wireless interconnect is provided on a small segment of Blackstone Avenue and along Fresno Street. Per the latest City of Fresno ITS projects map (2014), fiber interconnect construction is in progress along segments of Palm Avenue, Nees Avenue, Friant Road, and

Willow Avenue; and wireless interconnect construction is in progress along segments of Nees Avenue, Bullard Avenue, Ashlan Avenue, Shields Avenue, McKinley Avenue, Tulare Street, Fresno Street, West Avenue, First Street, and Van Ness Avenue. **Figure 4-1** shows existing and proposed ITS components, primarily communications infrastructure and signal timing enhancements for the City of Fresno.

The City of Clovis operates over 50 signals. Some of these are operated in partnership with Caltrans and the City of Fresno. Other ITS elements include incident management through the Traffic Operations Center, variable speed limit displays, and CCTV cameras. The City has upgraded its communications infrastructure to fiber optic, parts of which it shares with the City of Fresno system.

4.2.1 Other Incorporated Cities in Fresno County

Within the city of Coalinga there are four signalized intersections on the three state highways that traverse Coalinga. Coalinga's traffic issues revolve primarily around the state highways. Coalinga is applying for Highway Safety Improvement Program (HSIP) funding to address some of their traffic and traffic safety concerns. Caltrans has indicated that they are looking at implementing Caltrans Traffic Signal Management & Surveillance System (TSMSS) software at the traffic signals in Coalinga. TSMSS will allow Caltrans to remotely monitor the Caltrans traffic signals in Coalinga.

The City of Firebaugh is located along SR-33 in northwest Fresno County. There are two signalized intersections in the City, both of which are on the state highway, and are owned and operated by Caltrans. Additional ITS elements in the area of the City include changeable message signs and emergency vehicle preemption. Traffic safety and pavement conditions are an issue of concern for Firebaugh. The city may be looking to apply for Safe Routes to School funding to address some of their concerns.

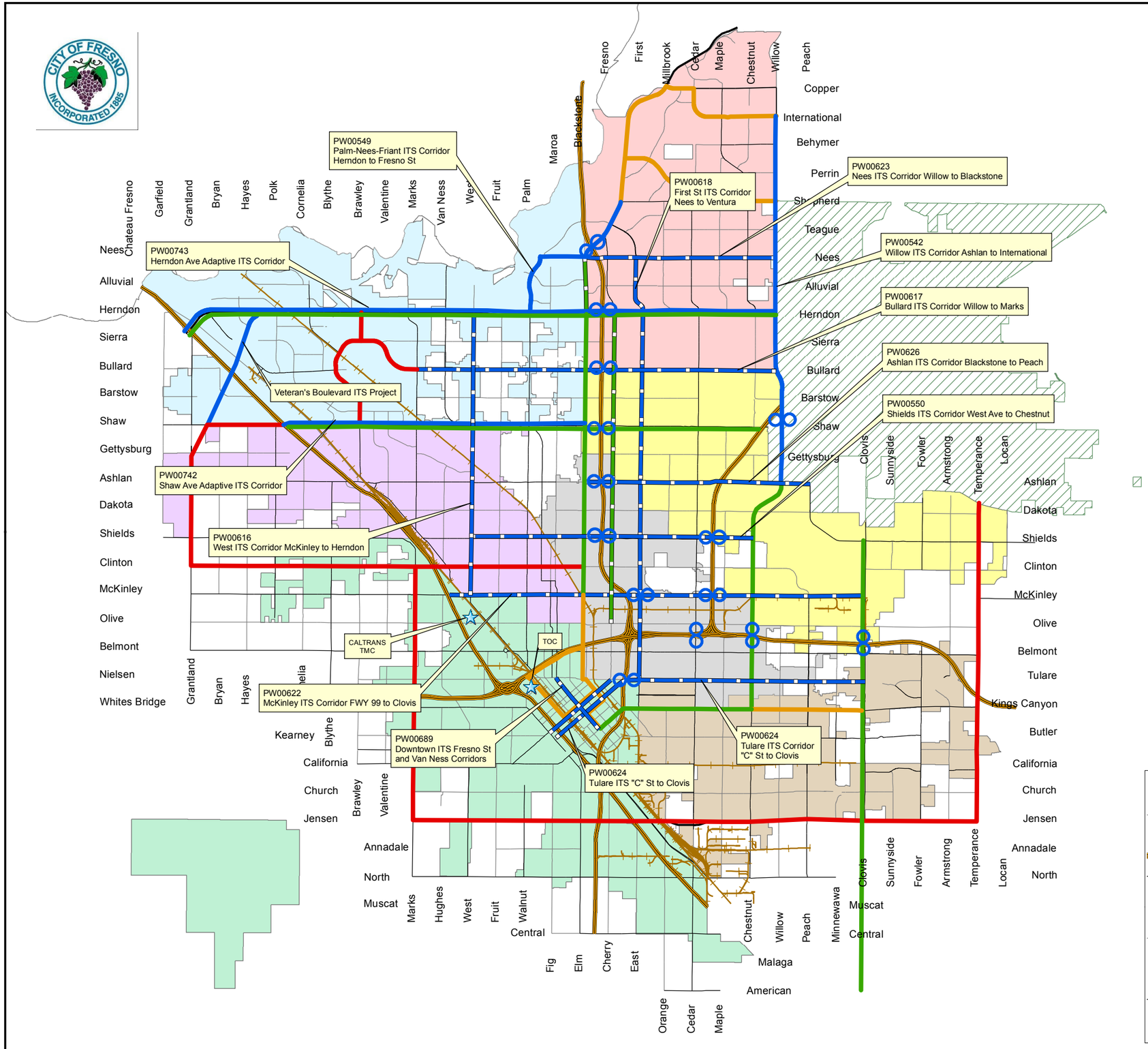
The City of Fowler is located along SR-99 just south of the City of Fresno metropolitan area. The City does not operate any ITS components. Its two signalized intersections are operated by Caltrans and maintained by the City of Fresno, by contract.

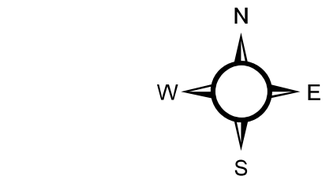
The City of Huron is located along SR-269 in southwest Fresno County. The City identified the following ITS components in operation: railroad grade crossing, transit passenger counting, ridesharing system, and speed warning system.

The City of Kerman has two primary roadways in the city, SR-145 and SR180. There are eight signalized intersections in the city, with all being on the state highways, and are owned and operated by Caltrans. Some of the primary transportation-related concerns for Kerman are pedestrian safety and truck traffic. Kerman is presently working with Caltrans to address some of the pedestrian safety issues.

The City of Kingsburg is located along SR-99 at the south border of Fresno County. The city has 7 signalized intersections, which are operated by Caltrans.

Figure 4-1: City of Fresno ITS





Legend

Intelligent Transportation Systems

- Citywide FWY Ramp Traffic Signal ITS (14 Locations)
- Fiber Corridor Synchronized
- Wireless Corridor Synchronized
- Fiber Corridor Synch in Design/Construction Wireless
- Corridor Synch in Design/Construction
- Fiber and/or Conduit Infrastructure Constructed
- Future Fiber Master Plan

Council Districts

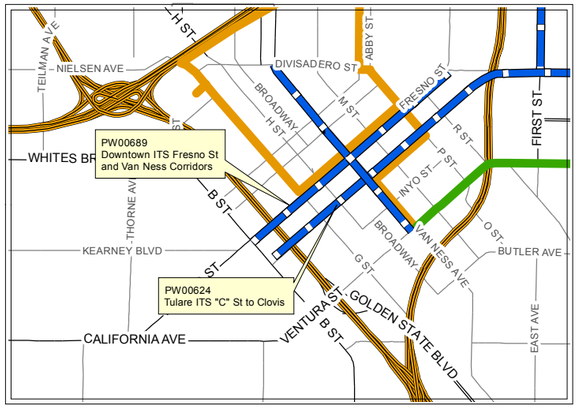
- District 1
- District 2
- District 3
- District 4
- District 5
- District 6
- District 7

Agency Code

- City of Clovis
- County of Fresno

0 0.5 1 2 3 4 Miles

Downtown Area



City of Fresno, Department of Public Works
Intelligent Transportation Systems

The City of Orange Cove has only one signalized intersection within the city. That traffic signal was funded with Safe Routes to School funding. The City and its residents depend on Fresno County Rural Transit Agency (FCRTA) to provide transportation to destinations in other cities in order to obtain access to pharmacological and medical services.

The City of Reedley has 12 signalized intersections. They are all maintained by the City of Reedley.

The City of Sanger is located east of City of Fresno metropolitan area. The City has a traffic signal system and contracts with the City of Fresno to maintain its traffic signals. Planned ITS elements include advanced traffic management system and emergency vehicle preemption.

The City of Selma has 16 signalized intersections, five of which are maintained by Caltrans. The rest are maintained by the City of Selma.

4.2.2 Transit Systems

4.2.2.1 Transit Within the Fresno-Clovis Metropolitan Area

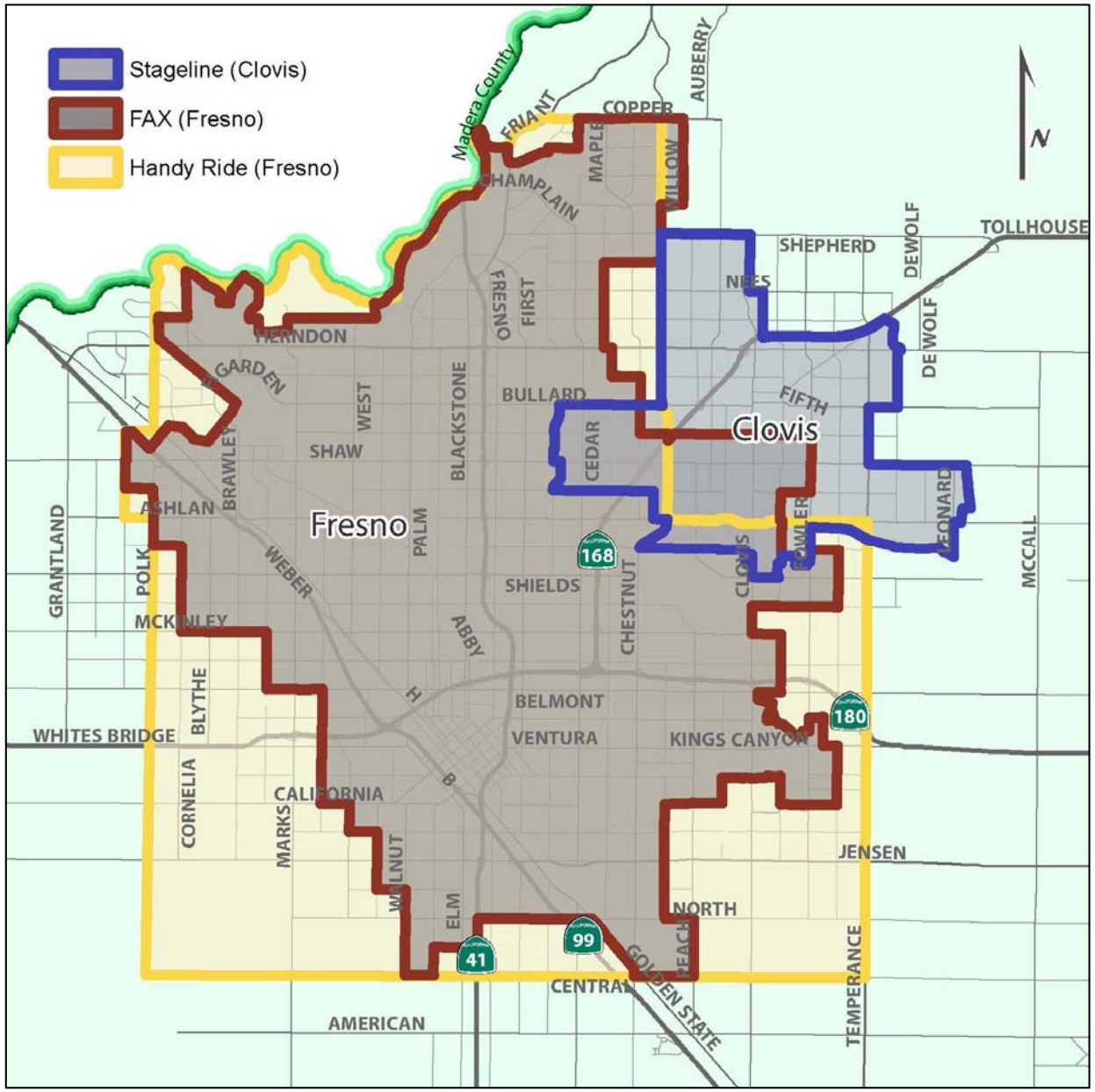
Public transportation in Fresno County consists of both bus transit and Amtrak rail passenger service. The major provider of public transportation in the county is Fresno Area Express (FAX), a department of the City of Fresno. FAX serves the Fresno-Clovis Metropolitan Area (FCMA) with both fixed-route bus lines and a paratransit service with service on demand for those not able to use the regular bus service (Handy Ride). FAX has implemented a number of ITS transit applications. Many of FAX's fixed-route buses are equipped with on-board surveillance cameras and voice enunciators. All vehicles are equipped with electronic fareboxes. Both fixed route and paratransit operations utilize computer-aided scheduling and dispatch computer software. FAX provides information to customers on their website, printed materials, kiosks, and a staffed telephone information line. Planned user information notifications include social media and email/text alerts. FAX has an automatic vehicle location (AVL) system, a GPS-based system with mobile data terminals (MDTs).

The City of Clovis also provides public transportation in the area. Clovis operates a public fixed-route service (Stageline), and a demand responsive service (Round-Up). The fixed route service is scheduled to coordinate with FAX routes when possible to allow for easy transfers between the two services. Additionally the City of Clovis contributes funds to FAX through a formal contract agreement. City of Clovis transit ITS elements include: AVL, electronic fare collection system, on board cameras, as well as route information on their webpage as well as through social media (Twitter). Service areas are shown in **Figure 4-2.**

4.2.2.2 Transit in the Rural Areas

The rural areas of Fresno County are served by a combination of providers, including common carriers, general public, and social service agencies. Common carriers include Greyhound and Orange Belt Stage Lines. These services provide very limited services to a few of the County's incorporated cities. These services generally use the state highway system.

Figure 4-2: Transit Service Area (Urban)



General rural public transportation is provided by the Fresno County Rural Transit Agency (FCRTA). The Joint Powers Agency was formed in 1979 to address the transit needs of the rural incorporated cities. These cities include: Coalinga, Firebaugh, Fowler, Huron, Kerman, Kingsburg, Mendota, Orange Cove, Parlier, Reedley, Sanger, San Joaquin, Selma, and Fresno County. The FCRTA provides fixed-route services that link communities with each other and the Fresno-Clovis Metropolitan Area. The FCRTA operates a total of 70 vehicles in 20 transit subsystems serving all thirteen rural incorporated cities and many unincorporated communities within Fresno County. A map of the service area is shown in **Figure 4-3.** This inter-community public transportation service provided through public, private, or non-profit entities. Four basic corridors are followed from the rural communities to the Fresno-Clovis Metropolitan Area. The FCRTA currently uses AVL on portions of the overall fleet, as well as tablets for communicating manifest and passenger information to the bus drivers. FCRTA also uses reservation software to manage bus and trip assignments.

4.2.1 Rail Facilities

4.2.1.1 Passenger Service

The City of Fresno is served by Amtrak passenger service. Amtrak operates four trains per day between Bakersfield and Oakland and two trains per day between Bakersfield and Sacramento, with each train making one round trip per day; for a total of six northbound and six southbound trips each day. Dedicated bus service connects rail stations with those cities not directly served by the train service.

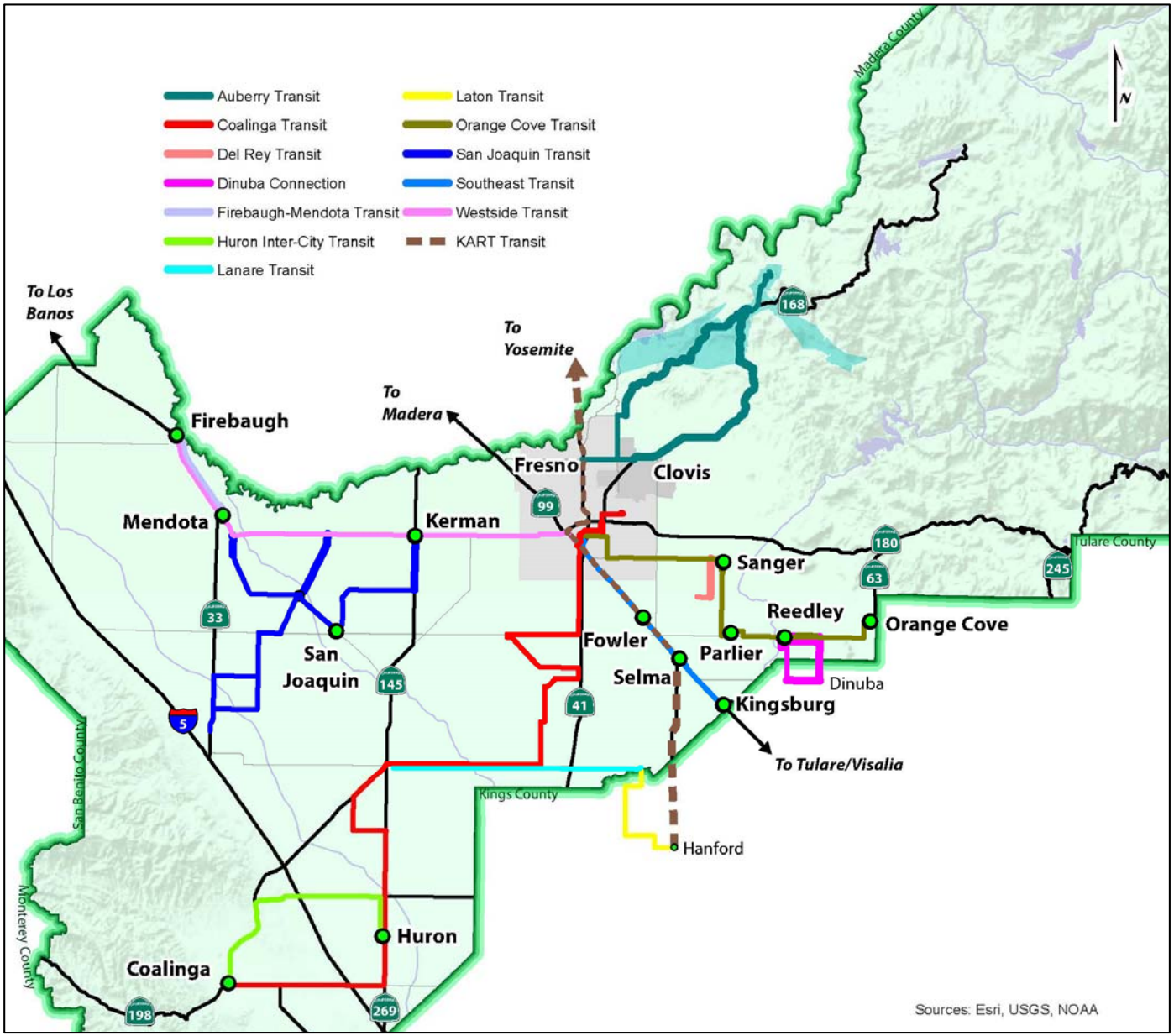
The rail service is supplemented by Thruway Bus service to destinations not served directly by rail. At Bakersfield, a number of buses fan out to reach destinations all over Southern California and Nevada, including Santa Barbara, Ventura, Los Angeles, Orange County, San Diego, Palm Springs, and Las Vegas. At Stockton, Thruway buses connect to destinations including South Lake Tahoe, Reno, Sacramento, Davis, Chico, and Redding.

In addition to rail service, Greyhound buses provide service to and from Fresno from a number of areas throughout California. Destinations include Hayward, Sacramento, San Francisco, San Jose, and Stockton to the north of Fresno. Southern areas served by Greyhound include Visalia, Bakersfield, and Los Angeles. Connecting service is available to San Diego (via Los Angeles). Other bus companies provide service, in a capacity more limited than Greyhound; two new transit systems provide service from Fresno to Yosemite National Park (YARTS) and Fresno to Kings Canyon National Park (Big Trees Transit).

4.2.1.1 Freight Service

The Union Pacific Railroad (UP) and the Burlington Northern Santa Fe Railway (BNSF) both operate freight rail service in the area, and this service is used to transport a large number of goods throughout the region. The UP and the BNSF each operates one mainline that passes through Fresno County. In addition, there are four branch-lines that either pass through (Exeter Subdivision) or lie completely within (West Side Subdivision, Riverdale, Subdivision, Clovis Subdivision) Fresno County.

Figure 4-3: Transit Service Area (Rural)



There are a total of approximately 300 miles of operating main and branch-line right-of-way in Fresno County. In addition, many spur lines serve both industrial and agricultural customers. The existing BNSF lines pass through urbanized areas of the City of Fresno, which creates numerous transportation problems. **Figure 4-4** depicts the regional railroad system.

4.2.1 Air Facilities

The Fresno Yosemite International Airport (FYI) is the primary passenger airport in Fresno County, and is the largest and busiest airport in the San Joaquin Valley. Approximately, 1.4 million passengers flew commercially and 11,863 tons of air cargo was accommodated from FYI. Recent improvements to the facility include a remodeling of the terminal, and a new baggage facility was constructed. The main runway was reconstructed, and a second runway was lengthened. There are plans for more improvements to the FYI, including an expansion of the terminal and parking lot.

Airport access is an important issue in the City of Fresno. The current access is limited, with Route 41 located about three miles from the airport, and Route 99 about five miles away. Freeway 168 provides direct north-south access to the airport, as well as connecting with the existing freeway system in the Fresno-Clovis Metropolitan Area. State Route 180 provides access from the east and the west.

Fresno Chandler Downtown Airport is a "reliever" airport. The facilities are much smaller than that of FYI, including shorter runways, with about half the number of airplanes based there. Additional airports in Fresno County include the Coalinga Municipal Airport, Firebaugh Airport, Harris Ranch Airport, Mendota Airport, Reedley Municipal Airport, Selma Aerodrome, and Sierra Sky Park. In Fresno County, approximately 225,925 operations occur per year. **Figure 4-5** depicts the regional airport locations.

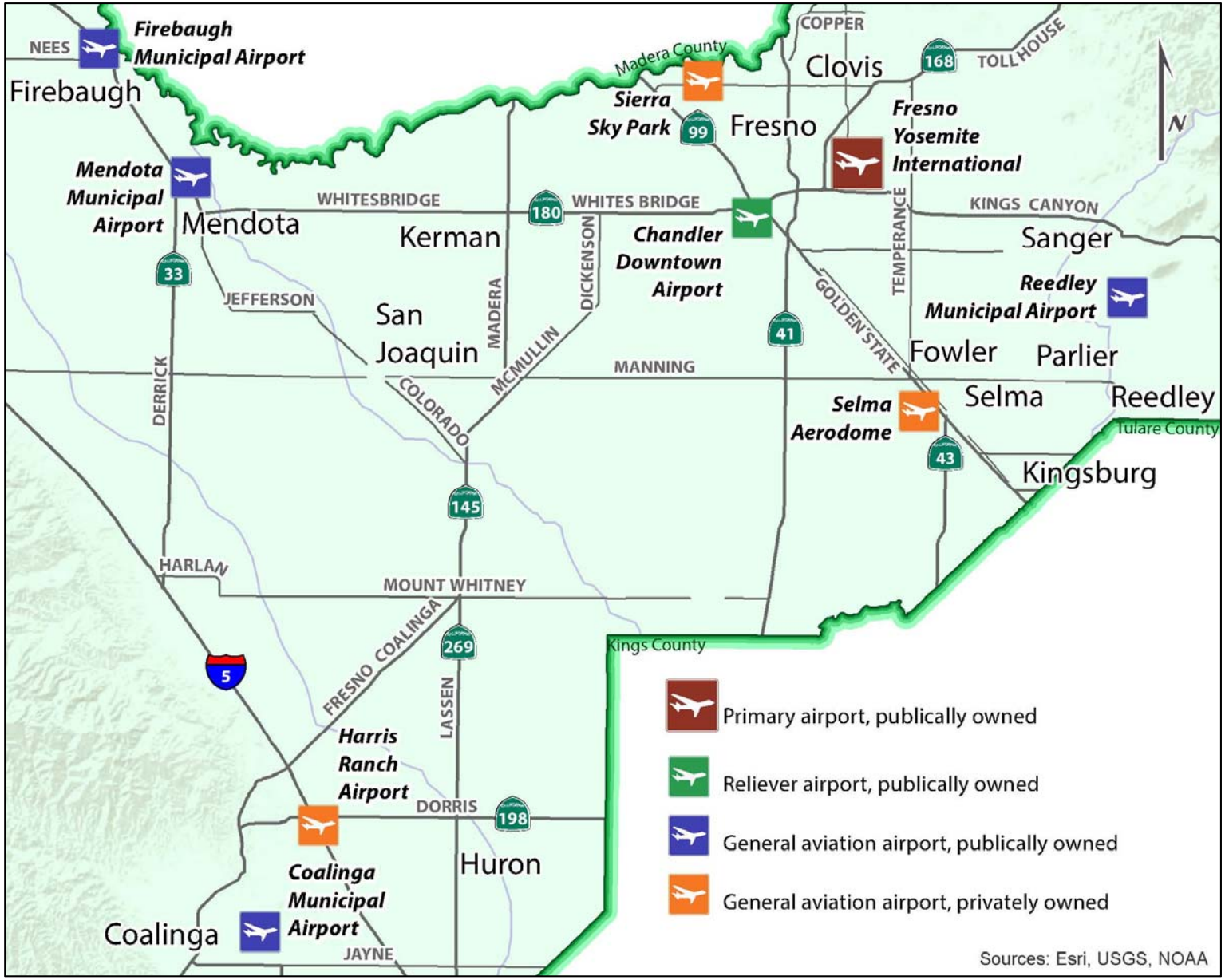
4.2.1 Emergency Services

The City of Fresno Fire and Police Departments utilize a computer aided dispatch/records management system (CAD/RMS) that includes automatic vehicle location and improved dispatch capabilities. Geographic information system (GIS) based mapping is used throughout the City. The Fresno County Fire Protection District and the California Forest Service share responsibilities for fire protection outside of incorporated areas in Fresno County. The majority of the service area is rural. City of Clovis also operates a computer aided dispatch system and has emergency vehicle preemption at various locations throughout the city.

Notably, American Ambulance, one of the largest emergency service providers in the Fresno-Clovis Metropolitan Area, have developed many ITS technologies for their fleet. Each vehicle is equipped with automated vehicle location (AVL) technology, in addition to on-board computers with linkages to fire and police dispatch information.

Figure 4-4: Regional Rail System

Figure 4-5: Regional Airports



5.0 ITS USER NEEDS ASSESSMENT AND RELEVANT ITS STRATEGIES

An ITS User Needs Assessment was conducted as part of the overall Strategic Deployment Plan development to determine the User Needs of the stakeholders in the Fresno County Region. The aim of the User Needs Assessment is to ensure that the updated ITS Plan and architecture meet the needs of the Fresno County Region stakeholders. The User Needs Assessment results can then be compared to the inventory to determine which needs are currently being met with existing ITS, which needs may be met with planned ITS, and which ITS needs are not being met at all. This comparison can also be used to determine interconnections and information exchange between systems and agencies. It is also used to select and / or determine the status of Service Packages – a concept from the National ITS Architecture – and to develop projects in the strategic deployment portion of the Plan.

5.1 ITS USER NEEDS ASSESSMENT METHODOLOGY

The process of collecting direct stakeholder input on ITS Needs was carried out with the help of a comprehensive "strawman" list of ITS Needs. The strawman list of ITS Needs, which can be found in **Appendix C** was used as a starting point to prompt input from the stakeholder group, rather than starting out with a "blank sheet of paper." The strawman list was developed based on knowledge of Fresno County, as well as experience in developing Regional ITS Architectures in other similar regions. A document review of both ITS plans and traditional transportation plans was also performed to gather additional or complementary information on ITS needs for the region. Understanding documented long-term policies and goals, where they were available, was helpful in executing a sound needs analysis.

The ITS User Needs on the strawman list were been broken into categories consistent with the main National ITS Architecture service areas of:

- Archived Data Management
- Public Transportation
- Traveler Information
- Traffic Management
- Vehicle Safety
- Commercial Vehicle Operations
- Emergency Management
- Maintenance and Construction Management

In a workshop setting, project stakeholders were asked to provide their priority rankings on a series of wall charts that contained the strawman list. Stakeholders were given a set of color

coded adhesive dots that they then placed on the wall charts. The different colored adhesive dots corresponded to different point values. Red dots were assigned a point value of 5; yellow dots were assigned appoint value of 3; green dots were assigned a point value of 1; and blue dots were assigned a point value of 0 (zero), which also corresponded to a more subjective "not needed" category. Stakeholders were also given the opportunity to provide verbal input, as well as written input after the meeting concluded. This exercise provided an objective scoring and ranking of ITS User Needs for Fresno County.

The scores from the above described ranking process were tallied and an initial ranking of ITS User Needs was developed. At a subsequent stakeholder meeting, the stakeholder group was provided with the results of the initial ranking of ITS User Needs, and was given an opportunity to provide additional input, which may result in some manual adjustments to the ranking of ITS User Needs. The employment of this secondary, subjective ranking opportunity ensures that the User Needs Assessment truly reflects the opinions needs of the regional stakeholders.

5.2 ITS USER NEEDS ASSESSMENT RESULTS

Table 5-1 shows the scoring results of the ITS User Needs Assessment, truncated at the ITS User Needs that scored 7 points or more. These ITS User Needs are considered the priority ITS User Needs for the Fresno County Region. The sections following Table 5-1 discuss the recommended ITS strategies for the Fresno County Region.

Using a score of 7 points or more as a cut-off line is somewhat arbitrary, but a priority line needed to be identified that strikes a balance between being all-inclusive and realistic as to what types of ITS can – and will – get deployed in the Region over the next 10 to 15 years. The point of identifying a cut-off line for priority ITS User Needs is to provide focus and structure to the planning process.

Table 5-1: ITS User Needs Assessment Results - Sorted by Total Points (greater than 7 points)

Needs	Priority				Total Points	Category/Service Area
	Red (5)	Green (3)	Yellow (1)	Blue (not needed)		
Improve information exchange between Caltrans and local transportation agencies	8	1	1		44	Data Management & Sharing
Improve signal timing/coordination	7		2		37	Arterial Management
Provide more timely incident information to travelers	4		1		21	Traveler Information
Improve data collection on freeways/expressways	4		1		21	Freeway Management
Staffing (added by Stakeholders)	4				20	Arterial Management
Provide/enhance congestion information to travelers	4				20	Traveler Information
Improve/implement ability to remotely modify signal timing	3	1			18	Arterial Management
Expand/enhance/upgrade AVL system	3	1			18	Transit
Improve data collection and archiving	2	2	2	1	18	Data Management & Sharing
Coordinate timed transfers between routes, providers and modes	2	2		1	16	Transit
Improve incident response	3		1		16	Emergency Management
Provide/enhance speed enforcement at high risk locations	3			3	15	Arterial Management
Implement/enhance web-based trip planner	2	1	2		15	Transit
Improve ramp metering operations	2	1	2		15	Freeway Management
implement smart card for transit fare payment	2	1	1		14	Transit
Share incident information with other agencies	2	1	1		14	Data Management & Sharing
Implement/expand DMS installations on arterials	2	1			13	Arterial Management
Upgrade signal hardware	2	1		1	13	Arterial Management

Needs	Priority				Total Points	Category/Service Area
	Red (5)	Green (3)	Yellow (1)	Blue (not needed)		
Improve/expand vehicle detection coverage on freeways/expressways	2	1		1	13	Freeway Management
Provide real-time traffic information to emergency responders	2	1			13	Emergency Management
Improve incident detection	1	2	1		12	Emergency Management
Coordinate arterial and freeway management strategies	2		1		11	Arterial Management
Improve communications in rural areas	2		1		11	Emergency Management
Implement Smart Work Zone technology	2		1	1	11	Road Weather
Reduce traffic congestion during incidents		2	4	1	10	Arterial Management
Implement/enhance remote monitoring of transit vehicle mechanical condition	2				10	Transit
Reduce recurring traffic congestion		2	3		9	Arterial Management
Implement intersection collision warning/avoidance systems	1	1	1	2	9	Arterial Management
Implement advanced parking management systems	1	1	1		9	Arterial Management
Provide freeway/expressway travel times	1	1	1		9	Traveler Information
Reduce incident clearance time	1	1	1		9	Emergency Management
Improve a multi-agency, system-coordinated response to major incidents	1	1	1		9	Emergency Management
Provide real-time transit arrival/departure information on web site	1	1		1	8	Transit
Improve quality, consistency and thoroughness of traveler information	1		3		8	Traveler Information
Use social media for traveler information dissemination	1	1		2	8	Traveler Information

Needs	Priority				Total Points	Category/Service Area
	Red (5)	Green (3)	Yellow (1)	Blue (not needed)		
Reduce recurring traffic congestion	1		3		8	Freeway Management
Implement/improve inter-jurisdictional signal coordination		2	1		7	Arterial Management
Provide incident information to travelers		1	4	1	7	Traveler Information
Expand CCTV coverage on freeways/expressways	1		2		7	Freeway Management
Warn work crews of errant vehicles		2	1		7	Road Weather

5.3 RELEVANT ITS STRATEGIES

The relevant ITS strategies in the following subsections are arranged by Program Areas that are consistent with the National ITS Architecture – and also consistent with the organization of the ITS User Needs Assessment. The identified strategies within each of the Program Areas are then organized to be consistent with the results of the ITS User Needs survey documented in Table 5-1. The strategies are not organized prioritized by priority order.

In an effort to bring focus to the planning process, strategies that are not relevant to the Region, or that do not appear to align with the ITS User Needs Assessment results have been filtered from the recommended ITS strategies. This allows the stakeholder group to focus on ITS strategies that are relevant to the Region and that are a Need in the Region.

5.3.1 Archived Data Management Program Area

ITS User Needs from the Archived Data Management Program Area that were identified as a priority for the Fresno County Region are listed in this subsection. Following each priority ITS User Need is a recommended strategy, or strategies, that could be implemented to address the priority ITS User Need.

5.3.1.1 ITS User Need: Improve information exchange between Caltrans and local transportation agencies

The following ITS strategy(ies) are listed to support the improvement of information exchange between Caltrans and local transportation agencies.

ITS Strategy: Archived Data Management System (ADMS)

This strategy provides an ITS historical data archive for all relevant ITS data and can provide a centralized system to share data between agencies. Data collected can provide information for use in monitoring and evaluating the performance and safety of the transportation system, fulfilling data reporting requirements, and other planning or operational functions. Such a data archive could be utilized as the foundation for real time data and information exchange and/or for providing content to a real time traveler information system.

ITS User Need: Improve data collection and archiving

The Archived Data Management System (ADMS) strategy described in Section 5.3.1.1 supports the objective of improving data collection and archiving. The following ITS strategies are listed to support the improvement of data collection and archiving.

ITS Strategy: Vehicle Detection

The enhancement and expansion of the vehicle detection systems at traffic signals could provide important data relative to traveler information systems. Vehicle data can be collected, stored and reported for intersections, as is done for most urban freeways and expressways in California.

5.3.1.2 ITS User Need: Share incident information with other agencies

The Archived Data Management System (ADMS) strategy described in Section 5.3.1.1 supports the objective of sharing incident information between agencies. The following ITS strategies are listed to support the sharing of incident information with other agencies.

ITS Strategy: Incident Detection Systems

Incident detection systems have been developed for agencies that manage freeway operations, as part of a larger freeway management system. The incident detection systems utilize algorithms that detect anomalies in traffic flow to detect incidents and alert operators to the incident. More sophisticated systems include decision support capabilities that activate closed circuit television (CCTV) cameras in the vicinity of the detected incident. The decision support system can then suggest other traffic management strategies, such as the content for posting messages on changeable message signs, as well as other functions.

More oriented to in-vehicle systems, this strategy may also aim for the user to request emergency assistance and the detection system to gather critical information and alert the appropriate emergency responders. This system can be manually triggered or automated to a vehicle (or vehicles). The detection system can also be integrated with the traffic management center or other surveillance systems to monitor public areas. The system would rely on Global Positioning System (GPS) tracking, wireless communications, and a separate response center which will notify the Public Safety Answering Point (PSAP) for emergency response. Automated in vehicle systems will notify the associated private operating entity which communicates to a PSAP.

5.3.1.3 Supporting ITS Architecture Service Packages

ITS Architecture Service Packages that support the user needs and strategies discussed within the Archived Data Management Program Area include the following:

- AD1 ITS Data mart
- AD2 ITS Data Warehouse
- ATIS06 Transportation Operations Data Sharing
- ATMS02 Network Surveillance
- ATMS08 Traffic Incident Management System.

5.3.2 Public Transportation Program Area

ITS User Needs from the Public Transportation Program Area that were identified as a priority for the Fresno County Region are listed in this subsection. Following each priority ITS User Need is a recommended strategy, or strategies, that could be implemented to address the priority ITS User Need.

5.3.2.1 ITS User Need: Expand / enhance / upgrade Automatic Vehicle Location (AVL) system

The following ITS strategies are listed to support the improvement of the ALV systems for public transportation.

ITS Strategy: Automatic Vehicle Location (AVL) and Computer Aided Dispatch (CAD)

AVL systems typically use global positioning system (GPS) based technology to monitor the location of transit vehicles. Efficient changes in routing can be accomplished as this information is processed in real time. This technology is a foundational technology that can be used to determine arrival times at waypoints or terminals, which can help managers and riders to adjust schedules. The CAD systems allow transit dispatch personnel to effectively manage demand and bus operations. CAD systems can also manage communications from the dispatch center to the transit vehicles.

ITS Strategy: Dynamic Routing and Scheduling System

Dynamic routing and scheduling systems perform vehicle routing and scheduling as well as monitoring for demand responsive transit services. These systems monitor the current status of the transit fleet and support allocation of the fleet to service incoming requests for service, while accounting for traffic conditions. The service can provide personalized transit services to be requests through the Information Service Provider (ISP) Subsystem. The ISP may be operated by a transit management center or a separate service provider.

5.3.2.2 ITS User Need: Coordinate timed transfers between routes, providers, and modes

The Automatic Vehicle Location (AVL) and Computer Aided Dispatch (CAD) strategy described in Section 5.3.2.1 supports the objective of coordinating timed transfers between routes, provides, and modes. The following ITS strategies are listed to support the improvement of transfers between routes, providers, and modes.

ITS Strategy: Transit Service Coordination

Coordinating service between multiple transportation operators can be improved with vehicle monitoring and communication technologies to facilitate passenger transfers between vehicles or transit systems. The services utilize combined, automated vehicle location (AVL) technologies, automated fare payment, and scheduling. In addition the software simplifies ridership reporting, financial tracking, and billing functions for transportation providers.

5.3.2.3 ITS User Need: Implement/enhance web-based trip planner

The following ITS strategies are listed to support the implementation and enhanced of web-based trip planners for public transportation.

ITS Strategy: Itinerary Planning Website

Itinerary planning websites allow riders to enter their trip origin and destination, and select fare categories, special accommodations (wheelchair or bicycle), and itinerary options (fastest trip, fewest transfers, minimal walking). The system provides a step-by-step itinerary for the transit trip. Call-center operators can provide detailed trip-planning interface, and are able to provide callers with more complex travel plan options than the website.

ITS Strategy: Traveler Information System

Static and / or real time information can be sent to travelers prior to, or during a trip. Information may include schedules, routes, maps, fares, park-and-ride lot locations, transit

trip itineraries, etc. Information can be communicated via the telephone, Internet, electronic kiosks, fax machines, television, etc. A subscriber feature can tailor information distribution to a specific user.

5.3.2.4 ITS User Need: Implement smart card for transit fare payment

The following ITS strategies are listed to support the implementation of smart card technology for transit fare collection.

ITS Strategy: Electronic Payment

This strategy refers to an in vehicle system using a smart card or a similar system to allow users to pay fares quickly. It also provides a streamlined system for financial recording and reporting for the operator. Additionally, the system may allow for ridership tracking by route and/or time of day.

5.3.2.5 ITS User Need: Implement/enhance remote monitoring of transit vehicle mechanical condition

The following ITS strategies are listed to support the implementation/enhancement of remote monitoring of transit vehicle mechanical conditions.

ITS Strategy: Remote Maintenance Bus Monitoring

This strategy utilizes onboard maintenance monitoring technologies to allow for automated collection and reporting of vehicle maintenance information. Information can be uploaded from the vehicle during service via wireless technology or at the end of a trip. A transit CAD/AVL system may facilitate the transfer of vehicle maintenance information from the vehicle to a transit dispatch center in real time.

5.3.2.6 ITS User Need: Provide real-time transit arrival/departure information on web site

The Itinerary Planning Website and Traveler Information System strategies described in Section 5.3.2.3 support the objective of providing real-time transit arrival/departure information on a web site.

5.3.2.7 Supporting ITS Architecture Service Packages

ITS Architecture Service Packages that support the user needs and strategies discussed within the Public Transportation Program Area include the following:

- APTS01 Transit Vehicle Tracking
- APTS04 Transit Vehicle Fare Collection Management
- APTS06 Transit Fleet Maintenance
- APTS07 Multi Modal Coordination
- APTS08 Transit Traveler Information
- APTS11 Multimodal Connection Protection

5.3.3 Traveler Information Program Area

ITS User Needs from the Traveler Information Program Area that were identified as a priority for the Fresno County Region are listed in this subsection. Following each priority ITS User Need is a recommended strategy, or strategies, that could be implemented to address the priority ITS User Need.

5.3.3.1 ITS User Need: Provide more timely incident information to travelers

The following ITS strategies are listed to support providing timelier incident information to travelers.

ITS Strategy: Incident Detection Systems

Incident detection systems have been developed for agencies that manage freeway operations, as part of a larger freeway management system. The incident detection systems utilize algorithms that detect anomalies in traffic flow to detect incidents and alert operators to the incident. More sophisticated systems include decision support capabilities that activate closed circuit television (CCTV) cameras in the vicinity of the detected incident. The decision support system can then suggest other traffic management strategies, such as the content for posting messages on changeable message signs, as well as other functions. This would be a foundation functionality for implementation of a traveler information system.

More oriented to in-vehicle systems, this strategy may also aim for the user to request emergency assistance and the detection system to gather critical information and alert the appropriate emergency responders. This system can be manually triggered or automated to a vehicle (or vehicles). The detection system can also be integrated with the traffic management center or other surveillance systems to monitor public areas. The system would rely on Global Positioning System (GPS) tracking, wireless communications, and a separate response center which will notify the Public Safety Answering Point (PSAP) for emergency response. Automated in vehicle systems will notify the associated private operating entity which communicates to a PSAP.

ITS Strategy: Traveler Information System

A variety of applications provide the end-user interface to pre-trip and en-route traveler information programs such as 511 telephone interactive traveler information systems, changeable message signs, websites, social media, television and radio programming, traveler information kiosks, in-vehicle devices, or other wireless devices. These systems typically depend upon other systems with traffic management and/or vehicle detection functionality at the foundation. The foundation functionality typically needs to be in place in advance of the more advanced traveler information dissemination functionality.

5.3.3.2 ITS User Need: Provide/enhance congestion information to travelers

An incident detection system and traveler information system are key strategies to support providing/enhancing congestion information to travelers. These strategies are described in Section 5.3.3.1.

5.3.3.3 ITS User Need: Provide freeway/expressway travel times

A traveler information system described in Section 5.3.3.1 is a key strategy to support providing freeway/expressway travel times. Similarly, travel time systems typically depend upon other systems with traffic management and especially vehicle detection functionality at the foundation. The foundation functionality typically needs to be in place in advance of the more advanced travel time information dissemination functionality.

5.3.3.4 ITS User Need: Improve quality, consistency and thoroughness of traveler information

A specific ITS strategy is not identified for this ITS User Need. Rather, a comprehensive traffic management and data collection system is required, with multiple data sources, and multiple information dissemination channels. From a policy standpoint, a committed source of funding to ensure the long term operations of the data collection systems, as well as the information dissemination systems is required.

5.3.3.5 ITS User Need: Use social media for traveler information dissemination

A traveler information system outlined in Section 5.3.3.1 with an interface to various social media platforms is a key strategy to support using social media for traveler information dissemination. The social media aspect may also require the commitment of a human resource to screen, filter, and in some cases disseminate information manually on the social media platforms, and potentially respond to public feedback on the social media platforms.

5.3.3.6 ITS User Need: Provide incident information to travelers

An incident detection system and traveler information system are key strategies to support providing/enhancing congestion information to travelers. These strategies are described in Section 5.3.3.1.

5.3.3.7 Supporting ITS Architecture Service Packages

ITS Architecture Service Packages that support the user needs and strategies discussed within the Traveler Information Program Area include the following:

- ATIS01 Broadcast Traveler Information
- ATIS02 Interactive Traveler Information
- ATMS06 Traffic Information Dissemination
- ATMS08 Traffic Incident Management System

5.3.4 Traffic Management Program Area

ITS User Needs from the Traffic Management Program Area that were identified as a priority for the Fresno County Region are listed in this subsection. Following each priority ITS User Need is a recommended strategy, or strategies, that could be implemented to address the priority ITS User Need.

5.3.4.1 ITS User Need: Improve signal timing/coordination

The following ITS strategies are listed to support the improvement of signal timing and signal coordination.

ITS Strategy: Traffic Signal Control Systems

Traffic control software and traffic signal controllers are the fundamental components of a modern arterial traffic management system. A central traffic control software system typically provides an agency with remote monitoring and control of the traffic signal controllers from a centrally located facility (a traffic management center, or a traffic operations center). Both these components need to have the capability to run signal timing plans and coordination plans in order to address the user need of improving signal timing and coordination.

ITS Strategy: Vehicle Detection

Vehicle detection is necessary for the efficient operation of traffic signals, and is a foundation functionality that enables other, more complex functions. The actual detection technology (loop, video, radar, etc.) is in most respects irrelevant to this discussion, as long as the selected technology meets the functional requirements of the traffic management systems, and the agency. Detection includes intersection (stop-bar) detection, advanced detection upstream of the stop-bar, and in some instances system level – or mid-block – detection. Vehicle detection is necessary for the efficient use of green time, which in turn is necessary for the efficient use of coordination timing plans. The primary use would be for traffic signal systems however the detectors can also provide traffic volume, speed and flow information that allow the management systems to maximize efficiency of the roadways.

ITS Strategy: Signal Coordination Plans

Improvements to signal coordination require data to effectively monitor changes in traffic trends on a regular basis. Adjustments can be made to the length of time that a signal allocates to each of the given phases of signal operation. Additionally, modern signal controllers and / or centralized traffic signal control systems can store numerous timing plans for use at various times of day and for different days of the week, and can be activated to address various levels of expected demand. Special event signal timing plans can address construction or incidents as well as special traffic attractors.

ITS Strategy: Adaptive Traffic Signal Control (ATSC)

Adaptive traffic signal control is a strategy in which traffic signal timing changes, or adapts, based on actual traffic demand. This is done using adaptive traffic control systems consisting of enhanced signal control hardware, software, and potentially firmware. Adaptive traffic signal control strategies are sometimes dependent on enhanced vehicle detection, and/or vehicle detection that is configured in a manner different from the configuration for typical traffic signal operations. ATSC is effective in situations where traffic demand varies, or is unpredictable, resulting in excessive delay. In such cases, ATSC can more quickly respond to changing traffic conditions as compared to utilizing the typical traffic signal timing processes utilized by most agencies.

5.3.4.2 ITS User Need: Staffing (added by Stakeholders)

In general, this is an ITS User Need that is not addressed with an ITS strategy, per se, but through agency funding and staffing commitments. Some ITS strategies provide the opportunity to streamline certain functions, reducing workload, or the amount of time it takes to perform certain functions. One example of this is a centralized traffic signal control system. Some maintenance/ monitoring functions on the traffic signal controller can be performed at a central location (i.e. "city hall"), without the need to travel to each individual intersection to perform that same function. There should be a net time savings performing these functions, allowing that worker to also work on other tasks.

5.3.4.3 ITS User Need: Improve/implement ability to remotely modify signal timing

Remote access of traffic signals requires a means of communications between the traffic signals in the field and a central software system. Section 5.3.4.1 explains this strategy.

5.3.4.4 ITS User Need: Provide/enhance speed enforcement at high risk locations

The following ITS strategies are listed to support providing/enhancing speed enforcement at high risk locations.

ITS Strategy: Automated Enforcement

Automated enforcement technologies can assist with the enforcement of speed limit compliance and red light running. Detection equipment activates a still-picture or video camera to record vehicles in violation of the posted speed limit, or the red light violation.

5.3.4.5 ITS User Need: Implement/expand Changeable Message Sign (CMS) installations on arterials

The following ITS strategies are listed to support the implementation/expansion of CMS installations on arterials.

ITS Strategy: Changeable Message Signs (CMS)

CMS provide a short message to motorists on an elevated electronic message board at the roadside. Messages can be updated from a remote location via various communications technologies. Deployment location are typically in advance of decision points for major attractors or parking areas, giving motorists the opportunity to make a decision in advance of the decision point. Portable CMS can be used for non-recurrent or temporary roadway and traffic impacts such as traffic accidents, construction zones or in the vicinity of maintenance personnel.

5.3.4.6 ITS User Need: Upgrade signal hardware

Upgrading traffic signal hardware is part of the traffic signal systems ITS strategy outlines in Section 5.3.4.1.

5.3.4.7 ITS User Need: Coordinate arterial and freeway management strategies

The following ITS strategies are listed to support the coordination of arterial and freeway management strategies between Caltrans and the local agencies.

ITS Strategy: Freeway and Arterial Coordination

Freeway and arterial coordination involves coordinating timely responses to traffic conditions obtained from both facilities. Coordination involves using the field devices (CMS, ramp meters, signal controllers, CCTV, etc.) on each of the respective agency's traffic management systems to implement cooperative responses. A new software system can integrate communications between signal timing along the arterial with ramp metering. An ancillary system can also be implemented to manage communications between the freeway management system and local agency traffic signal control systems.

5.3.4.8 ITS User Need: Reduce traffic congestion during incidents

In order to address this user need, the incident response time and clearance response time would also need to be improved as outlined in Section 5.3.7 Emergency Management. Dissemination of incident information to roadway users is also important in addressing congestion due to incidents. Section 5.3.3 outlines traveler information strategies that support this identified user need. CMS systems described in Section 5.3.4.5 are also a communication strategy that supports this user need. In addition, the following ITS strategies are listed to support the reduction of traffic congestion resulting from and during incidents.

ITS Strategy: CCTV Camera Surveillance

This strategy uses closed circuit television (CCTV) cameras for remote video monitoring of traffic conditions. Cameras can be placed along freeways and arterials and at freeway interchanges, as well as at or near signalized intersections. Identified high incident areas would be good candidates for this system. The cameras can work in conjunction with a TMC providing visual monitoring of intersections to allow and verify effective modifications to signal timing plans. The visual monitoring can also be used to identify incidents, providing early detection and quick response and efficient restoration of traffic flow.

5.3.4.9 ITS User Need: Reduce recurring traffic congestion

ITS strategies to support the reduction of recurring traffic congestion along arterials and freeways/expressways are similar to addressing congestion due to an incident. Strategies identified for dissemination of information in Section 5.3.3 Traveler Information supports this user need as well. In addition, CCTV camera surveillance outlined in Section 5.3.4.8 also supports this user need. CMS systems outlined in Section 5.3.4.5 is also a communication strategy that supports this user need.

5.3.4.10 ITS User Need: Implement advanced parking management systems

The following ITS strategies are listed to support the implementation of advanced parking management systems.

ITS Strategy: Parking Management Systems

Parking management systems include sensors counting vehicles in/out, electronic parking payment systems, message boards providing directions/space availability, etc. CMS described in Section 5.3.4.5 can also help with parking management. Parking management systems can communicate with transportation authorities and TMCs.

5.3.4.11 ITS User Need: Improve data collection on freeways/expressways/arterials

The following ITS strategies are listed to support the improvement of data collection on freeways/expressways/arterials.

ITS Strategy: Vehicle Detection

Detection systems are described in Section 5.3.4.1, and are a strategy that supports this user need. A plan for enhancement and expansion of existing vehicle detection systems along freeways, expressways, and arterials in the region would be a good starting point. The plan should start with the goals and objectives of the system expansion, which includes defining the various types of additional and expanded data desired by the interested parties. Data collection for one application may not suit the needs of data collection for another application. Thus the need for a clear understanding of goals, objectives, and data types under consideration. Depending on the development of goals and objectives, and the results of the definition of expanded and additional data, a prioritization of system expansion and in-fill would occur.

5.3.4.12 ITS User Need: Improve ramp metering operations

Rather than describing ITS strategies to support the improvement of ramp metering operations, it is suggested that a Ramp Metering Master Plan be developed that includes development of goals and objectives for ramp metering in the Fresno Metropolitan Area. Ramp metering goals and objectives can be addressed with various ramp metering strategies. The goals and objectives need to be completely understood in order to select a ramp metering strategy, or strategies, to appropriately address the needs of the metropolitan area. Ramp metering strategies may include elements of the following: localized ramp metering versus systemwide ramp metering, time of day operations, adaptive ramp metering, high occupancy vehicle bypass considerations, freeway to freeway ramp metering, and other variations of these basic strategies.

5.3.4.13 ITS User Need: Improve/expand vehicle detection coverage on freeways/expressways/arterials

The vehicle detection strategy outlined in Section 5.3.4.1 also supports the improvement/expansion of vehicle detection coverage on freeways/expressways/arterials.

5.3.4.14 ITS User Need: Expand CCTV coverage on freeways/expressways/arterials

The CCTV strategy outlined in 2.4.8.1 supports the expansion of CCTV coverage on freeways/expressways/arterials.

5.3.4.15 Supporting ITS Architecture Service Packages

ITS Architecture Service Packages that support the user needs and strategies discussed within the Traffic Management Program Area include the following:

- ATIS06 Transportation Operations Data Sharing
- ATMS01 Network Surveillance
- ATMS02 Traffic Probe Surveillance
- ATMS03 Traffic Signal Control
- ATMS04 Traffic Metering
- ATMS05 HOV Lane Management
- ATMS06 Traffic Information Dissemination
- ATMS07 Regional Traffic Management
- ATMS08 Traffic Incident Management System
- ATMS09 Transportation Decision Support and Demand Management
- ATMS16 Parking Facility Management
- ATMS18 Reversible Lane Management
- ATMS19 Speed Warning and Enforcement
- and ATMS23 Dynamic Lane Management and Shoulder Use

5.3.5 Advanced Vehicle Safety Program Area

ITS User Needs from the Vehicle Safety Program Area that were identified as a priority for the Fresno County Region are listed in this subsection. Following each priority ITS User Need is a recommended strategy, or strategies, that could be implemented to address the priority ITS User Need. This Program Area is largely an emerging ITS function, with many elements still in the research stages. Additionally, the majority of the elements in the Program Area will be deployed in the vehicle, by the vehicle manufacturers, or by after-market suppliers. It is largely assumed at this time that the public sector role is in providing appropriate infrastructure support to the vehicle safety systems being developed by the private sector.

5.3.5.1 ITS User Need: Implement intersection collision warning/avoidance systems

The following ITS strategies are listed to support the implementation of intersection collision warning/avoidance systems.

ITS Strategy: Safety Warning System

These systems involve a group of technologies that provide a warning of a specific hazard to motorists. The suite of technologies is located primarily in the vehicle, but may also include some technologies on the roadside. At a high level, a properly equipped vehicle approaching a controlled intersection should have the ability to receive messages from roadside equipment that may include parameters such as signal phase and timing information, real-time traffic signal status, information on the geometry of the intersection, and location references such as global positioning system (GPS) coordinates. The vehicle driver would be issued a warning if the equipment in the vehicle, and/or at the roadside, determines that the vehicle is predicted to violate the upcoming traffic signal in a manner that is likely to result in a collision with another vehicle or object. This warning may be issued to provide the driver an opportunity to take corrective action to avoid the collision. Or the vehicle may have the ability to take

corrective action autonomously, potentially bringing the vehicle to a safe stop before it enters the intersection collision area.

5.3.5.2 Supporting ITS Architecture Service Packages

ITS Architecture Service Packages that support the user need and strategies discussed within the Vehicle Safety Program Area include the following:

- AVSS05 Intersection Safety Warning
- AVSS10 Intersection Collision Avoidance

5.3.6 Commercial Vehicle Operations Program Area

No Priority ITS User Need identified.

5.3.7 Emergency Management Program Area

ITS User Needs from the Emergency Management Program Area that were identified as a priority for the Fresno County Region are listed in this subsection. Following each priority ITS User Need is a recommended strategy, or strategies, that could be implemented to address the priority ITS User Need. A major concern for the ITS Stakeholders on Emergency Management are incidents caused by low visibility conditions. Seasonal fog and dust storms are a concern throughout the Central Valley of California. Stakeholders desire improvements to incident response, communication, and coordination. (from 1999 Plan). While some considerable effort has been undertaken in this area with the deployment of the Fog Detection and Warning System along SR-99, the Region's ITS stakeholders continue to seek out technology solutions to aid in Emergency Management

5.3.7.1 ITS User Need: Improve Incident Response

The following ITS strategies are listed to support the improvement of incident response.

ITS Strategy: Communications

Communication improvement strategies include two-way communications system between emergency vehicles and dispatchers as well as implementing common communications channels for multi-agency incident responses. In addition, integration with traffic management centers (TMC) will allow for improved communication with the public and related agencies. It would also allow the TMC to provide real-time traffic information to emergency responders. An incident data feed to emergency responders as well as sharing CCTV images/feeds would be part of this strategy.

ITS Strategy: Response Management System

An improvement to response management systems may include tracking of emergency vehicles using automated vehicle location (AVL) technology. Improving emergency dispatch with computer aided dispatch system is also an ITS strategy that will benefit response times and coordination.

ITS Strategy: Emergency Vehicle Preemption

Emergency Vehicle Preemption (EVP) is a technology that adjusts traffic signals to assist in safe and expedient passage of emergency vehicles upon approach. These systems detect approaching emergency vehicles with various communications technologies (radio, acoustic, infrared) and triggers a pre-planned response programmed into the traffic signal controller, allowing the emergency vehicle to progress through the intersection safely, while reducing delay.

ITS Strategy: Incident Detection Systems

This strategy aims for the user to request emergency assistance and the detection system to gather critical information and alert the appropriate emergency responders. This system can be manually triggered or automated to the vehicle. The detection system can also be integrated with the traffic management center or other surveillance systems to monitor public areas. The system would rely on GPS tracking, wireless communications, and a separate response center, which will notify the Public Safety Answering Point (PSAP) for emergency response. Automated in vehicle systems will notify the associated private operating entity which communicates to a PSAP.

5.3.7.2 ITS User Need: Provide Real-Time Traffic Information to Emergency Responders

The communications strategy outlined in Section 5.3.7.1 supports the user identified need of providing real-time traffic information to emergency responders.

5.3.7.3 ITS User Need: Improve Incident Detection

The incident detection system strategy outlined in Section 5.3.7.1 supports the user identified need of improving incident detection.

5.3.7.4 ITS User Need: Improve Communications in Rural Areas

The following ITS strategies are listed to support the improvement of communications in rural areas.

ITS Strategy: Communications

Communication improvement strategies include two-way communications systems between emergency vehicles and dispatchers, as well as implementing common communications channels for multi-agency incident responses. Installing additional communication towers in rural areas as well as expanding the fiber network to rural areas will improve existing communication systems.

5.3.7.5 ITS User Need: Reduce Incident Clearance Time

The communication and response management system strategies outlined Section 5.3.7.1 support the user need of reducing incident clearance time.

5.3.7.6 ITS User Need: Improve a multi-agency, System-coordinated Response to Major Incidents

The communication and response management system strategies outlined Section 5.3.7.1 support the user need of reducing incident clearance time.

5.3.7.7 Supporting ITS Architecture Service Packages

ITS Architecture Service Packages that support the user needs and strategies discussed within the Emergency Management Program Area include the following:

- ATMS01 Network Surveillance
- ATMS08 Traffic Incident Management System
- ATIS06 Transportation Operations and Data Sharing
- EM01 Emergency Call-Taking and Dispatch
- EM02 Emergency Routing
- and EM08 Disaster Response and Recovery

5.3.8 Maintenance and Construction Management Program Area

5.3.8.1 ITS User Need: Implement Smart Work Zone technology

The following ITS strategies are listed to support the implementation of Smart Work Zone technology.

ITS Strategy: Smart Work Zone

A Smart Work Zone system is comprised of computers, communications, and sensor technology to obtain, analyze, and communicate real-time traffic flow data to users. It is portable to be used on work zones and accurate as well as fully automated.

5.3.8.2 ITS User Need: Warn work crews of errant vehicles

The following ITS strategies are listed to support the implementation of a system to warn work crews of errant vehicles.

ITS Strategy: Safety Warning System

These systems involve a group of technologies that provide a warning of a specific hazard to motorists. An example of a system is one that can use speed detection technologies to determine if a vehicle is exceeding a safe speed for geometric roadway conditions within a work zone. A CMS system can be used to warn the user who may be unaware of upcoming geometric constraints. Other systems will need to integrate with in vehicle systems to warn of approaching vehicles.

5.3.8.3 Supporting ITS Architecture Service Packages

ITS Architecture Service Packages that support the user needs and strategies discussed with the Maintenance and Construction Management Program Area include the following:

- MO08 Work Zone Management
- MO09 Work Zone Safety Monitoring

6.0 FRESNO COUNTY REGION VISION STATEMENT

The development of a project vision statement is important for bringing focus and structure to the ITS planning process. The project vision statement features a picture of what the regional ITS program can become in the future and is an important tool for communicating to agency management and staff, the public, and the funding decision makers the intent of the ITS plan.

Both the 1999 Fresno County Plan and the 2001 Valleywide[1] Plan contained vision and goal statements that were leveraged for this ITS Plan update. The ITS vision and the goals and objectives from the 1999 ITS SDP were reviewed with the stakeholder group at a stakeholder meeting in order to obtain input from the stakeholder group. The statement reflects the work, input, and local knowledge of the group, and represents a common view of the role of ITS in addressing transportation issues in Fresno County.

During the first large group Stakeholder meeting, the project stakeholders were presented the vision statement from the 1999 Plan and asked to provide input on updating the vision statement. The following input was provided:

- Include all modes of transportation
- Include sustainability
- Include sustainability in the cost effective and efficiency sense
- Include goods movement
- Include transportation equity
- Final decision was to add all modes of transportation to the vision statement and to include sustainability and goods movement in the framework of the ITS plan and not the vision statement. Transportation equity is a social issue rather than a technological one therefore adding the modes of transportation was deemed sufficient.

The updated project vision statement reads:

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

6.1 VISION ELEMENTS

The overall Vision Statement is a high-level statement that allows the region to work through the Plan update process with an "end state" in mind. The following Vision Elements were

[1] The term "valleywide" is generally understood to mean the eight county San Joaquin Valley Region, which consists of Fresno, Kern, Kings, Madera, Merced, San Joaquin, Stanislaus, and Tulare counties.

documented and verified for a set of ITS functional areas for the purpose of bringing focus and clarity to those functional areas. The Vision Elements presented in the following paragraphs are based on vision statements developed in the San Joaquin Valley ITS Strategic Deployment Plan (September 2001). By their very nature, these Vision Elements are future-based and are meant to provide direction to the Fresno County Region ITS stakeholder group. The Vision Elements remain somewhat generalized, and high-level, though some examples are provided where pertinent systems or capabilities exist in the Fresno County Region.

6.1.1 Freeway Management

Caltrans has deployed multi-faceted freeway management systems in the metropolitan areas of Fresno County. These systems provide the ability to quickly identify traffic accidents and other incidents, and adverse weather and pavement conditions, and convey this information to travelers and other transportation agencies. The vision for freeway management is to expand the geographic coverage of the Caltrans traffic operations systems (TOS), enhance the Caltrans TOS by adding and upgrading equipment and capabilities, and promote closer coordination between Caltrans and traffic management staff at other local agencies. This vision must include more effective utilization of equipment currently deployed.

6.1.2 Arterial Management

The cities of Fresno and Clovis have led the way in local agency traffic management ITS deployment in the area. Previous efforts have focused on development of city-based Traffic Operations Centers (TOCs) and a robust fiber optic communications system that would improve traffic signal system operations and management. With a TOC now in place in the city of Fresno, the focus is expected to be on expansion of the fiber optic communications system, to be supplemented by wireless technologies. The focus will also be upon expanding the reach of the centralized traffic signal control system, implementing coordinated operations on key corridors throughout the Fresno-Clovis Metropolitan Area (FCMA), and implementing other local traffic management technologies. Similarly, the City of Clovis has developed a small-scale TOC at city hall, from which the city's traffic signal system (and other ITS field elements) can be monitored and controlled. These agencies have developed an overall Implementation Plan for local ITS elements. The overall vision for traffic management in the FCMA 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.

6.1.3 Incident Management

The incident management vision for the Fresno County 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 by geographic region. This vision also includes the promotion of real-time data sharing to improve all aspects of incident management. Quick and accurate verification followed by rapid dissemination of motorist information by ITS means will prevent secondary collisions, improve traffic flow, and reduce emissions.

6.1.4 Public Transportation

The transit ITS vision for the area focuses around increasing the capabilities and scope of the existing technology deployments at Fresno Area Express, Clovis Transit, and the Fresno County

Rural Transit Agency while building a simple, effective system for smaller fixed route properties and paratransit operations. The goal is to maximize compatibility between urban and rural systems throughout the valley. This vision also incorporates enhanced cooperation and coordination between transit agencies.

6.1.5 Traveler Information

The vision for traveler information in the area is to provide information based on the existing and expanding capabilities of the existing and planned transportation management systems, and at the same time, preparing for other traveler information deployment efforts. Traveler information must be timely and useful, providing traffic and weather conditions for commuters, commercial vehicles and visitors to the region. It should focus on incident, road weather, and tourist information and expand on previous efforts. Fresno Area Express (FAX) is currently providing transit traveler information through various channels, including trip planning via Google Transit, the recently launched FresGO application (app) and the Fresno Transit Free app. Both apps include FAX bus schedules.

6.1.6 Agency Coordination and Systems Integration

The systems integration vision for the area is based on previous successes. The concept is to utilize the national and statewide architectures as a basis, and then provide for coordinated deployments and standards within the County.

6.1.7 Commercial Operations

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

6.1.8 Travel Demand

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

6.1.9 Emergency Management

ITS infrastructure, along with companion decision support systems, have the capability to notifying authorities of the need to dispatch emergency vehicles and other resources to the site of collisions or incidents. The ITS infrastructure is supplemented by information from the public, as well as agency staff monitoring decision support systems and traffic management systems. Systems will coordinate the response from fire, police and medical agencies for fast response in the most appropriate manner. Other systems will coordinate the removal of incidents to promote the timely return of the travel network to optimal performance.

6.1.10 Air Quality

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

6.1.11 Intermodal and Multi-modal Cooperation

The future of the Fresno County Region starts with the mutual cooperation between transportation agencies. All agencies and transportation providers will work together to promote and encourage safe and efficient operation of the transportation network. These agencies/providers will work together to plan, design, implement and operate ITS systems.

7.0 OPERATIONAL CONCEPTS

The purpose for identifying Regional ITS Operational Roles and Responsibilities is to identify each stakeholder's current and future roles and responsibilities in the operation of regional ITS services in the Fresno County Region. Also known as the Operational Concept in the terminology of the National ITS Architecture, this section documents these roles and responsibilities for selected transportation service areas relevant to the needs of the region. It provides an "executive summary" view of the way the region's stakeholders will work together to provide ITS services. The Operational Concept is an element of the Regional ITS Architecture that is required by FHWA Rule 940.9(d)3 (the “Architecture Rule”).

7.1 ROLES AND RESPONSIBILITIES

This section of the document identifies each operating agency’s current and future roles and responsibilities in operating ITS systems in the Fresno County Region. The clearly defined operational roles and responsibilities help the agencies reach Fresno County Region ITS goals and objectives and also to realize the ITS vision for the region. Though the respective agencies are not committed to performing any or all of the identified roles and responsibilities, the roles and responsibilities are based on best practices, and are intended to be a guide to the optimal operation of ITS in the region.

The operational roles and responsibilities are categorized in nine transportation service areas. These nine service areas are consistent with the program areas from the National ITS Architecture, with the exception of the Vehicle Safety service area. These transportation service areas provide general classifications of what functions the agencies are providing, or may provide in the future. The nine service areas and their major functions are described below.

Archived Data Systems – Archived data systems provide the functions that collect, process, store and utilize transportation data including traffic data, accident data, maintenance and construction data, public transportation data, commercial vehicle data, emission data, parking data and others.

Transit Services – Transit Services represent the functions that plan, manage, operate and maintain transit services. It also includes the function that provides transit traveler information and collects and processes fare payments.

Traveler Information – Traveler information represents the functions that collect, process, store, and disseminate static and real time transportation information to the traveling public.

Traffic Management – Traffic management represents the functions that manage a broad range of transportation facilities including freeway systems, rural and suburban highway systems, and urban and suburban traffic control systems.

Parking Management – Parking Management represents the functions that provide enhanced monitoring and management of parking facilities and coordination between parking facilities.

Commercial Vehicle Operations – Commercial vehicle operations represents the administrative functions that support commercial vehicle credentialing, commercial vehicle tax collection, and commercial vehicle safety records and regulations.

Emergency Management – Emergency management represents the functions that provide emergency call taking, public safety dispatch, disaster response and evacuation, securing monitoring and other security and public safety-oriented services.

Incident Management – Incident management represents the functions that manage both unexpected incidents and planned events so that the impact to the transportation network and traveler safety is minimized. It includes incident detection and verification, appropriate incident response, and regional coordination between traffic management agencies, maintenance and construction management agencies, emergency management agencies and others.

Maintenance and Construction Management – Maintenance and construction management represents the functions that provide construction management and maintenance of roadways, including snow and ice removal.

The nine transportation service areas collectively provide essential ITS functions to support the Fresno County Region to realize its ITS Vision and reach the ITS goals and objectives that stakeholders identified to support the ITS Vision. The specific relationships among the transportation service areas and the ITS goals for the Fresno County Region are depicted in **Table 7-1**.

Table 7-1: Relationships between Transportation Services and Regional ITS Goals

Transportation Service Area	Fresno County Region ITS Goals					
	Enhance Productivity	Improve Safety	Improve the Environment	Increase Efficiency	Create a State of the Art Transportation System	Promote Sustainability
Archived Data Systems	✓				✓	✓
Transit Services	✓		✓	✓	✓	✓
Traveler Information	✓		✓	✓	✓	✓
Traffic Management	✓	✓	✓	✓	✓	✓

Transportation Service Area	Fresno County Region ITS Goals					
	Enhance Productivity	Improve Safety	Improve the Environment	Increase Efficiency	Create a State of the Art Transportation System	Promote Sustainability
Parking Management	✓			✓	✓	✓
Commercial Vehicle Operations	✓				✓	✓
Emergency Management		✓			✓	✓
Incident Management	✓	✓	✓	✓	✓	✓
Maintenance and Construction Management	✓	✓	✓		✓	✓

Table 7-2 presents each operating agencies' current and/or potential future roles and responsibilities in operating the ITS systems in the Fresno County Region.

Table 7-2: Operational Roles and Responsibilities

Stakeholder	Transportation Service Area	Roles and Responsibilities
American Ambulance	Emergency Management	• Operate the Fresno County EMS Communications Center • Response to emergency calls • Provide ambulance dispatch services for all ambulance requests in Fresno, Kings, and Madera Counties and fire dispatch services to the City of Fresno and City of Clovis Fire Departments • Coordinate emergency response with local emergency management and public safety agencies • Operate emergency vehicles. Some vehicles are equipped with AVL and MDT.

Stakeholder	Transportation Service Area	Roles and Responsibilities
California Department of Forestry and Fire Protection (CAL FIRE)	Emergency Management	• Share responsibilities with Fire Protection Districts within Fresno County for fire protection outside of incorporated areas in Fresno County
California Highway Patrol	Archived Data Systems	• Collect incident and emergency data • Provide incident and emergency data to the Fresno Region Archived Data Management System
California Highway Patrol	Commercial Vehicle Operations	• Exchange safety and/or security information with other agencies • Operate roadside inspection equipment for law and regulations enforcement • Participate in roadside vehicle inspection for law and regulations enforcement
California Highway Patrol	Emergency Management	• Coordinate emergency response with local emergency management agencies, public safety agencies, and/or transportation agencies • Support disaster response and recovery, and disaster evacuation • Operate CHP Fresno Dispatch Center. Provide emergency calls taking and dispatching CHP vehicles. Communicate with Caltrans District offices when Caltrans personnel, equipment, or materials are needed to support incident management and response to emergency calls • Provide disaster-related information to the public
California Highway Patrol	Incident Management	• Routinely patrol major roadways including interstates, US highways, and state routes, and enforce motor vehicle laws • Coordinate incident response with Caltrans and local emergency management agencies, public safety agencies, and/or transportation agencies, including road closure • Receive emergency calls for incidents and dispatch CHP vehicles responding to emergency calls • Jointly operate the Freeway Service Patrol (FSP) with Caltrans District 6 and Fresno COG to provide roadway assistance and incident management support
California Highway Patrol	Traffic Management	• Jointly operate the Central Valley TMC with Caltrans • Assist with traffic management during incidents and emergency events

Stakeholder	Transportation Service Area	Roles and Responsibilities
California Highway Patrol	Traveler Information	• Provide road conditions and incident information on public accessible website
Caltrans District 6	Archived Data Systems	• Collect traffic and incident data • Collect road weather conditions information • Provide traffic and incident data and road weather conditions to the Fresno Archived Data Management System
Caltrans District 6	Emergency Management	• Share information and personnel with County Emergency Operations Center for emergency response • Support disaster response and recovery, and disaster evacuation • Disseminate disaster-related information to the public
Caltrans District 6	Incident Management	• Operate CCTV cameras to detect, verify and monitor traffic incidents • Communicate traffic and incident related information to other agencies • Jointly operate the Freeway Service Patrol (FSP) with CHP and Fresno COG to provide roadway assistance and incident management support
Caltrans District 6	Maintenance and Construction	• Communicate maintenance and construction schedule and other related information with local agencies • Perform construction management • Operate RWIS system and collect road weather information along major roadways • Monitor road weather conditions and distribute information to local public safety agencies and transportation agencies
Caltrans District 6	Traffic Management	• Operate the Central Valley TMC • Operate traffic signals on State Highways • Responsible for traffic control on Interstates and State Highways • Communicate traffic related information to other agencies • Manage and control roadside equipment (including traffic signal system, CCTV, CMS, HAR, detection sensors, ramp meters, road weather stations, a fog warning system, and others) • Operate safety warning systems at key intersections • Coordinate freeway and arterial operations with local transportation agencies

Stakeholder	Transportation Service Area	Roles and Responsibilities
Caltrans District 6	Traveler Information	• Operate CMS and HAR to disseminate traveler information • Provide traveler information to local media outlets
Caltrans Headquarters	Archived Data Systems	• Operate Caltrans Performance Monitoring System (PeMS) • Collect and archive traffic, incident and weigh-in-motion data across all metropolitan areas for the state • Operate Statewide Integrated Traffic Records System (SWITRS)
Caltrans Headquarters	Emergency Management	• Provide statewide assistance to districts with managing contaminants and wastes encountered on highway projects and Caltrans properties
Caltrans Headquarters	Traveler Information	• Operate Caltrans QuickMap • Provide travel conditions information, including traffic congestion information, lane closures, incidents, posted CMS messages, and camera images to the public
City of Clovis	Archived Data Systems	• Collect traffic and incident data • Provide traffic and incident data and traffic signal timing plans to the Fresno Archived Data Management System
City of Clovis	Emergency Management	• Operate a CAD system for emergency response • Coordinate emergency response with local emergency management agencies, public safety agencies, and/or transportation agencies. • Support disaster response and recovery evacuations. • Provide disaster-related information to the public. • Provide emergency call taking (911) within the city jurisdiction and dispatch police, fire and EMS services.
City of Clovis	Incident Management	• Operate a CAD system for incident response • Coordinate incident response and road closures with local emergency management agencies, law enforcement agencies, and/or transportation agencies • Perform incident detection and verification for city streets using CCTV • Operate emergency vehicle preemption • Provide incident information to local public safety agencies • Provide resources when requested by emergency agencies

Stakeholder	Transportation Service Area	Roles and Responsibilities
City of Clovis	Maintenance and Construction	• Maintain city streets • Operate and maintain agency vehicle fleet • Provide roadway construction and restriction information on website
City of Clovis	Traffic Management	• Operate Clovis Traffic Operations Center • Communicate traffic related information to other agencies • Operate CCTV, detection sensors, variable speed limit displays, and other roadside equipment within city jurisdictions • Operate traffic signal systems within city jurisdictions • Operate safety warning systems at key intersections • Coordinate freeway and arterial operations with Caltrans and local transportation agencies
City of Clovis	Transit Services	• Operate a fixed-route service (Stageline) and a demand responsive service (Round-Up) • Operate surveillance cameras on-board buses • Operate electronic fare payment system • Manage and maintain bus fleet. Buses are equipped with AVL • Provide transit information via website and social media
City of Clovis	Traveler Information	• Provide traffic advisories, including roadway construction and restrictions on city website
City of Fresno	Archived Data Systems	• Collect traffic and incident data • Provide traffic and incident data and traffic signal timing plans to the Fresno Archived Data Management System
City of Fresno	Emergency Management	• Operate a CAD/records management system for emergency response • Operate AVL-equipped police and fire vehicles Coordinate emergency response with County and local emergency management agencies, public safety agencies, and/or transportation agencies • Support disaster response and recovery evacuations • Provide disaster-related information to the public • Provide emergency call taking (911) within the city and county and dispatch sheriff, police, fire and EMS service

Stakeholder	Transportation Service Area	Roles and Responsibilities
City of Fresno	Incident Management	• Operate a CAD/records management system for incident response • Operate AVL-equipped police and fire vehicles • Coordinate incident response and road closures with local emergency management agencies, law enforcement agencies, and transportation agencies. • Perform incident detection and verification for city streets using CCTV • Provide incident information to local public safety agencies • Provide resources when requested by emergency agencies
City of Fresno	Maintenance and Construction	• Communicate maintenance and construction schedule and other related information to local agencies • Manage maintenance and construction activities of city roads • Operate and maintain agency vehicle fleet • Under contract to Fresno County, maintain traffic signals that are not the responsibility of Caltrans, in the unincorporated areas of the county
City of Fresno	Parking Management	• Operate advanced parking management systems
City of Fresno	Traffic Management	• Operate Fresno Traffic Operations Center • Communicate traffic related information to other agencies • Operate CMS, CCTV, detection sensors, and other roadside equipment within city jurisdictions • Operate traffic signal systems within city jurisdictions • Operate safety warning systems at key intersections • Coordinate freeway and arterial operations with Caltrans and local transportation agencies
City of Fresno	Traveler Information	• Provide traveler information to the public via website and social media • Share traveler information to local media outlets
Fresno Area Express	Archived Data Systems	• Collect transit operations data • Provide transit operations data to the Fresno Region Archived Data Management System

Stakeholder	Transportation Service Area	Roles and Responsibilities
Fresno Area Express	Transit Services	• Operate fixed-route bus and paratransit services • Operate surveillance cameras and voice annunciators on-board buses • Operate electronic fare payment system • Operate a CAD system for fixed-route and paratransit services • Manage and maintain bus fleet. Buses are equipped with AVL and MDTs • Provide transit information via website, printed materials, kiosks, and a telephone information line • Provide transit information via social media and email/text alerts • Coordinate services with other transit service providers
Fresno Council of Governments	Archived Data Systems	• Manage state and federal traffic and transportation data collection and reporting programs for the Fresno County Region • Operate the Fresno Archived Data Management System • Collect and archive transportation data including traffic counts, incident information, transit data, etc.
Fresno Council of Governments	Incident Management	• Jointly operate the Freeway Service Patrol (FSP) with Caltrans District 6 and CHP to provide roadway assistance and incident management support
Fresno Council of Governments	Traveler Information	• Assist with planning and operation of a 511 traveler information system that includes Fresno County • Manage Valley Rides – a commuter ridematching program
Fresno County	Archived Data Systems	• Collect traffic, incident and emergency data • Provide traffic, incident and emergency data to the Fresno Region Archived Data Management System

Stakeholder	Transportation Service Area	Roles and Responsibilities
Fresno County	Emergency Management	• Manage the Fresno County EMS Communications Center • Provide ambulance dispatch services for all ambulance requests in Fresno, Kings, and Madera Counties and fire dispatch services to the City of Fresno and City of Clovis Fire Departments • Develop countywide emergency management plan addressing preparation, response, recovery and mitigation actions for all potential risks to the public • Coordinate emergency response with local emergency management agencies, public safety agencies, and/or transportation agencies
Fresno County	Incident Management	• Perform incident detection and verification using CCTV • Provide incident information to local public safety agencies • Provide resources when requested by emergency agencies
Fresno County	Maintenance and Construction	• Maintain roadway infrastructure of unincorporated Fresno County, including snow removal • Provide maintenance on agency vehicle fleet • Communicate maintenance and construction schedule and other related information to local agencies
Fresno County	Traffic Management	• Communicate traffic related information to other agencies • Operate CMS, CCTV, detection sensors, and other roadside equipment within county jurisdictions • Contract with the City of Fresno to operate and maintain traffic signal systems in the unincorporated areas of the county that are not the responsibility of Caltrans
Fresno County Fire Protection Districts	Emergency Management	• Share responsibilities with the California Department of Forestry and Fire Protection (CAL FIRE) for fire protection outside of the incorporated areas in Fresno County
Fresno County Rural Transit Agency	Archived Data Systems	• Collect transit operations data • Provide transit operations data to the Fresno Region Archived Data Management System

Stakeholder	Transportation Service Area	Roles and Responsibilities
Fresno County Rural Transit Agency	Transit Services	• Operate fixed-route services • Manage and maintain bus fleet. Some buses are equipped with AVL and tablets for communicating manifest and passenger information to the bus drivers. • Operate reservation software and manage bus and trip assignments • Coordinate services with other transit service providers
Fresno Metropolitan Flood Control District	Maintenance and Construction Management	• Operate flood sensors, snow sensors, precipitation sensors, seismic sensors, etc. throughout the Fresno County area
Local Jurisdictions	Archived Data Systems	• Collect transportation data including traffic counts, incident information, etc. • Provide transportation data to the Fresno Archived Data Management System
Local Jurisdictions	Traffic Management	• Communicate traffic related information to other agencies • Operate traffic signal systems within city jurisdictions • Operate CMS, speed warning systems, emergency vehicle preemption, and other roadside equipment within city jurisdictions • Operate CCTV and advanced traffic signal control software

8.0 FUNCTIONAL REQUIREMENTS

The purpose of documenting Regional ITS Functional Requirements is to provide an overview of the functional requirements for each of the ITS inventory elements and service packages (planned and existing) contained in the Fresno County Regional ITS Architecture. The functional requirements are generated from the Turbo Architecture database for the Region. These functional requirements are intended to be used in ITS project planning, definition, design, and deployment. Functional requirements are a key piece of the systems engineering process and are essential for developing systems and subsystems. Functional requirements explain WHAT a system is supposed to do, but not HOW it is done.

8.1 FUNCTIONAL REQUIREMENTS OVERVIEW

Functional requirements are descriptions of required functionalities for each inventory item. They are high level descriptions of functionality that, when used in a set of specifications for a specific project, help agencies procure, obtain, and contract with solution-providers that will meet their needs. Functional requirements are not product-specific, technology-specific, or communication media-specific.

Generic functional requirements that could apply to a system or service area can be found on the National ITS Architecture website (www.iteris.com/itsarch/). The process for finding general functional requirements related to a proposed project can be found in section 11.1.3.2 of this document (or section 3.3.2 of the Fresno County Regional ITS Architecture Use and Maintenance Plan; Deliverable 11 from this Plan update effort).

Specific functional requirements found in the Fresno County Regional ITS Architecture are intended to be helpful in producing specifications for Fresno County agencies during ITS project development. Agencies in the Fresno County Region can request a list of functional requirements related to a particular project or program directly from the Fresno Council of Governments (Fresno COG). Fresno COG will utilize the method described in section 11.1.3.2 of this document (How to find general functional requirements related to a proposed project) to collect the requirements specific to the request.

A complete listing of functional requirements for the Fresno County Regional ITS Architecture is provided in **Appendix D** of this document, which is a direct output from the Fresno County Regional ITS Architecture Turbo Architecture database. This appendix will only be provided electronically, as it is over 250 pages long. This information is also available on the ITS pages of the Fresno COG website, at the following Internet website address: http://www.fresnocog.org/intelligent-transportation-systems. Information in Appendix D is organized by the following categories in order to be able to search for applicable requirements for a specific project:

- Inventory Element Name ;
- Functional area; and
- Functional requirements.

If a stakeholder or inventory item is not defined for the specific agency owner being sought, it is possible that the inventory item is captured under one of the generic titles of:

- Financial Institutions
- Freeway Service Patrol Vehicles
- General On-Board Vehicle Equipment
- Local Jurisdiction Emergency Service Vehicles
- Local Jurisdiction Fire/Police
- Local Jurisdiction Maintenance Vehicles
- Local Jurisdiction Public Works
- Local Railroad Crossing
- Personal Computing Devices
- Private Information Service Providers
- Travelers
- Vehicle

The functional requirements are found by selecting the inventory item that would be included in the agency project and then selecting the applicable functional areas (or services) that the inventory item would provide to the agency or the traveling public. For example, in order to find the appropriate functional requirements for Caltrans speed and volume data to be shared with the Fresno Traffic Operations Center (TOC), Caltrans would follow the process of:

- Identifying “Caltrans D6/CHP Central Valley TMC” in their inventory list;
- Identifying the functional area that describes what the TMC is supposed to do, in this case “TMC Traffic Information Dissemination”; and
- Summarized to the right of the functional area will be the functional requirements associated with Caltrans D6/CHP Central Valley TMC providing that specific service.

As another example, for the installation of arterial DMS in the City of Clovis, the City of Clovis would follow the process of:

- Identifying “City of Clovis Dynamic Message Sign System” in their inventory list;
- Identifying the functional area that describes what the DMS is supposed to do, in this case “Roadway Traffic Information Dissemination”; and
- Summarized to the right of the functional area will be the functional requirements associated with Clovis DMS providing that specific service.

9.0 INTERFACES/ INFORMATION FLOWS

This section of the Strategic Deployment Plan provides an overview of the interfaces and information flows represented in the Fresno County Regional ITS Architecture. In the context of the National ITS Architecture and regional ITS architectures, interfaces are the physical and logical connections between systems and subsystems. Also in the context of the National ITS Architecture and regional ITS architectures, information flows are the information exchanged between interconnected systems and subsystems.

9.1 USE OF TURBO ARCHITECTURE

Turbo Architecture™ is a software application that supports development of regional and project ITS architectures using the National ITS Architecture as a starting point. It uses the Microsoft Access database application as the underlying foundation. Turbo Version 7.1 was released in coordination with, and corresponds to, the National ITS Architecture Version 7.1.

Information about existing and planned ITS (the ITS inventory) within a region can be entered into Turbo Architecture (Turbo) to represent the state of ITS within that region. Once this initial data input is complete, Turbo provides powerful customization tools that allow the user to customize the regional architecture to match their specific requirements. For example, in addition to the ITS services selection process, the Turbo user is also able to select which systems in the region's inventory interconnect to other systems in the region's inventory, based on certain criteria of the National ITS Architecture. This interconnection also extends to the selection of information flows between the interconnected systems.

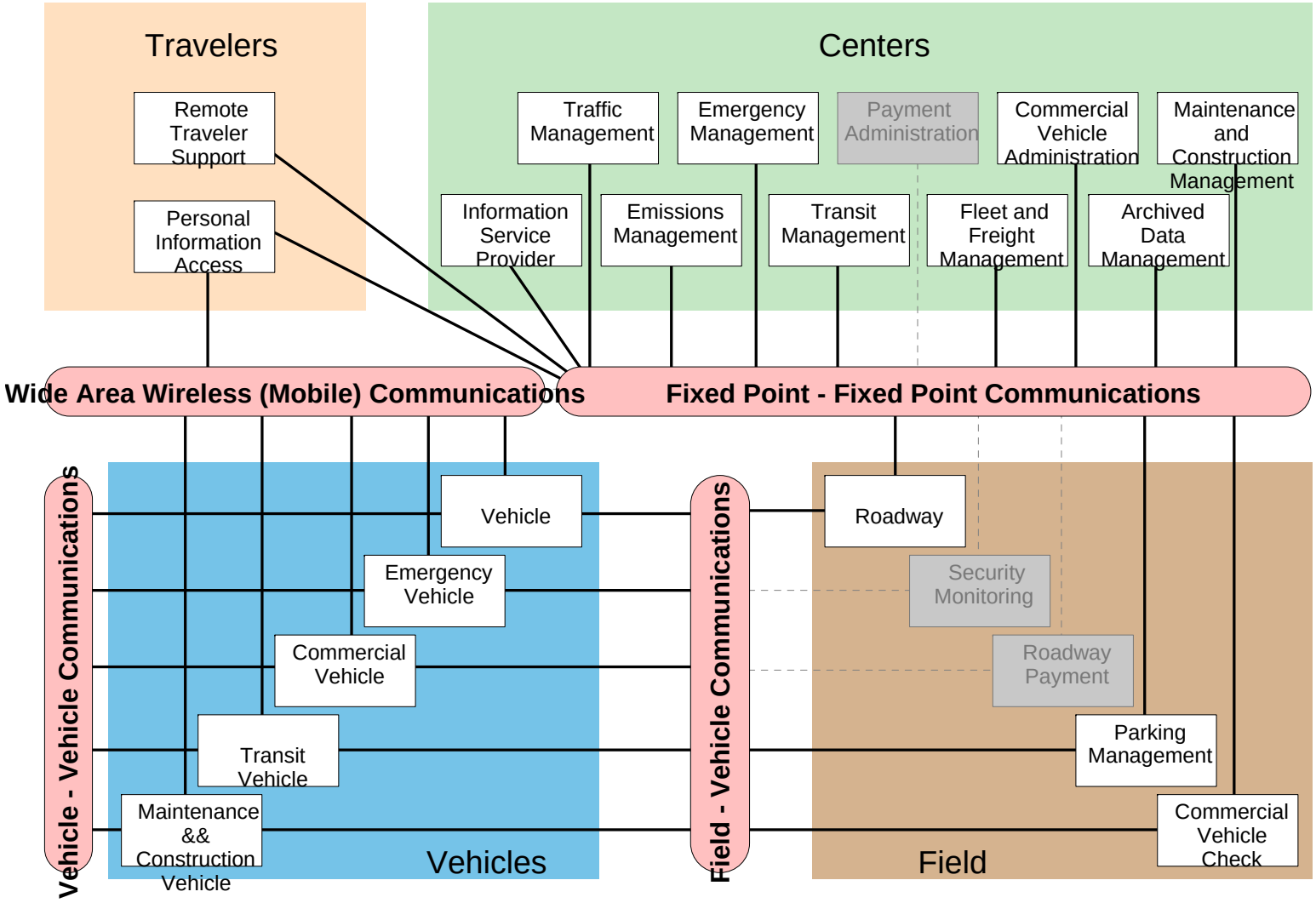
The user can extend the National ITS Architecture by adding their own information flows and transportation elements for those areas not covered by the National ITS Architecture. However, there was no such customization for this development of the Fresno County Regional ITS Architecture.

Many reports and diagrams are available from Turbo to display, print, or publish in other documents / formats. The following subsections discuss some of those reports and diagrams and also provide the key reports and/or diagrams for the Fresno County Regional ITS Architecture.

9.2 HIGH-LEVEL FRESNO COUNTY REGION ARCHITECTURE

Based on the systems inventory, the Service Package analysis and the Turbo Architecture data input work completed to date, **Figure 9-1** shows a high-level view of the Fresno County Regional ITS Architecture. This figure is the "sausage diagram" for the Fresno County Region that is generated from Turbo. It shows the four types of subsystems (Travelers, Centers, Vehicles and Field) represented in the Fresno County Regional ITS Architecture.

Figure 9-1: Fresno County Region High-Level Architecture



The white boxes in Figure 9-1 indicate that one or more of those types of subsystems are represented in the Fresno County Regional ITS Architecture. The status (existing or planned) of the subsystems represented in the Fresno County Regional ITS Architecture is not indicated in this diagram. Alternatively, the gray boxes indicate that there are none of those types of subsystems represented in the Fresno County Regional ITS Architecture. The bubbles between the subsystems represent typical communications media that are used by the subsystems to communicate between and among each other.

9.3 Fresno County Regional ITS Architecture Interconnect Diagrams and Information Flow Diagrams

Interconnect Diagrams and Information Flow Diagrams are standard outputs from Turbo. The Interconnect Diagram depicts how a particular element of a regional ITS architecture interconnects to other elements in the regional architecture. Interconnect diagrams are less detailed than Information Flow diagrams. The Interconnect Diagram simply shows a physical or logical connection between two or more elements in the architecture. An Information Flow diagram, on the other hand, shows the detailed information exchange between the elements. One line on an Interconnect Diagram between two systems may represent many lines on the Information Flow Diagram between the same systems.

Figure 9-2 is the Interconnect Diagram for the Caltrans District 6 Freeway CCTV inventory element, an Existing element in the Fresno County Regional ITS Architecture. The Interconnect and Information Flow Diagrams usually show the target Element in the center of the diagram with each of the interconnected elements surrounding it. In National ITS Architecture terminology, these are referred to as context diagrams. For Figure 9-2 you will notice that the Caltrans District 6 Freeway CCTV system is in the center of the diagram, with all of the other elements interconnected to the Caltrans District 6 Freeway CCTV system surrounding it.

The diagram may show interconnects that are Existing and Planned. It should be noted that, in the context of these Interconnect Diagrams, the term “Planned” does not necessarily indicate that a commitment has been made to establish the Planned interconnect in the future. More importantly, it does not commit any of the agencies to establishing the interconnect in the future. The term “Planned” merely indicates that the interconnect does not exist today; and that some consideration has been given by the stakeholders and/or the developers of the Turbo Architecture database to establishing that particular interconnect in the future. It does not necessarily mean that a project has been identified to establish the interconnect in the future.

Because of the volume of Interconnect Diagrams, they are not all contained in this report. However, they are all available at the following Internet website address: http://www.fresnocog.org/intelligent-transportation-systems. In lieu of the full set of Interconnect Diagrams being contained in this report, a full tabular listing of the interfaces in the Fresno County Regional ITS Architecture is contained in **Appendix E** (the Interface Report).

Figure 9-2: Interconnect Diagram for the Caltrans District 6 Freeway CCTV System

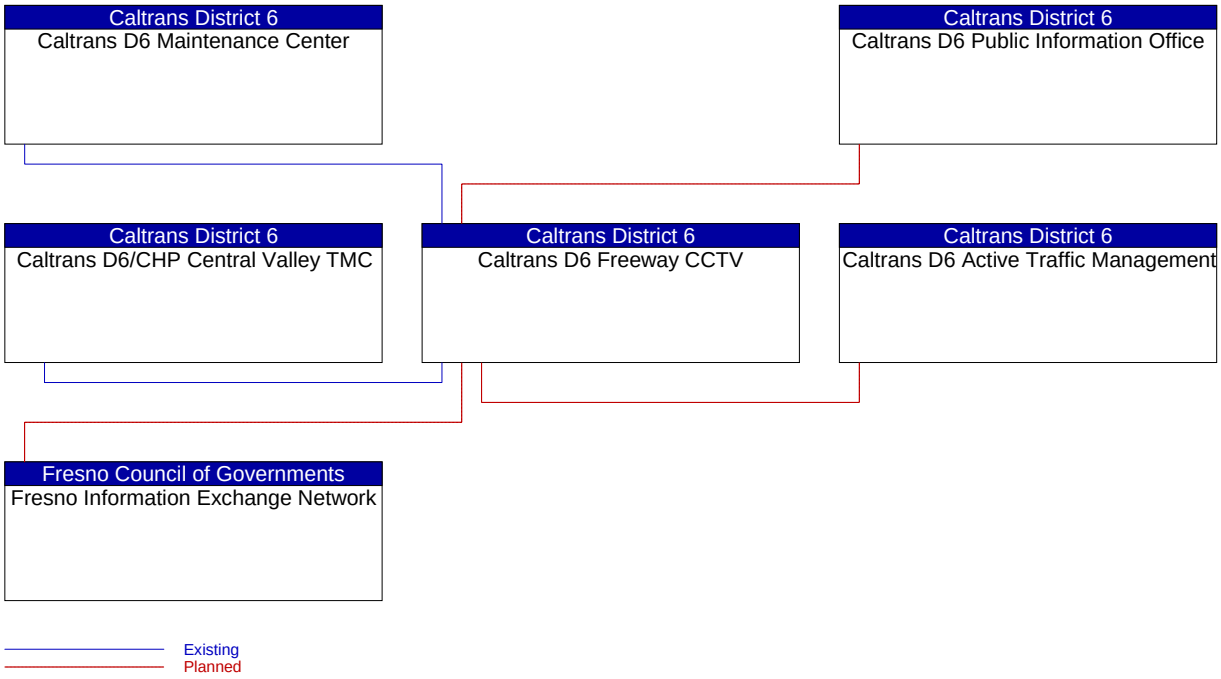
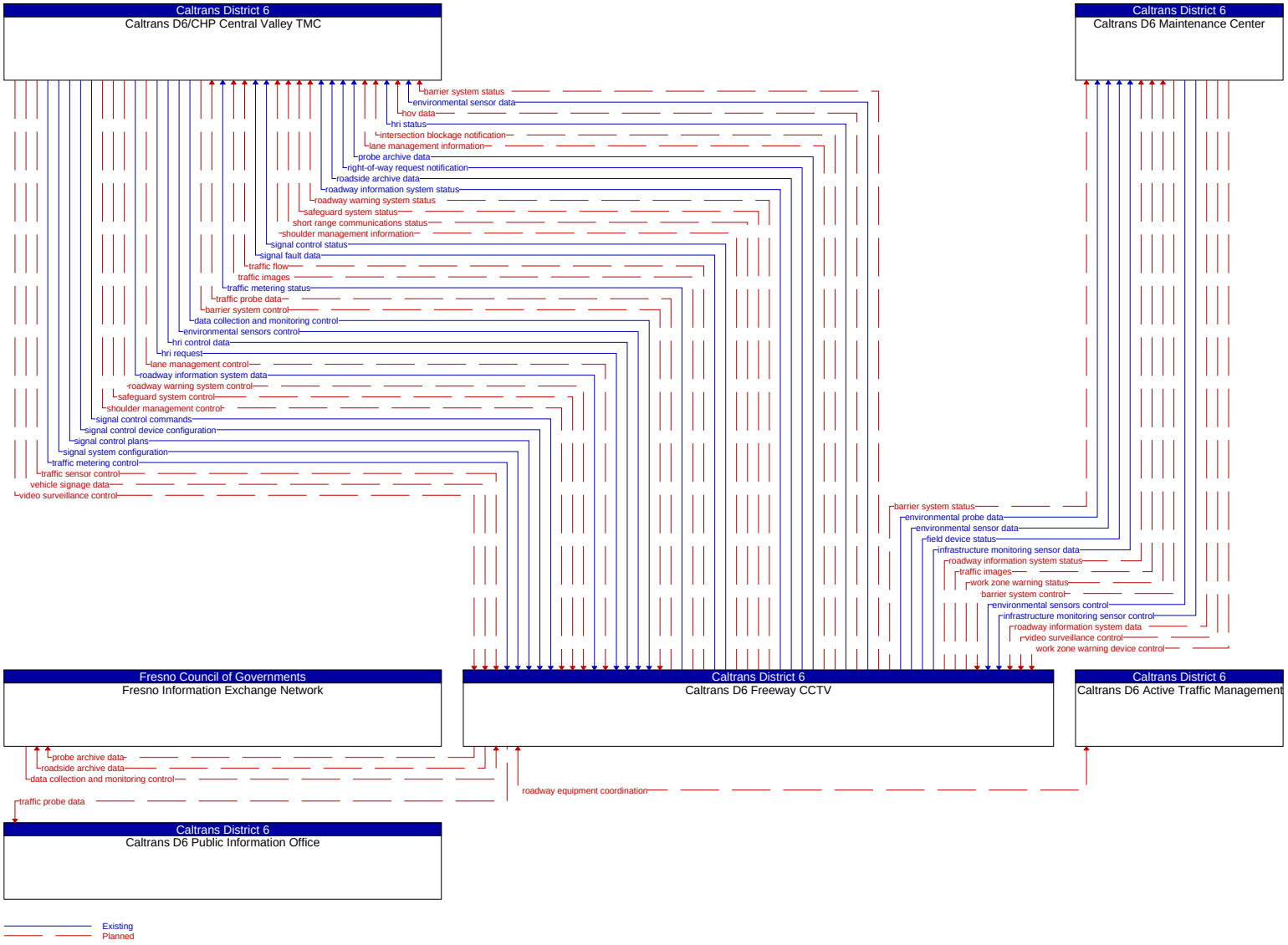


Figure 9-3 is the Information Flow Diagram for the Caltrans District 6 Freeway CCTV inventory element, an Existing element in the Fresno County Regional ITS Architecture. The Interconnect and Information Flow Diagrams usually show the target Element in the center of the diagram with each of the interconnected elements surrounding it. In National ITS Architecture terminology, these are referred to as context diagrams. For Figure 9-2 you will notice that the Caltrans District 6 Freeway CCTV system is in the center of the diagram, with all of the other elements interconnected to the Caltrans District 6 Freeway CCTV system surrounding it.

Notice that where there was only one line connecting the Caltrans District 6 Freeway CCTV system to each of the other Elements in the Interconnect Diagram (Figure 9-2), there are now several lines connecting the Caltrans District 6 Freeway CCTV system to each of the other Elements in the diagram.

The diagram may show information flows that are Existing and Planned. It should be noted that, in the context of these Information Flow Diagrams, the term “Planned” does not necessarily indicate that a commitment has been made to establish the Planned information flow in the future. More importantly, it does not commit any of the agencies to establishing the information flows in the future. The term “Planned” merely indicates that the information flow does not exist today; and that some consideration has been given by the stakeholders and/or the developers of the Turbo Architecture database to establishing that particular information flow in the future. It does not necessarily mean that a project has been identified to establish the information flow in the future.

Figure 9-3: Information Flow Diagram for the Caltrans District 6 Freeway CCTV System



Because of the volume and complexity of Information Flow Diagrams, they are not all contained in this report. However, they are all available at the following Internet website address: http://www.fresnocog.org/intelligent-transportation-systems. In lieu of the full set of Interconnect Diagrams being contained in this report, a full tabular listing of the Information Flows in the Fresno County Regional ITS Architecture is contained in **Appendix F** (Listing of Information Flows). This appendix will only be provided electronically, as it is over 340 pages long.

10.0 ITS STANDARDS

The primary purpose of this section is to identify the ITS Standards that are relevant to, and recommended for the Fresno County Region. A list of recommended ITS standards needed to implement a regional ITS architecture is a required element of the Federal Highway Administration (FHWA) and Federal Transit Administration (FTA) Final Rule/Policy on ITS Architecture and Standards. The resulting list of ITS standards is to be considered during deployment and implementation of ITS projects in the region. This section also provides an overview of ITS Standards, how ITS Standards are developed, and the use of ITS Standards in procurement of ITS.

10.1 RECOMMENDED ITS STANDARDS FOR FRESNO COUNTY

A key component of a regional architecture is the ability to exchange information between control centers and devices. Additionally, a frequent requirement is to allow for joint control of field devices such as cameras and changeable message signs. To be able to do this, however, requires the use of communications protocols that can be understood at each end of the transmission. Common protocols such as the National Transportation Communications for Intelligent Transportation System (ITS) Protocol (NTCIP) are recommended for use in the Fresno County Region. Additionally, other standards such as those for location referencing where all systems can comprehend each other's location references may be necessary at some point in the future.

NTCIP standards provide both the rules for communicating (protocols) and the vocabulary (objects) necessary to allow electronic traffic control equipment from different manufacturers to operate with each other as a system. NTCIP is the first set of standards for the transportation industry that allows traffic control systems to be built using a "mix and match" approach with equipment from different manufacturers.

Appendix G contains a summary listing of recommended ITS Standards for the Fresno County Region. The recommended standards are a direct output from Turbo Architecture. The recommended ITS standards are based on Architecture Flows contained in the regional ITS architecture.

A more detailed listing of the relevant ITS standards is available from Turbo Architecture, sorted alphabetically by the name of the Architecture Flow, then the source and destination of each instance of a particular Architecture Flow within the regional architecture. However, that version of the Standards Report is a rather lengthy appendix – over 400 pages long. Therefore, that version of the Standards Report will only be provided electronically to Fresno COG; and it can be obtained from Fresno COG upon request. Due to the high page count of the unabbreviated Standards Report, it is recommended that the Report NOT be printed in its entirety. It is recommended that ITS stakeholders find only those pages that are of interest to them, and print and / or review only those pages.

10.2 OVERVIEW OF ITS ARCHITECTURE AND STANDARDS

ITS standards are fundamental to the establishment of an open ITS environment, a goal originally envisioned by the U.S. Department of Transportation (USDOT) and are an important component of the information flows in a regional ITS architecture. National ITS standards are attached to each information flow (Architecture Flow in National ITS Architecture terms) and as such, this is how they are identified throughout the regional architecture for the Fresno County Region.

Use of non-proprietary ITS standards facilitates interoperability within a system and between systems at local, regional, and national levels without impeding innovation as technology advances and new approaches evolve. The National ITS Architecture is "technology neutral;" ITS standards for Architecture Flows between systems ensure consistency and compatibility between systems.

Establishing national and regional ITS standards for exchanging information among ITS deployments is important not only from an interoperability point of view, but it also reduces risk and cost since a region can select among multiple vendors for products and applications. ITS standards help create competition and better products and, potentially lower prices.

As of 2014, over 100 ITS standards and profiles are in various stages of development, but not all standards will be used in most regions. Even within Fresno County, not all agencies will use standards for ITS deployment. In order to conform to the FHWA / FTA Final Rule / Policy on ITS Architecture and Standards, the regional ITS architecture is required to reference those standards that are applicable to the region based on the types of information that will be exchanged between Elements in the regional architecture. The types of information that will be exchanged is based on the selected Architecture Flows between ITS Elements.

The standards that are most widely applicable to ITS deployments are the National Transportation Communications for ITS Protocol (NTCIP) family of standards. NTCIP is a joint product of the National Electronic Manufacturers Association (NEMA), the American Association of State Highway and Transportation Officials (AASHTO), and the Institute of Transportation Engineers (ITE).

NTCIP is a family of communication protocols and data definition standards that have been designed for use in all types of systems dealing with the transportation environment, including those for freeways, traffic signals, transit, emergency management, traveler information, and data archiving. It has been adopted by the FHWA to meet the needs and requirements for ITS communication and to ensure that inter-network connectivity is done through industry standard interfaces.

10.3 STANDARDS DEVELOPMENT ORGANIZATIONS

The ITS community recognized the advantages of standards and encouraged Standards Development Organizations (SDOs) to create ITS standards between the most critical ITS interfaces. The following is a list of SDOs that are developing ITS standards. Along with acronyms that show up repeatedly throughout the list of regional appropriate standards, this

listing shows the Internet website address for each organization, as well as a brief description of the organization:

- American Association of State Highway and Transportation Officials (AASHTO)
  - http://www.transportation.org
  - The American Association of State Highway and Transportation Officials (AASHTO) is a standards setting body that publishes specifications, test protocols, and guidelines that are used in highway design and construction throughout the United States. The association represents other transportation modes besides highways, which include air, rail, water, and public transportation.

- American National Standards Institute (ANSI)
  - http://www.ansi.org
  - The American National Standards Institute (ANSI) oversees the creation, promulgation and use of thousands of standards that directly impact businesses in nearly every sector of the United States and world economy. ANSI is a private, non-profit organization that administers and coordinates the U.S. voluntary standardization and conformity assessment system.

- ASTM International
  - http://www.astm.org
  - ASTM International, formerly known as the American Society for Testing and Materials (ASTM), is one of the largest voluntary standards development organizations in the world – a trusted source for technical standards for materials, products, systems, and services. ASTM International standards have an important role in the information infrastructure that guides design, manufacturing and trade in the global economy.
- Institute of Electrical and Electronics Engineers (IEEE)
  - www.ieee.org
  - IEEE is one of the leading standards-making organizations in the world. IEEE performs its standards making and maintaining functions through the IEEE Standards Association (IEEE-SA). IEEE standards affect a wide range of industries including, which include Information Technology (IT), telecommunications, and transportation. In 2013, IEEE had over 900 active standards, with over 500 standards under development.
- Institute of Transportation Engineers (ITE)
  - www.ite.org
  - The Institute of Transportation Engineers (ITE) is an international educational and scientific association of transportation professionals who are responsible for meeting mobility and safety needs. ITE facilitates the application of technology and scientific principles to research, planning, functional design, implementation, operation, policy development and management for any mode of ground transportation. ITE is also a standards development organization designated by the U.S. Department of Transportation (U.S. DOT). ITE's nine area-of-practice technical councils serve as forums to define issues and develop solutions. More than 100 activities currently underway by ITE Councils include the development of standards and recommended practices.

- National Electrical Manufacturers Association (NEMA)
  - www.nema.org
  - The National Electrical Manufacturers Association (NEMA) is the association of electrical equipment and medical imaging manufacturers. Its member companies represent a diverse set of industries, including power transmission and distribution, lighting, factory automation and control, and medical imaging. NEMA provides a forum for the development of standards that are in the best interests of the respective industries and users, policy and legislative advocacy, and collection, analysis, and dissemination of industry data.

- Society of Automotive Engineers (SAE)
  - www.sae.org
  - SAE International, initially established as the Society of Automotive Engineers, is a U.S.-based, globally active professional association and standards organization. Primary emphasis is placed on transport industries such as automotive, aerospace, and commercial vehicles. SAE International coordinates the development of technical standards based on best practices identified and described by SAE committees and task forces, composed of engineering professionals from relevant fields.

10.4 STAGES OF DEVELOPMENT OF A STANDARD

The Intelligent Transportation Systems Joint Program Office has established an industry-standard process to develop ITS standards. The process can vary slightly with each standards development organization (SDO) but the process is the same.

- The process begins with a proposed work item that must be approved by the SDO.

- Once approved, the working group develops a Working Group Draft of the standard.

- When the draft is ready, the User Comment Draft (UCD) is then balloted.

- The working group addresses and resolves the comments received at this stage by revising the standard. If comments have been satisfactorily resolved, the standard is then approved.

- An additional step — Jointly Approved Standard — is included for cases in which a standard is a joint project between several SDOs. The standard is Jointly Approved when it has been successfully balloted by all of the sponsoring SDOs.

- Following approval, the standard is published.

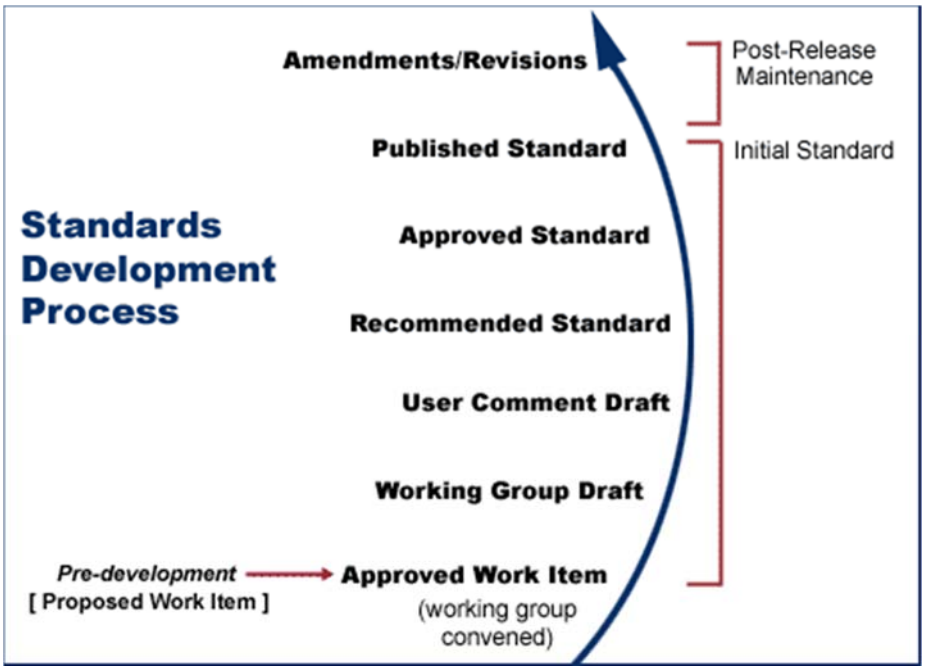
- Once published, time is needed for the market to adopt the standard. Manufacturers will then incorporate the standard into devices and systems, making this standards-based technology readily available to deployers. Deployers can choose to build standards-based systems directly from the standards themselves and/or incorporate standardized components from vendors.

- The standard continues to evolve as lessons are learned during its deployment. Amendments are approved by ballot and published.

- USDOT ITS Standards Program allows access to view current development status of standards supported by the program.

Figure 10-1 is meant to describe the series of steps to lead up to the publishing and testing of any given standard and the associated risks with specifying that standard as part of a procurement.

Figure 10-1[2]: Stages of Development of a Standard



10.5 ITS STANDARDS IN PROCUREMENT SPECIFICATIONS

The use of ITS standards in procurement specifications can reduce or minimize risk during procurement and deployment. Standards can be included in a procurement specifications by documenting all of the standards applicable to the ITS deployment. One must also specify definitions, references, options, and requirements, where applicable, for each standard to be used in the system. Proper use of ITS standards in procurement will then direct standards conformance and acceptance tests that the systems must pass. Vague statements to the effect that the systems must be "ITS standards compliant" or must "conform to" specific standards are not sufficient.

[2] https://www.standards.its.dot.gov/LearnAboutStandards/StandardsDevelopment

One resource that can be used for assistance with procurement specifications is NTCIP 9001 v04, also known as "The NTCIP Guide." NTCIP 9001 v04 is a publication developed to assist planners, specification writers, and implementers in understanding the various NTCIP standards publications, as well as how to use them. NTCIP 9001 v04 can be accessed on the NTCIP website at the following URL: https://www.ntcip.org/library/documents/pdf/9001v0406r.pdf

Other resources technical assistance resources provided by the U.S. Department of Transportation include the following:

- The ITS Standards Implementation Program
  - The Office of Operations, Federal Highway Administration (FHWA)
  - Offers ITS standards implementation resources, technical assistance, training, and guidance through the ITS Standards Implementation Program. The Standards Implementation Program is one of six program areas within the Office of Operations' Facilitating Integrated ITS Deployment Program.

- FHWA ITS Standards Program Field Support Team
  - The FHWA ITS Standards Field Support Team (SFST)
  - Provides short-term, on-call, technical assistance to support the adoption and use of ITS standards. The Team is composed of FHWA staff and experts from the private sector. Services are available to public sector staff at the Federal, State, and local levels.

- FHWA and FTA ITS Specialists
  - ITS assistance is available from the FHWA (Operations Deployment Team, FHWA Division Office or the FHWA Resource Center) or the FTA Regional Office.

- ITS Peer-to-Peer Program
  - The ITS Peer-to-Peer Program (P2P) provides short-term technical assistance to agencies facing ITS planning, procurement, deployment, and operational challenges. P2P is an important tool for transferring ITS knowledge, resources, and experiences with ITS technologies throughout the transportation industry and, specifically, among public agencies.
  - Eligible agencies include: State and local Departments of Transportation, •Transit agencies, Metropolitan and Statewide Planning organizations, Emergency and public safety organizations, and Motor carrier offices

- ITS Help Line
  - The ITS Help Line was established to assist the general transportation community to seek resources, websites, and documents that relate to Operations and ITS. The transportation community can call the toll-free Help Line at 866-367-7487; or send an email to: itshelp@volpe.dot.gov.

11.0 REGIONAL ARCHITECTURE USE AND MAINTENANCE

The purpose of the Maintenance Plan is to provide guidance to the Fresno County Region ITS stakeholders on how to use the newly updated regional ITS architecture for project planning and development, as well as how to maintain the newly updated architecture once this development process is completed. The Federal Highway Administration (FHWA) ITS Architecture and Standards Rule, and its companion Federal Transit Administration Policy, requires the development and documentation of a regional ITS architecture in metropolitan areas that are deploying ITS. Among the required elements of a regional ITS Architecture is the development and implementation of procedures and responsibilities for maintaining the architecture as needs evolve within the region on highways and transit systems. This document serves the purpose of documenting the procedures and responsibilities for maintaining the Fresno County Regional ITS Architecture.

11.1 USE OF THE REGIONAL ARCHITECTURE

The success of the Fresno County ITS Architecture is dependent upon effective use of the architecture once it is completed.

In order to get the most out of the regional ITS architecture, this Report introduces and expands on specific planning processes that already exist in the region and how the Fresno County ITS Architecture will be maintained to support those processes in the future.

11.1.1 Project Planning

The Fresno Council of Governments (FCOG) will be responsible for housing and maintaining the Fresno County Regional ITS Architecture. Being responsible for the architecture requires FCOG to be able to identify stakeholders, inventory, and service packages that are related to specific systems or projects when agencies request pertinent information.

In order to do this, the first step is to identify the type of service package(s) (e.g. transit, traveler information, emergency management, etc.) that are related to the project. Depending on the scope of the project, multiple types of service packages could be relevant and they should all be identified. For example, for a project involving the installation of dynamic message signs, the relevant service package types would be traveler information and emergency management. After service package types are identified, the specific service package(s) that describe the project must be identified. In continuing the example, the specific service packages that relate to dynamic message sign installation would be ATMS06 Traffic Information Dissemination, ATMS07 Regional Traffic Management, and EM06 Wide Area Alert.

Once specific service packages have been identified, the service package diagrams must be reviewed to make sure they are correct and not duplicating functionality with another service package. For each project, the following items should be considered and inputted into Turbo:

- Make sure all specific service packages that relate to the project are identified (i.e. ATMS06, EM06, etc.);

- A specific service package may be associated with multiple agencies, therefore, multiple instances of that service package will need to be created – once for each of the stakeholder agencies for which that specific service package is associated (i.e. an ATMS06 for City of Fresno, and ATMS06 for City of Clovis, etc.);
- Select the appropriate inventory items that are related to each specific service package;
- Select the appropriate stakeholder that owns the inventory item; and
- Check whether the data flow is planned or existing.

Following review of the service package diagrams, the updated diagrams should be passed along to the agencies who are implementing the project to ensure all stakeholders are involved and they have the proper information to determine if it will impact other projects. This is documented through the communications trail between the project sponsor and Fresno COG. It would be further documented in the change request form (discussed later in this document) and "before and after" versions of the service package diagrams.

11.1.2 Project Programming

The availability of an up-to-date regional ITS architecture allows jurisdictions to request federal project funding or programming as projects must be consistent with the area's regional ITS architecture to receive federal funds. This section discusses how stakeholders can determine if a project is consistent with the architecture.

In order to use the Fresno County Regional ITS Architecture to support project development, the agency must identify how the project contributes to or aligns with a portion of the architecture. This is a key step when using the architecture because it requires the agency to view the ITS project in the broader context of the entire architecture. Having an agency consider the wider architecture while the project's scope is being defined, forces them to consider the services, functionality, and integration opportunities that are envisioned by the Region as a whole. As mentioned previously, this step is also required to meet the FHWA Architecture Rule/FTA Architecture Policy.

The architecture should be used as early in the project development lifecycle as possible so that integration opportunities are considered. The architecture should be reviewed before firm project cost estimates are established so that there is still opportunity to adjust the scope in order to accommodate the regional functionality and interfaces identified in the Fresno County Regional ITS Architecture. This opportunity may occur before or after programming/budgeting, depending on how specifically the ITS project is defined in the programming/budget documents.

11.1.2.1 Federal and State Funding for ITS Projects

Any agency applying for and/or using, federal and/or state funds for ITS planning, design, and deployment will need to be familiar with, and utilize, administrative, programming, and project development procedures from Chapter 13 of the Caltrans Local Assistance Program Guidelines (LAPG). Chapter 13 of the LAPG provides guidance on the following key topic areas:

- The definition of ITS

- Required ITS project risk assessment procedures
- General ITS roles and responsibilities for the various funding, implementing, and oversight agencies in the region
- Step-by-step procedures of the funding process

As of January 2015, the most current version of the Caltrans Local Assistance Program Guidelines (LAPG) could be found on the Internet, at the following Uniform Resource Locator (URL):
http://www.dot.ca.gov/hq/LocalPrograms/lam/lapg.htm

As of January 2015, Chapter 13 of the LAPG could be found at the following URL:
http://dot.ca.gov/hq/LocalPrograms/ITS/ITS.htm

11.1.3 Project Design

When designing a project, functionality and ITS standards provide guidance and criteria to identify how the project will serve and connect the region's overall operations. As projects grow in size, the function and standards can become complicated and could require agreements between agencies. It is beneficial to be able to identify the agencies involved and the type(s) of agreement(s) needed early on in the project design.

This section describes how functional requirements were developed and where they can be found. There is discussion of standards that are in the Fresno County Regional ITS Architecture currently, standards that are envisioned to be needed or utilized in the future, and the applicability of the standards. Additionally, this section includes a discussion of agreements between stakeholders in the Fresno County Region that are currently in place, as well as those that may need to be developed to facilitate operations, coordination, information sharing, and integration.

11.1.3.1 How ITS infrastructure is shown in the architecture

The National ITS Architecture uses Service Packages to depict the current and future functionalities of ITS infrastructure, systems, management centers, and people (travelers, system operators, etc.). Elements that represent a source of multiple levels of information transfer are called "subsystems", which are grouped into four classes: centers, fields, vehicles, and travelers. **Table 11-1** provides descriptions from the National ITS Architecture for each subsystem and identifies examples of those subsystem in the Fresno County Region.

Table 11-1: Subsystem Definitions

Subsystem	Definition	Examples in Fresno County
Center	Provides management, administrative, and support functions for the transportation system. The center subsystems each communicate with other centers to enable coordination between modes and across jurisdictions.	Traffic Operations Centers Emergency Operations Centers Police/Fire Dispatch Centers

Subsystem	Definition	Examples in Fresno County
Field	Intelligent infrastructure distributed along the transportation network which perform surveillance, information gathering, and information dissemination and whose operation is governed by the center subsystem.	Traffic Signals CCTV Cameras Dynamic Message Signs Vehicle Detection Flood Sensors
Vehicle	Covers ITS related elements on vehicle platforms such as automatic vehicle location equipment and operations capabilities for portable field equipment.	Maintenance and Construction Vehicles Public Safety Vehicles Incident Response Vehicles
Traveler	Equipment used by travelers to access ITS services prior to a trip, including information service providers.	Internet Web Sites San Joaquin Valley 511

11.1.3.2 How to find general functional requirements related to a proposed project

Functional requirements are the detailed purpose of an inventory item to provide the services as described by their equipment packages. Equipment packages group inventory items together based on what overall function they serve and into deployment-sized pieces (for example: emergency dispatch, roadway basic surveillance, traffic data collection, and transit center fixed-route operations).

The functional requirements identified for this architecture were generated based on the inventory elements that were identified and the customization of the service packages.

The functional requirements can be found on the National ITS Architecture website (http://www.iteris.com/itsarch/). The following process should be followed to access requirements for specific inventory items:

- Select “Architecture” in the top left corner of the Home Page of the National ITS Architecture website
- Then select “Physical Architecture”
- The select the “Physical Entities” link in the text of the Physical Architecture web page
- From the two tables on the Physical Entities web page, select the subsystem or terminator for which you are seeking functional requirements
- A list of functionalities will be identified by the equipment package in which it is used

11.1.3.3 How to obtain specific functional requirements from the Fresno County Regional ITS Architecture

The need to obtain specific functional requirements from the Fresno County Regional ITS Architecture related to a specific project can be accommodated by requesting the information directly from the Fresno COG contact listed below. The Fresno COG contact will utilize the method described in section 11.1.1 - Project Planning to collect the requirements specific to the request. This is documented through the communications trail between the project sponsor and FCOG. It would be further documented in the change request form. One of the final products

would be a comparison of the "before" functional requirements to the "after" functional requirements.

The specific request will need to include:

- Identifying which specific service packages where the project is represented;
- Provide scope/description of the project;
- List the infrastructure involved;
- List the stakeholders involved; and
- List the purpose of the project (if not already captured in the scope/description of the project).

Contact information for the Fresno County Regional ITS Architecture is:
Name: Peggy Arnest
Email: parnest@fresnocog.org

A complete listing of functional requirements for the Fresno County Regional ITS Architecture is provided in Appendix D – Functional Requirements. Those functional requirements are an output from the Fresno County Regional ITS Architecture Turbo Architecture database. They are organized in the following hierarchy: stakeholder, inventory item, equipment package, then applicable functional requirements for that equipment package.

Table 11-2 provides examples of various potential ITS project proposals in the Fresno County Region, to help agencies find the location of information within the architecture that might be needed during the project development process, such as pertinent subsystems, service packages, equipment packages, and functional requirements for a given project. This will be useful as an agency applies for funding for various types of ITS projects. This sample information may be used to identify a project within the Regional ITS Architecture in order to illustrate Fresno County Regional ITS Architecture compliance. The table is not intended to be the Strategic Deployment Plan listing of projects. The table is merely intended to provide project examples and guidance for the architecture maintainer to find various types of information on future project proposals based on the type of project proposal that is brought forward.

Table 11-2: Example Project Type Mapping to Fresno COG ITS Architecture Components

Project Type	ITS Inventory	Subsystems	Associated Service Packages	Equipment Packages	Functional Requirements Example	User Services
Installation of new CCTV cameras/expansion of existing camera system and integrating the cameras to be operational from a control center.	CCTV, TMC	Roadway Subsystem, Traffic Management	ATMS01 - Network Surveillance	Roadway Basic Surveillance	The field element shall collect, process, and send traffic images to the center for further analysis and distribution.	1.6 Traffic Control 1.7 Incident Management
Installation of new DMS and integrating DMS to be operational from a control center.	DMS, TMC	Roadway Subsystem, Traffic Management	ATMS06 - Traffic Information Dissemination	Roadway Traffic Information Dissemination	The field element shall include dynamic messages signs for dissemination of traffic and other information to drivers, under center control; the DMS may be either those that display variable text messages, or those that have fixed format display(s) (e.g. vehicle restrictions, or lane open/close).	1.2 En-Route Driver Information
Synchronization of traffic signals along key corridor and integrating system to be operational from a control center.	Traffic Signals, TMC	Roadway Subsystem, Traffic Management	ATMS03 – Traffic Signal Control	Roadway Signal Controls	The field element shall control traffic signals at intersections and on main highways for urban and rural areas, under center control.	1.6 Traffic Control
Deployment of traffic detection for use at mid-block locations and intersections.	Vehicle Detectors, TMC	Roadway Subsystem, Traffic Management	ATMS01 - Network Surveillance	Roadway Basic Surveillance	The field element shall collect, process, digitize, and send traffic sensor data (speed, volume, and occupancy) to the center for further analysis and storage, under center control.	1.6 Traffic Control
TMC to TMC communications installation to facilitate interagency coordination	TMC	Traffic Management	ATMS07 - Regional Traffic Management	TMC Regional Traffic Management	The center shall exchange traffic information with other traffic management centers including incident information, congestion data, traffic data, signal timing plans, and real-time signal control information.	1.6 Traffic Control 1.7 Incident Management

Project Type	ITS Inventory	Subsystems	Associated Service Packages	Equipment Packages	Functional Requirements Example	User Services
Implement a project to archive data and send applicable information to a regional server for dissemination via 511 or another traveler information service.	TMC, Caltrans Department of Emergency Operations Center	Archived Data Management Subsystem	AD1 - ITS Data Mart AD2 - ITS Data Warehouse	ITS Data Repository	The center shall collect data catalogs from one or more data sources. A catalog describes the data contained in the collection of archived data and may include descriptions of the schema or structure of the data, a description of the contents of the data.	7.1 Archived Data
Installation of tracking devices on transit vehicles to facilitate schedule adherence	Transit Detectors, Transit Operations Center	Transit Vehicle Subsystem	APTS01 – Transit Vehicle Tracking	On-Board Transit Trip Monitoring	The transit vehicle shall track the current location of the transit vehicle.	2.1 Public Transportation Management
Installation of environmental sensors along roadways that monitor weather and roadway conditions	Environmental Sensors, Maintenance and Construction Center	Roadway, Maintenance and Construction Management	MC03 – Road Weather Data Collection	MCM Environmental Information Collection	The center shall remotely control environmental sensors that measure weather conditions including temperature, wind, humidity, precipitation, and visibility.	8.1 Maintenance and Construction Operations
Implementing a connection with ITS devices and information service providers to disseminate pertinent information to the public.	Local Changeable Message Sign, Highway Advisory Radio, San Joaquin Valley 511	Information Service Provider, vehicle, personal information access, remote traveler support	EM 06 – Wide Area Alert	Emergency Early Warning System, ISP Emergency Traveler Information, TMC Traffic Information Dissemination	The center shall track the availability of resources and coordinate resource sharing with allied agency centers including traffic, maintenance, or other emergency centers.	5.1 Emergency Notification and Personal Security
Installation of automated vehicle identification capabilities at port of entries to allow for higher speed weigh-in-motion process.	Caltrans Department of Motor Vehicles, Caltrans Weigh-In-Motion, Commercial Vehicles	Commercial Vehicle Check, Commercial Vehicle	CV 06 – Weigh-in-Motion	Roadside WIM, On-board CV Electronic Data	The commercial vehicle shall respond to requests to provide the identity, status and other information from the electronic cargo lock tag, if so equipped, to roadside check facilities, including border crossings.	4.4 Commercial Vehicle Administration Processes

Project Type	ITS Inventory	Subsystems	Associated Service Packages	Equipment Packages	Functional Requirements Example	User Services
Implement a project To disseminate applicable information via 511 or another traveler information service to the public.	San Joaquin Valley 511, travelers, Fresno Website, Other Information Service Providers	Information Service Provider, vehicle, personal information access, remote traveler support	ATIS 02 – Interactive Traveler Information	Interactive infrastructure information, ISP traveler data collection	The center shall collect, process, and store traffic and highway condition information, including incident information, detours and road closures, event information, recommended routes, and current speeds on specific routes.	1.1 Pre-trip Traveler Information

11.1.3.4 How to select communication standards that apply to the project

ITS standards define how system components interact within the overall framework of the National ITS Architecture. The use of standards ensures interoperability amongst various functions of an ITS project so that components or technologies from various vendors and at different scales (local, regional, and national) are still compatible. Standards also facilitate innovation in technology development without necessitating replacement of hardware or software systems that are needed to operate the new technology. Other purposes for ITS standards include:

- ITS standards used in a deployment can greatly reduce component development costs;
- ITS standards are open and non-proprietary, helping state and local transportation managers avoid costly single-source procurements and locked-in maintenance relationships with vendors;
- ITS standards support the deployment of interoperable ITS systems, helping agencies link together different types of ITS technologies and making system expansions easier to plan and implement; and
- ITS standards are being developed for many different types of ITS technologies and their use in project deployment is a key aspect of conformity with the Final Rule.

New standards that are developed go through an approval process before they are included in documents as formalized standards. Existing standards are amended and modified as needed based on new standards development or new technology development. Several national and international standards organizations are working toward developing ITS standards for communications, field infrastructure, messages and data dictionaries, and other areas. The organizations participating in ITS standards activities include:

- AASHTO (American Association of State Highway and Transportation Officials)
- ANSI (American National Standards Institute)
- APTA (American Public Transportation Association)
- ASTM (American Society for Testing and Materials)
- IEEE (Institute of Electrical and Electronics Engineers)
- ITE (Institute of Transportation Engineers)
- NEMA (National Electrical Manufacturers Association)
- SAE (Society of Automotive Engineers)

A listing of ITS standards that are pertinent to the Fresno County Regional ITS Architecture is contained in the Strategic Deployment Plan, near the prioritized project listing. That listing is taken from the Fresno County Regional ITS Architecture Turbo Architecture database, and represents ITS Standards that need to be considered in the Fresno County Region.

11.1.3.5 What agreements may be needed to support a proposed project?

Institutional agreements can support ITS functionality and project development in the region. Agreements allow agencies to document the roles and responsibilities of the particular service or function that is being agreed to, as well as any obligations each agency has for maintenance, operations, or financial support.

There are no existing agreements governing ITS activities in place in the Region. There is some interagency ITS coordination currently taking among a small group of stakeholders, but these activities are being done informally. The Region is aware of the need for formal agreements, and has begun some preliminary discussion within the Region about what needs to formalize those activities. Specifically, sharing of communications infrastructure (mostly fiber optic cable) between the City of Fresno and Caltrans, and between the City of Fresno and the City of Clovis. Agreements related to multijurisdictional traffic signal synchronization are also needed.

Fresno COG has been provided with some sample agreements from elsewhere in California, which may be of assistance in getting formal agreements in place. The Memorandum of Understanding (MOU) for the Fresno Regional E-Government System (E-Gov) may also be a model that can be used for the Fresno County Regional ITS Stakeholders to enter into formal ITS agreements. The E-Gov System is a Fresno County-based system that automates, as much as possible, the processes for obtaining routine government permits, or making application for such permits, including building permits, plan checks, encroachments permits, grading permits, land use entitlements, and other such administrative processes. While the activities conducted under the E-Gov MOU are different from ITS activities, the agreement itself may be leveraged to more efficiently get formal ITS agreements in place in the Region. Fresno COG will work with the ITS stakeholders around the Region to get formal ITS agreements in place.

Table 11-3 provides a list of potential agreements based on the types of interfaces identified in the Fresno County Regional ITS Architecture. It is important to note that as ITS services and systems are implemented or expanded in the region, part of the planning and review process for those projects should include a review of potential agreements that would be needed for implementation or operations. These agreements are not specified for specific projects because the possibility of coordination/sharing/joint operations should be evaluated on every project. The table also identifies the agency/agencies for which each agreement would be beneficial.

Table 11-3: Potential Agreements that Support Existing/Future Coordination Shown in Architecture

Agreement and Agencies	Agreement Description
Data Sharing and Usage (Internal Public Divisions)	
TMC/EOC TMC/Police TMC/Fire TMC/Public Works	This agreement would define the parameters, guidelines, and policies for intra-agency ITS data, road restriction, maintenance activity and work zone activity information sharing. This data sharing would support regional activities related to traffic management, incident management, work zone notifications, traveler information, and other functions. The terms of this agreement should generally address such items as: ▪ Types of data and information to be shared – camera feeds, roadway restrictions, detector information, incident and special event information, maintenance activity ▪ How the information will be used (traffic incident management, displayed on web site for travel information, distributed to private media, etc.) ▪ Parameters for data format, quality, security ▪ Frequency of sharing data
Data Sharing and Usage (Public Agency-Public Agency)	
TMC/TMC TMC/Transit TMC/Police TMC/Fire TMC/EOC TMC/Airport	This agreement would define the parameters, guidelines, and policies for data sharing and usage of ITS-related information from public agency to public agency. Because this agreement is with external entities, it will likely be in the form of a Memorandum of Understanding or Inter-Governmental Agreement. This type of agreement is recommended to define terms of use for distributing public-agency information regarding: ▪ Traffic conditions ▪ Traffic signal timing plans ▪ Road closures and restrictions ▪ CCTV camera images ▪ Data sent to data warehouses or data archive servers ▪ Work zone information ▪ Public safety coordination with traffic management ▪ Transit coordination with traffic management In specific, coordination among jurisdictions for traffic signal timing to improve overall flow and progression along multi-jurisdictional corridors is a priority for this region.
Shared Video Monitoring (Public Agency-Public Agency)	
TMC/Police TMC/Fire TMC/EOC	This agreement would enable shared video monitoring of CCTV by public safety and neighboring jurisdictions for incident and traffic management purposes. This agreement would define the parameters and policies for public safety and other transportation agencies to access video images. It is recommended that the agreement include any established or newly developed policies relating to video images (including archiving, privacy, disclaimers, use of video and redistribution) as well as processes for agency requests for specific views. Shared video monitoring does not address shared use or shared control of video equipment functions. There might be some cost incurred for infrastructure, systems or fiber to enable communications between agencies, particularly with the high bandwidth required for transmitting live video images. Lower bandwidth video images such as screen-shots could also be considered for sharing.

Agreement and Agencies	Agreement Description
Joint Operations/Shared Control Agreements (Public Agency-Public Agency)	
TMC/TMC TMC/Police	This agreement is a formal arrangement to allow joint operations or control of certain systems and equipment. This agreement will allow the other TMCs or public safety to control certain devices such as permanent DMS and CCTV cameras in incident or emergency situations and in after-hours operations. The agreement would need to define the terms of this arrangement, such as hours of operation and time of day/day of week where shared control would take effect, circumstances or incidents where shared control would take effect, system requirements for each agency to be able to share device control, definition of permissions with device control, etc. Traffic signals are typically not included as part of a joint operations strategy. Agencies have typically determined that sharing access to traffic signal timing plans will enable enhanced corridor management and operations among multiple partners, but that actual control of signals or changing timing plans on traffic signals by another jurisdiction is not permitted.
Multi-jurisdictional Traffic Signal Synchronization (Public Agency-Public Agency)	
TMC/TMC TMC/Public Works	These agreements establish the roles and responsibilities for multi-jurisdictional traffic signal coordination and synchronization. Traffic Signal Synchronization may include parameters such as roles and responsibilities, delegation of duties, allocation of costs, cycle lengths (ranges by corridor), progression goals, and incident/special event signal timing procedures.
Emergency Coordination Agreements (Public Agency-Public Agency)	
TMC/Local EOC, Fire, Police, County or State EOC	This agreement would establish the roles and responsibilities of a TMC in supporting emergency coordination for disasters or threats requiring evacuation or other mass coordination efforts. May include sharing requirements of CCTV video images by emergency management agencies. Such an agreement could be put into place to formalize the traffic signal coordination activities between the City of Fresno and Caltrans, and between the City of Fresno and the City of Clovis.
Fiber Sharing Agreements (Public Agency-Public Agency)	
TMC/TMC	This agreement would establish the requirements and security needs of each agency in sharing fiber cable to connect to their respective devices. Cost sharing should be delineated in the agreement as well as network maintenance / management on the fiber infrastructure. Such an agreement could be put into place to formalize the fiber sharing arrangements between the City of Fresno and Caltrans, and between the City of Fresno and the City of Clovis. These agreements are developed to define the roles and responsibilities of the agencies for the actual sharing of fiber and should outline cost sharing that established the fiber sharing path.

11.1.4 Regional Planning

The ITS Strategic Deployment Plan supports the Regional Planning process by providing an ITS-specific vision for the region, and its consistency with the current (2014) Regional Transportation Plan / Sustainable Communities Strategy (RTP/SCS). This ITS-specific vision is furthermore supported by ITS-specific goals and objectives, which have been vetted by representatives of the same agencies that collaboratively develop the RTP/SCS. The ITS Strategic Deployment Plan also supports the Regional Planning process by documenting ITS strategies and projects for incorporation into the next update of the RTP/SCS.

11.2 Regional ITS Architecture Maintenance

The Fresno County Regional ITS Architecture is a dynamic plan that documents current and future ITS infrastructure and plans throughout Fresno County, as well as the systems' relationships with other agencies and systems. To stay consistent with changing needs and evolving technologies, the architecture and database will require periodic updates as the ITS

program evolves. In order to maintain and upkeep the architecture, regular maintenance should occur, especially as projects are implemented or expanded, agency priorities change, or other changes occur that impact ITS in the various jurisdictions. The architecture maintenance plan outlined in the following subsections acts as a control mechanism for maintaining order, while updating the architecture. It also outlines a process for keeping the architecture up-to-date over time.

This maintenance plan is laid out in two parts, both of which provide instructions for making changes to the architecture. The first section is built for stakeholders to use in order to identify when updates are needed in the architecture. The second section of the maintenance plan was built for the person in charge of maintaining the architecture and database; a Regional ITS Architecture Maintenance Committee at Fresno COG will assume this responsibility. This section of the plan proposes a process to be used when reviewing updates that are submitted by stakeholders.

11.2.1 Purpose for Maintenance

The Fresno County Regional ITS Architecture and database are dynamic planning tools that are subject to change as ITS needs and infrastructure evolve in the County. New projects that are planned or constructed each year may change the status or existence of inventory elements and information flows that are currently represented in the architecture. As changes occur, portions of the architecture documents and database will need to be updated accordingly. These changes should be initiated by the stakeholders as the need arises and should be submitted to Fresno COG via e-mail for inclusion in the next ITS architecture update. The Fresno County Regional ITS Architecture would need to be updated for any of the following reasons:

- **New Stakeholders** – New stakeholders become active in ITS. If this occurs, the architecture documents and database should be updated to reflect the new stakeholder's place in the local network of ITS elements, interfaces, information flows, and participation in regional activities. For example, new transportation modes and new transportation services might arise that touch the systems of additional stakeholders.
- **Changes in Scope of Services Considered** – The range of services that are provided in the region expands to new functionalities and new uses of technologies not already covered by the current architecture.
- **Changes in Other Architectures** – The Fresno County Regional ITS Architecture should be coordinated with the Caltrans Statewide ITS Architecture. Changes in the statewide ITS architecture may necessitate changes in the architecture for the Fresno County Region to maintain consistency between them. Changes to the Caltrans Statewide ITS Architecture should be communicated to Fresno COG (and other affected stakeholders) by the maintainer of that architecture so that there can be coordination between the Caltrans Statewide ITS Architecture and the Fresno Regional ITS Architecture. Similarly, changes to the San Joaquin Valley ITS Architecture should be communicated to Fresno COG (and other affected stakeholders) by the maintainer of that architecture so that there can be coordination between the San Joaquin Valley ITS Architecture and the Fresno Regional ITS Architecture. Fresno GOG should also be cognizant of the need to notify the maintainers of neighboring and overlapping ITS architectures when changes are made to the Fresno County Regional ITS Architecture, so

that those architectures can be assessed and updated as appropriate. The coordination can take place via existing forums and/or processes utilized by Fresno COG for interregional coordination on other subject matters. Any impacts to the Fresno Regional ITS Architecture by neighboring or overlapping ITS architectures would be coordinated with Fresno County ITS stakeholders, by Fresno COG, following the processes established in this Use and Maintenance Plan.

- **Changes due to Project Definition or Implementation** – A project may add, subtract, or modify elements, interfaces, or information flows when actually defined or implemented, and these changes need to be reflected in the architecture. The architecture is meant to describe the current, as well as future implementation of ITS, thus it must be updated to accurately reflect how any newly deployed projects integrate into the region's systems.
- **Changes due to Project Addition/Deletion** – Occasionally a project will be added or deleted from the architecture due to funding, planning processes, or through project delivery. This could change the status or existence of inventory items, information flows, and service packages in the architecture and database.

11.2.2 Frequency and Process of Review/Updates

There is no fixed time period or exact event dictating when the regional ITS Architecture **should** be updated. Even when a change occurs, it does not necessarily require that the architecture be updated immediately. For example, it is not necessary to update the architecture just because a new version of the U.S. National ITS Architecture is released. Similarly, if there are no significant changes in policies or in the status of the deployment of ITS in the region, it may not be necessary to update the architecture for several years. Fresno COG, in association with the ITS stakeholders in the Fresno County Region, would determine what constitutes "significant changes" on a case by case basis. However, it is important to ensure that the architecture continues to accurately represent ITS in the region, and that the architecture remains compliant with federal requirements.

It will be important to periodically review the architecture, even though a major update might not necessarily be warranted. A recommended review and update cycle is presented below:

- **Annual Review** – The Fresno County Regional ITS Architecture will be checked annually, and updated it if necessary, to make minor corrections and modifications to reflect any changes to existing or future ITS projects that might have occurred. These modifications may be a result of changes in project status, emergence of new stakeholders, or updates to agency agreements. Modifications may also result from projects being implemented (changing status of data flows from "planned" to "existing"). This review will be led by Fresno COG. It is recommended that Fresno COG compile and distribute any architecture Change Request Forms that have been received over the past year to stakeholders for review prior to the annual review meeting. This will provide stakeholders with the opportunity to discuss any changes needed to the architecture. Fresno COG will consider changes stemming from the annual reviews in conjunction with more comprehensive updates to the Fresno County Regional ITS Architecture that are coordinated with updates to the Regional Transportation Plan (RTP).

- **Comprehensive Update** – Fresno COG will coordinate a more thorough update of the Fresno County Regional ITS Architecture in coordination with the update of the RTP, as needed. With minor updates and modifications occurring in the interim, this Comprehensive Update would address new or adjusted projects outlined in the funding programs being included in the Fresno County Regional ITS Architecture, as well as identify significant changes or additions that could affect multiple stakeholders. It is recommended that this Comprehensive Update include input from the stakeholders, either through a workshop format, individual phone calls, or smaller focus groups. Proposed updates and revisions to the Fresno County Regional ITS Architecture should be reviewed by the affected stakeholders for consensus.

As mentioned in the first bullet, stakeholders should complete and submit a Change Request Form when they anticipate or identify a possible change to the architecture. This request should be submitted to Fresno COG, and should include the following information:

- Contact information of the individual proposing the change: name, title, agency, email, fax number, and phone number;
- Date;
- Short description of proposed change (a title up to 25 characters);
- Detailed description of proposed change. (What is to be added, deleted, or modified?);
- Type of change proposed (e.g. new project, new stakeholder, etc.);
- Name of system(s) or project(s) being implemented or modified (if applicable);
- Status:
    - Proposed (want to implement but has not yet secured funding for the project);
    - Planned (secured funding for the project);
    - Under Construction (currently deploying the system); or
    - Existing (deployed the system and it is currently operational).

The Change Request Form is included in **Table 11-4**. A copy of the form can be sent via e-mail or fax to:
Name: Peggy Arnest
Email: parnest@fresnocog.org
Fax: 559-233-9645

Fresno COG will designate a Regional ITS Architecture Maintenance Committee that will be responsible for reviewing information contained in the submitted Change Request Forms and approving and/or recommending the corresponding updates within the Fresno County Regional ITS Architecture. By default, the Regional ITS Architecture Maintenance Committee will be made up of a representative from each of the following agencies:

- Fresno COG
- Caltrans District 6

- City of Fresno
- City of Clovis
- County of Fresno
- Fresno Area Express
- Clovis Transit
- Fresno County Rural Transit Agency

Fresno COG will also encourage the participation of at least one representative from the group of smaller cities outside of the Fresno-Clovis Metropolitan Area.

The Regional ITS Architecture Maintenance Committee will operate in a transparent manner. Any parties that are impacted directly, or indirectly, by any matters that come before the Committee will be engaged in open discussion to ensure full understanding of all matters that come before the Committee, by all affected parties. All ITS stakeholders in the Fresno County Region will be notified about change requests that come before the Committee, and will be given an opportunity to provide input into the process. All ITS stakeholders in the Fresno County Region will be notified of the final disposition of matters deliberated by the Committee. In addition, Fresno COG will notify the maintainers of neighboring and overlapping ITS architectures when changes are made to the Fresno County Regional ITS Architecture, so that those architectures can be assessed and updated as appropriate.

A flow chart outlining the thought processes that the Committee should go through when reviewing a Change Request Form has been developed to assist the Fresno COG Regional ITS Architecture Maintenance Committee in determining whether an architecture update is necessary. The flow chart has two questions to help identify if stakeholders agree on the change that is being requested, what impact the change will have to the physical architecture, and what discussions should occur in specific situations. For each change request form, both questions should be reviewed in their entirety.

The committee should use the following processes responding to two specific questions as described in **Figure 11-1** and **Figure 11-2** when reviewing each Change Request Form for approval.

Table 11-4: Change Request Form

Stakeholder Proposing Change	Name		Title	
	Agency			
	Email			
	Phone No.		Fax No.	
Date				
Description of Change	Title	*Short Description (up to 25 characters)*		
	Detailed Description	*(What is to be added, deleted, or modified? Attach additional documentation if necessary)*		
	Type of Change	☐ New Service Package ☐ Deleted Service Package ☐ Modified Service Package or Data Flow (attach mark up or sketch)	☐ New/Changed Stakeholder ☐ Change in Project Status (planned now existing) ☐ Other	
	Systems or Projects	*Name of System(s) or Project(s) being implemented or modified (if applicable)*		
Project Status	☐ PROPOSED (funding not yet secured) ☐ PLANNED (funding secured) ☐ UNDER CONSTRUCTION (stakeholder is currently deploying system/project) ☐ EXISTING			

Figure 11-1 – Fresno COG Architecture Update Review Process – Agreement Question

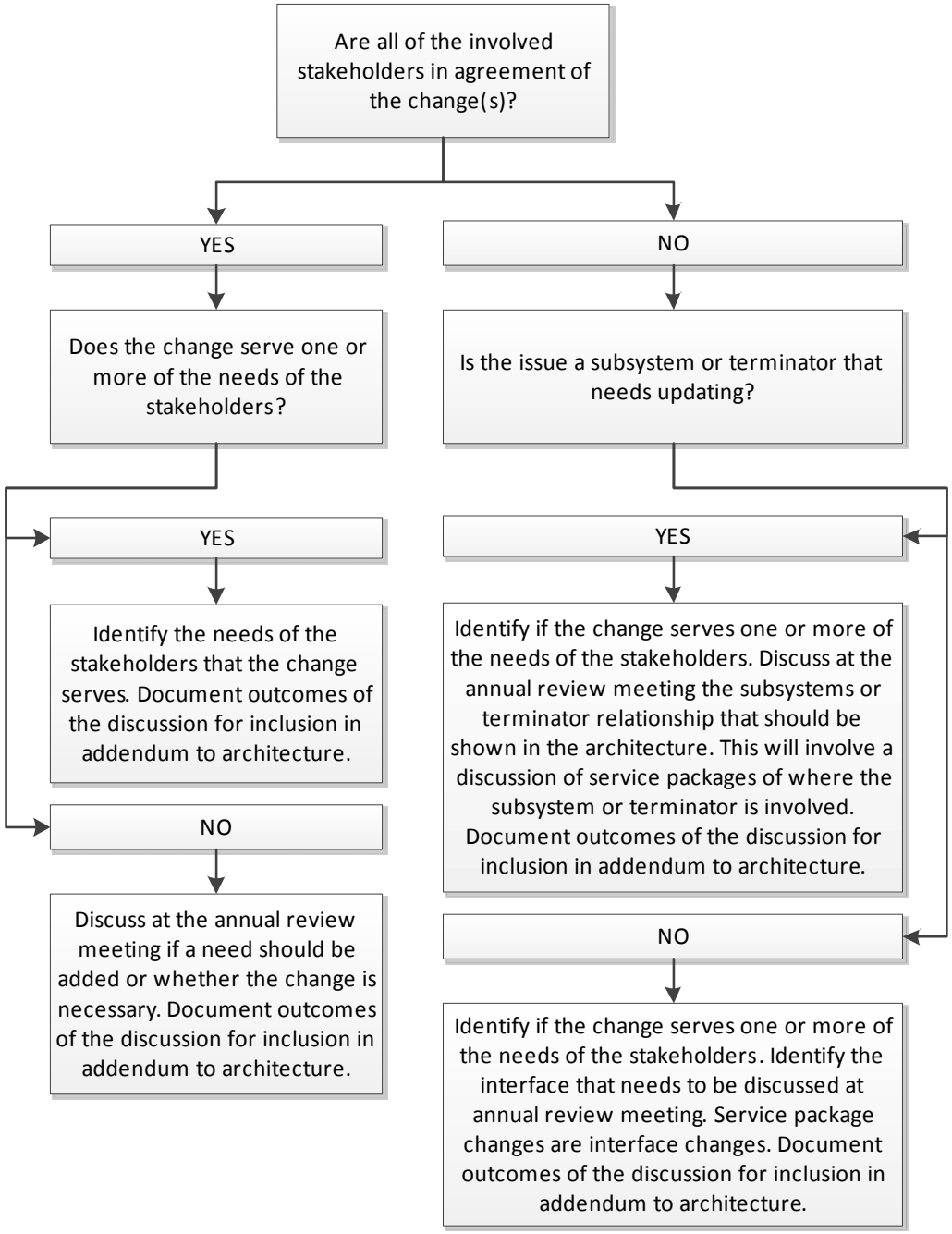
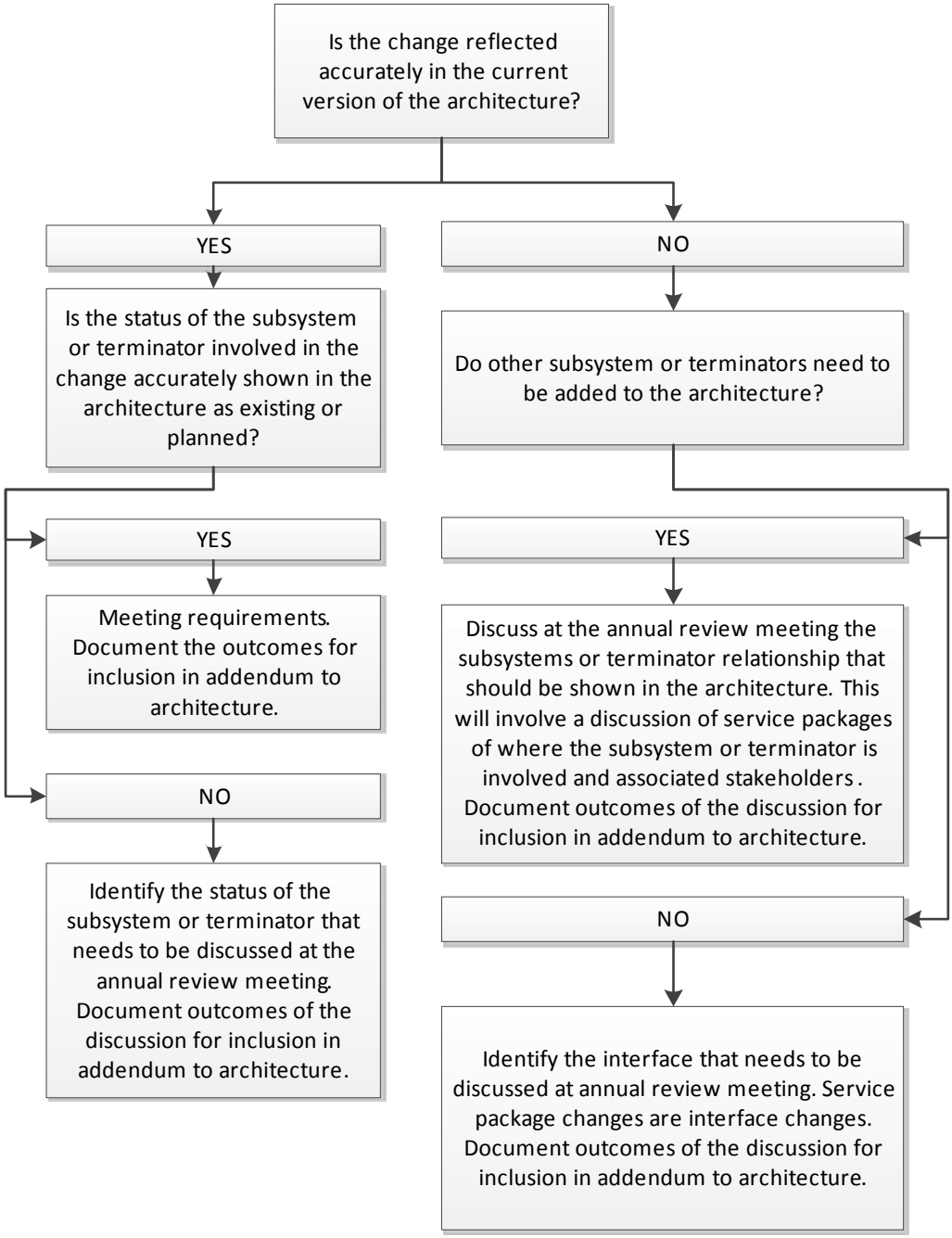


Figure 11-2 – Fresno COG Architecture Update Review Process – Architecture Question



11.3 ROLES AND RESPONSIBILITIES

Fresno COG will update the architecture (addition, deletion, or modification) as specified in the approved Change Request Form, which includes performing the following tasks:

- Evaluate how the changes affect the architecture documents, Turbo database, and website.
- Evaluate whether or not the change impacts multiple stakeholders or other elements within the regional ITS architecture. This step will also include coordinating with those stakeholders to obtain consensus on the proposed change.
- Ensure that changes are carried out in the most recent versions of the documents, databases, and graphics.
- Verify that all dependencies and updated and related documents are synchronized with each other.
- After changes are made, make sure that the revised documents are posted, stored online, or otherwise disseminated in "read-only" format to prevent any unauthorized changes from being made.
- Ensure that the most current Turbo Architecture file version and day/date/time are updated on the Start tab of the Turbo Architecture database file.
- Ensure file names, document titles, and website are consistent with the architecture name, version, and dates.
- Fresno COG staff will periodically update the Transportation Technical Committee, Policy Advisory Committee, and Policy Board on matters concerning the ITS Architecture and Strategic Deployment Plan.

12.0 PROJECT SEQUENCING (STRATEGIC DEPLOYMENT PLAN)

The Federal Highway Administration (FHWA) ITS Architecture and Standards Rule, and its companion Federal Transit Administration Policy, requires the development of a list of projects that implement the regional ITS architecture. The list of projects should take into account existing ITS inventory and identified future projects. Other projects identified in the course of developing the regional ITS architecture are added to the list. The list should also identify a priority for the projects identified in the project sequence. The purpose of Project Sequencing is to develop a logical grouping and sequence of ITS projects for the Fresno County Region that will implement the Architecture defined as part of the overall ITS Plan project. Many ITS deployments exist or are underway in the County.

12.1 PROJECT IDENTIFICATION PROCESS

This step of the ITS architecture development, develops a list of implementable ITS projects. A sequence of the ITS projects, that will contribute to the integrated regional transportation system, is also developed.

The regional ITS architecture planning process aims to use local knowledge and a consensus process to determine the best sequence of projects to create a transportation network that meets the needs of the region. Translating this goal into a specific Fresno County Region focus results in the following objectives:

- to create an efficient list of ITS projects
- to build out the ITS architecture and
- to fill in system gaps, all based on regional needs, project readiness, and the capacity to deploy.

The term “build-out the architecture” refers to projects that deploy the system interconnections and information flows from a center-to-center perspective. Each “center” or central system may have many other functions or features that need to be explored as part of a robust system engineering process during project deployment, but the regional architecture does not always capture that level of detail. The architecture is also not focused on technology or infrastructure solutions; the architecture is technology-independent and the projects listed attempt to reflect this independence by, again, capturing primarily the needs for center-to-center system integration.

The development of the list of ITS projects for the Fresno County Region was performed in an iterative manner. The first step was to review existing regional plans, programs and studies collected in earlier activities of the project, to find those ITS projects already planned and/or programmed to ensure they are included in this plan. The following resources were reviewed:

- Fresno Council of Governments – Regional Transportation Plan – 2014

- Council of Fresno County Governments - Fresno County Intelligent Transportation System Strategic Deployment Plan – 1999

- San Joaquin Valley ITS Technical Advisory Committee and Steering Committee - San Joaquin Valley Intelligent Transportation System (ITS) Strategic Deployment Plan – 2001

Stakeholders also provided project lists for their own jurisdictions, where available.

12.2 PROJECT SEQUENCING PROCESS

To move forward in the actual sequencing of projects, each of the projects identified has been assigned a relative priority, designated as Short Term, Medium Term, and Long Term. This phasing established groupings for projects rather than attempting to establish a specific decreasing phase ranking for all identified projects. This approach is desirable in that it does not discretely identify "Project A" as being a higher priority than "Project B," thus potentially pitting one project or agency against another when competing for funding. This method of phasing projects brings structure to the planning process and gives focus to eventual project selection and deployment without establishing a "pre-defined" funding priority for specific projects. At the same, it allows for flexibility in the overall ITS Plan and Program.

The projects priorities have been assigned to the respective projects based on two primary factors. The first factor considered was the need for a particular ITS function for the Region as outlined in Deliverable #5 – Visions, Goals, Objectives and Needs Technical Report. Information on High, Medium and Low priority needs identified in Deliverable #5 has been carried forward in the project prioritization process; with High Priority equating to Short Term, Medium Priority equating to Medium Term, and Low Priority equating to Long Term. The second factor was a logical ordering of projects to ensure that prerequisite projects or infrastructure is in place. Lastly, the Fresno County Region ITS stakeholders had the opportunity to provide manual adjustments on project time frames in the process of reviewing and commenting on the Draft Strategic Deployment Plan.

The prioritization of projects should be used as a guide and not a prescription. Some of the projects should be considered longer-term efforts because near-term deployment may represent an unacceptable risk. Or, other near-term projects need to be in place prior to deployment of a medium- or long-term project. Sequencing could be translated into "near-term" (1 to 5 years), "medium-term" (6 to 10 years) and "long-term" (11 to 20+ years) deployments.

In some cases an early opportunity to deploy a medium- or long-term project in the region, with relatively low risk, may present itself. Or, perhaps a technology or system may advance more quickly than was originally anticipated in the development of this ITS Plan. Neither of these scenarios should preclude implementation of a medium or long-term project before a short-term project, if it makes sense in the context of the local setting and changing local priorities and needs. This plan should provide flexibility to the region in project deployment and not necessarily restrictions.

The actual deployment of ITS projects could also be dependent on other factors including the data or policy decisions that support the projects. Certain project deployments may benefit by the needed results from a study on costs and benefits. Other system integration projects may require a ratified national standard. These types of dependencies should be recognized not just in the prioritization and sequencing of projects but also the selection and planning of projects.

12.3 PRIORITIZED LISTING OF ITS PROJECTS

Table 12-1 contains the Project listing for the Strategic Deployment Plan. The Project ID Number in the left-most column is not an indicator of a discrete priority order, but is intended to be able to more easily refer to specific projects in the review and comment process.

Table 12-1: Fresno County Strategic Deployment Plan Project List

Project ID #	Project Description	Participating Agencies	Program Area	Interdependencies/ Other Notes
Short Term (0 – 5 years)				
1	**Regional Transportation Data Archive –** Develop an ITS historical data archive for all relevant ITS data and provide a centralized system to share data between agencies. Data collected can provide information for use in monitoring and evaluating the performance and safety of the transportation system, fulfilling data reporting requirements, and other planning or operational functions. Such a data archive could be utilized as the foundation for real time data and information exchange and/or for providing content to a real time traveler information system.	• FCOG • Caltrans • City of Fresno • City of Clovis • Fresno County • FAX • Clovis Transit • FCRTA • CSU Fresno • Other local agencies, as appropriate	• Archived Data Management	• System will depend on transportation management entities having robust, modern, full function transportation management systems • System will depend on willingness of multiple agencies to connect and share data • System will depend on robust communications in the Region
2	**ITS Technologies to Support Bus Rapid Transit (BRT) –** Implement ITS technologies to support Bus Rapid Transit (BRT) service along heavily utilized transit corridors. Technologies may include, but not be limited to: Transit Signal Priority (TSP), transit traveler information system elements, traffic signal coordination, and off-board payment ticket vending machines. Potential Short Term candidate corridors include: Blackstone/Kings Canyon Corridors, Ventura BRT Extension, Shaw Avenue, and potentially others.	• FAX • City of Fresno • Fresno County • FCOG	• Public Transportation	• TSP will depend on full function, modern traffic signal controllers • Traveler information system(s) will depend on transit vehicle location systems, and full function transit management system(s)

Project ID #	Project Description	Participating Agencies	Program Area	Interdependencies/ Other Notes
3	**Upgrade and/or replace Computer Aided Dispatch/Automated Vehicle Location (CAD/AVL) System(s) –** Upgrade and/or replace CAD/AVL systems at FAX, Clovis Transit, and FCRTA, including interfaces to other transit management systems.	• FAX • Clovis Transit • FCRTA	• Public Transportation	• System is foundation for other transit ITS technologies, especially transit traveler information system(s) • Systems will depend on modern, full function communications systems (wireless and wireline)
4	**Expand Computer Aided Dispatch/Automated Vehicle Location (CAD/AVL) System(s) –** Expand existing CAD/AVL systems at FAX, Clovis Transit, and FCRTA, including implementation of complementary equipment and interfaces to other transit management systems.	• FAX • Clovis Transit • FCRTA	• Public Transportation	• System is foundation for other transit ITS technologies, especially transit traveler information system(s) • System expansion assumes there is an existing system in place, with adequate useful life remaining
5	**Wi-Fi on BRT Buses –** Equip FAX BRT buses with Wi-Fi for passenger use.	• FAX • City of Fresno	• Public Transportation	• Stand-alone project

Project ID #	Project Description	Participating Agencies	Program Area	Interdependencies/ Other Notes
6	**Regional Automated Farebox System –** Implement a regional farebox system that would allow use of universal fare media among the transit operators in the Fresno County Region.	• FAX • Clovis Transit • FCRTA • FCOG	• Public Transportation	• System will be dependent on institutional agreements for regional fare media • System will be dependent on each transit operator possessing modern, full function fare box systems, with universal fare media readers
7	**Transit Security Deployments –** Implement transit security and safety technologies on buses and at transit stations/stops and facilities, including: building and lot access control, video surveillance, fire safety systems, and potentially other technologies.	• FAX • City of Fresno • Clovis Transit • City of Clovis • FCRTA • FCOG	• Public Transportation	• Largely stand-alone projects • Systems will depend on modern, full function communications systems (wireless and wireline)
8	**Downtown Transit Station –** Implement ITS technologies to support a potential new Transit Station in Downtown Fresno. Technologies may include, but not be limited to: Transit Signal Priority (TSP), transit traveler information system elements, and off-board payment ticket vending machines.	• FAX • City of Fresno • FCRTA • FCOG	• Public Transportation	• TSP will depend on full function, modern traffic signal controllers • Traveler information system(s) will depend on transit vehicle location systems, and full function transit management system(s)

Project ID #	Project Description	Participating Agencies	Program Area	Interdependencies/ Other Notes
9	**Transit Signal Priority (TSP) –** Implement TSP at intersections and along corridors, independent of the BRT corridors and program.	• FAX • City of Fresno • Clovis Transit • City of Clovis • FCRTA	• Public Transportation • Traffic Management	• TSP will depend on full function, modern traffic signal controllers
10	**Upgrade and/or Replace Fareboxes –** Upgrade and/or replace on-board farebox equipment, as well as "Back Office" System(s), including implementation of complementary equipment and interfaces to other transit management systems.	• FAX • City of Fresno • Clovis Transit • FCRTA	• Public Transportation	• Stand-alone project • System is foundation for other transit ITS technologies, especially back office administration system(s)
11	**Trip Planning Software –** Provide integrated and coordinated trip planning and ridesharing services on the internet and via voice recognition telephone services.	• FAX • Clovis Transit • FCRTA • FCOG	• Public Transportation • Traveler Information	• System will depend on full function transit management system(s) • System will depend on rideshare matching systems, and an entity (or entities) to operate and maintain them • System may require automated voice response telephone technologies
12	**Transit Dynamic Routing and Scheduling System –** Implement dynamic routing and scheduling systems that perform vehicle routing and scheduling as well as monitoring for demand responsive transit services. The service can provide personalized transit services with requests directly through a transit management center, or could be routed through a 511 system, or a dedicated transit traveler information provider.	• FAX • Clovis Transit • FCRTA • FCOG	• Public Transportation	• System will depend on transit vehicle location systems, and full function transit management system(s) • System may require an interface to other regional traveler information systems (such as 511)

Project ID #	Project Description	Participating Agencies	Program Area	Interdependencies/ Other Notes
13	**Transit Itinerary Planning Website –** Implement a transit traveler information system that may include static and/or real time information that can be sent to transit users prior to, or during a trip. Information may include real time bus arrival times, schedules, routes, maps, fares, park-and-ride lot locations, transit trip itineraries, etc. Information can be communicated through a variety of channels, such as smart phone, landline telephone, Internet website, electronic kiosks, television, etc. A subscriber feature can tailor information distribution to a specific user.	• FAX • Clovis Transit • FCRTA • FCOG	• Public Transportation • Traveler Information	• System will depend on full function transit management system(s), with capability to interface with external information delivery systems • System may require an interface to other regional traveler information systems (such as 511)
14	**ITS Technologies to Support Local and Regional Park and Ride Lot Program –** Implement ITS technologies to support Park and Ride Program operations. Technologies may include, but not be limited to: Ridematching systems, parking management systems, parking guidance systems, video surveillance, emergency telephones, off-board payment ticket vending machines, etc.	• FCOG • Caltrans • FAX • Clovis Transit • FCRTA • Fresno County • Other local and regional agencies, as appropriate	• Public Transportation • Emergency Management	• Systems will depend on modern, full function communications systems (wireless and wireline)

Project ID #	Project Description	Participating Agencies	Program Area	Interdependencies/ Other Notes
15	**Multimodal Regional Traveler Information System –** Deploy a multimodal regional traveler information system. This may be in the form of expansion and / or upgrades to the existing San Joaquin Valley 511, or development of a new system.	• FCOG • Caltrans • Other local and regional agencies, as appropriate	• Traveler Information	• System will depend on data feeds from existing Caltrans systems • System may depend on data feeds from existing local agency systems • System will depend on full function transit management system(s), with capability to interface with external information delivery systems • System will depend on data feeds from transit management systems • System may require automated voice response telephone technologies
16	**En-route Traveler Information Systems (Caltrans) –** Expand upon existing en-route traveler information system elements, such as Changeable Message Signs (CMS) and Highway Advisory Radio (HAR). Work with rural communities on strategic deployment of CMS and travel time information dissemination (Rural CMS Program). Study in-vehicle signing systems as it relates to the Connected Vehicles Program.	• Caltrans • Other local agencies, as appropriate • FCOG	• Traveler Information • Traffic Management	• Primarily expansion of existing systems • Will depend on institutional coordination in placement of CMS and HAR transmitters

Project ID #	Project Description	Participating Agencies	Program Area	Interdependencies/ Other Notes
17	**En-route Traveler Information Systems (Local Agencies) –** Implement en-route traveler information system elements, such as Changeable Message Signs (CMS) and Highway Advisory Radio (HAR). Consider shared control of these systems with Caltrans and other local agencies, as appropriate. The rural communities should work with Caltrans on strategic deployment of CMS and travel time information dissemination. Study in-vehicle signing systems as it relates to the Connected Vehicles Program.	• Other local agencies, as appropriate • Caltrans • FCOG	• Traveler Information • Traffic Management	• Systems will depend on modern, full function communications systems (wireless and wireline) • Systems may depend on communications links with Caltrans (and potentially other agencies) for the purpose of shared control and monitoring
18	**Expressway/Highway Passing Lane Additions (Caltrans) –** Implement ITS technologies in support of Expressway/Highway Passing Lane Addition projects. Technologies may include, but not be limited to: signs, detection, surveillance, and potentially others. Potential Short Term candidate projects include: SR-180 W-James to Lake (Passing Lanes), and potentially others.	• Caltrans • Other agencies, as appropriate • FCOG	• Traffic Management	• Largely stand-alone projects from an ITS perspective • This project represents the ITS field infrastructure component of larger roadway construction projects
19	**Expressway/Highway Widening (Caltrans) –** Implement ITS technologies in support of Expressway/Highway Widening projects. Technologies may include, but not be limited to: signs, detection, surveillance, and potentially others. Potential Short Term candidate projects include: SR 180, Quality to Trimmer Springs (2 LU to 4L); SR 180-west of Smith to east of Frankwood (construct 4 Lane Expressway); SR 41, Kings County Line to Elkhorn Avenue (widen from 2L to 4L), and potentially others.	• Caltrans • Other agencies, as appropriate • FCOG	• Traffic Management	• This project represents the ITS field infrastructure component of larger roadway construction projects

Project ID #	Project Description	Participating Agencies	Program Area	Interdependencies/ Other Notes
20	**Expressway/Highway Auxiliary Lane Additions (Caltrans) –** Implement ITS technologies in support of Expressway/Highway Passing Lane Addition projects. Technologies may include, but not be limited to: signs, detection, surveillance, and potentially others. Potential Short Term candidate projects include: SR 41-El Paso to Friant (SB Auxiliary Lane), and potentially others.	• Caltrans • Other agencies, as appropriate • FCOG	• Traffic Management	• Largely stand-alone projects from an ITS perspective • This project represents the ITS field infrastructure component of larger roadway construction projects
21	**Arterial Widening (Local Agencies) –** Implement ITS technologies to support arterial widening projects. Technologies may include, but not be limited to: signs, detection, surveillance, signal control, controller/firmware/software upgrades, interconnect, and potentially others. Potential Short Term candidate projects are listed in Table Note 1.	• Caltrans • City of Fresno • City of Clovis • Fresno County • Other local agencies, as appropriate	• Traffic Management	• This project represents the ITS field infrastructure component of larger roadway construction projects
22	**Fiber Optic Communications:** Fowler-Alluvial to Herndon	• City of Clovis	• Traffic Management	• Expansion/in-fill of existing communications infrastructure
23	**Fresno Street Corridor Traffic Signal Upgrades –** Upgrade ITS equipment, vaults, upgraded controllers, Opticom, pedestrian countdowns, ADA sidewalk improvements, traffic signal actuation, and install loop detectors at the intersections of Divisadero St; R St; P St; O St; N St; M St; Van Ness Ave; F St; E St	• City of Fresno	• Traffic Management	• Expansion/in-fill of existing system components • This project represents expansion of existing central system capabilities

Project ID #	Project Description	Participating Agencies	Program Area	Interdependencies/ Other Notes
24	**Install Signal Interconnect System:** On I St. from Manning to 13th – Install Traffic Interconnect and Signal Synchronization Hardware and Software	• City of Reedley	• Traffic Management	• Expansion/in-fill of existing communications infrastructure • Signal synchronization depends on modern, full function traffic signal controllers • Signal synchronization may depend on robust communications infrastructure
25	**ITS Improvements/Upgrades:** Ashlan- Blackstone to Peach – Install ITS Wireless communications, upgraded controllers, cameras; detection, vaults & cabinets	• City of Fresno	• Traffic Management	• Expansion/in-fill of existing communications infrastructure • Expansion/in-fill of existing system components • This project represents expansion of existing central system capabilities
26	**ITS Improvements/Upgrades:** Bullard Ave-Marks to Willow – Install ITS Wireless communications, upgraded controllers, cameras; detection, vaults & cabinets	• City of Fresno	• Traffic Management	• Expansion/in-fill of existing communications infrastructure • Expansion/in-fill of existing system components • This project represents expansion of existing central system capabilities

Project ID #	Project Description	Participating Agencies	Program Area	Interdependencies/ Other Notes
27	**ITS Improvements/Upgrades:** First Street-Nees to Ventura – Install ITS wireless communication, upgraded controllers, cameras; detection, vaults & cabinets	• City of Fresno	• Traffic Management	• Expansion/in-fill of existing communications infrastructure • Expansion/in-fill of existing system components • This project represents expansion of existing central system capabilities
28	**ITS Freeway Crossings-City Wide –** Traffic Signal Synchronization of Arterials and Freeway Crossings: 14 Crossing Locations and 28 Signals City Wide; Install ITS Communications, upgraded controllers, cameras, cabinets, and detection.	• City of Fresno	• Traffic Management	• This project requires advanced coordination between City and Caltrans • Expansion/in-fill of existing communications infrastructure • Expansion/in-fill of existing system components • This project represents expansion of existing central system capabilities

Project ID #	Project Description	Participating Agencies	Program Area	Interdependencies/ Other Notes
29	**ITS Improvements/Upgrades: Fresno Street and Van Ness Avenue –** Fresno Street from B Street to Divisadero Street and Van Ness Avenue from Ventura Avenue to Divisadero Street; Install ITS communications, upgraded controllers; cameras, detection and vaults	• City of Fresno	• Traffic Management	• Expansion/in-fill of existing communications infrastructure • Expansion/in-fill of existing system components • This project represents expansion of existing central system capabilities
30	**ITS Improvements/Upgrades and Signal Synchronization:** 1) Friant from Fresno to Palm 2) Nees from Blackstone to Palm 3) Palm from Nees to Palmdon – Installation of ITS equipment (communications, upgraded controllers; cameras, detection and vaults) and signal synchronization.	• City of Fresno	• Traffic Management	• Expansion/in-fill of existing communications infrastructure • Expansion/in-fill of existing system components • This project represents expansion of existing central system capabilities • Signal synchronization depends on modern, full function traffic signal controllers • Signal synchronization may depend on robust communications infrastructure

Project ID #	Project Description	Participating Agencies	Program Area	Interdependencies/ Other Notes
31	**ITS Improvements/Upgrades:** Kings Canyon- Chestnut to Clovis – Deploy Fiber Interconnect, ATMS, Adaptive Signal Control Technology	• City of Fresno	• Traffic Management	• Expansion/in-fill of existing communications infrastructure • This project represents expansion of existing central system capabilities • Adaptive signal control depends on modern, full function traffic signal controllers • Adaptive signal control may depend on robust communications infrastructure
32	**ITS Improvements/Upgrades:** McKinley-SR99 to Clovis Ave – Install ITS wireless communications, upgraded controllers, cameras; detection, vaults & cabinets	• City of Fresno	• Traffic Management	• Expansion/in-fill of existing communications infrastructure • Expansion/in-fill of existing system components • This project represents expansion of existing central system capabilities

Project ID #	Project Description	Participating Agencies	Program Area	Interdependencies/ Other Notes
33	**ITS Improvements/Upgrades:** Nees Ave-Palm to Willow Ave – Install ITS Wireless communications, upgraded controllers, cameras; detection, vaults & cabinets	• City of Fresno	• Traffic Management	• Expansion/in-fill of existing communications infrastructure • Expansion/in-fill of existing system components • This project represents expansion of existing central system capabilities
34	**ITS Signal Coordination:** ITS Shields Ave-West to Chestnut	• City of Fresno	• Traffic Management	• This project represents expansion of existing central system capabilities • Signal synchronization depends on modern, full function traffic signal controllers • Signal synchronization may depend on robust communications infrastructure
35	**ITS Technologies to Support Bike lanes / Multi-Purpose Trail / Pedestrian Facilities –** Deploy ITS technologies to support bicycle and pedestrian modes of transportation. ITS elements may include, but not be limited to: signs, signal control, CCTV surveillance, emergency phones, etc.	• City of Fresno	• Traffic Management	• Some projects may tend to be stand-alone projects from an ITS perspective • Systems will depend on modern, full function communications systems (wireless and wireline)

Project ID #	Project Description	Participating Agencies	Program Area	Interdependencies/ Other Notes
36	**ITS Improvements/Upgrades:** Tulare St-Clovis Ave to C St – Install ITS Wireless communications, upgraded controllers, cameras; detection, vaults & cabinets	• City of Fresno	• Traffic Management	• Expansion/in-fill of existing communications infrastructure • Expansion/in-fill of existing system components • This project represents expansion of existing central system capabilities
37	**ITS Improvements/Upgrades:** West Ave- Herndon to Olive – Install ITS wireless communications, upgraded controllers, cameras; detection, vaults & cabinets	• City of Fresno	• Traffic Management	• Expansion/in-fill of existing communications infrastructure • Expansion/in-fill of existing system components • This project represents expansion of existing central system capabilities

Project ID #	Project Description	Participating Agencies	Program Area	Interdependencies/ Other Notes
38	**ITS Improvements/Upgrades and Signal Synchronization:** Willow Ave - Ashlan to International – Installation of ITS equipment (communications, upgraded controllers; cameras, detection, poles, cabinets, and vaults) and signal synchronization.	• City of Fresno	• Traffic Management	• Expansion/in-fill of existing communications infrastructure • Expansion/in-fill of existing system components • This project represents expansion of existing central system capabilities • Signal synchronization depends on modern, full function traffic signal controllers • Signal synchronization may depend on robust communications infrastructure

Project ID #	Project Description	Participating Agencies	Program Area	Interdependencies/ Other Notes
39	**ITS Improvements/Upgrades:** Manning & Golden State – Manning Ave, from SR 99 northbound ramps to 0.25 miles east of Golden State Blvd. Reconstruct approaches to RR crossing. Installation of ITS equipment; upgrade interconnect & synchronize traffic signals; signage & striping.	• City of Fresno	• Traffic Management	• Expansion/in-fill of existing communications infrastructure • Expansion/in-fill of existing system components • This project represents expansion of existing central system capabilities • Signal synchronization depends on modern, full function traffic signal controllers • Signal synchronization may depend on robust communications infrastructure

Project ID #	Project Description	Participating Agencies	Program Area	Interdependencies/ Other Notes
40	**ITS Improvements/Upgrades:** Jensen Ave-Clovis to SR 99; and Temperance to Marks – Deploy fiber interconnect, deploy ATMS, implement Adaptive Signal Control Technology	• City of Fresno	• Traffic Management	• Expansion/in-fill of existing communications infrastructure • This project represents expansion of existing central system capabilities • Adaptive signal control depends on modern, full function traffic signal controllers • Adaptive signal control may depend on robust communications infrastructure

Project ID #	Project Description	Participating Agencies	Program Area	Interdependencies/ Other Notes
41	**ITS Improvements/Upgrades and Signal Synchronization:** Shaw Avenue from Willow to Temperance – Synchronize traffic signals and install communication hubs, conduit, and fiber optic cables.	• City of Clovis	• Traffic Management	• Expansion/in-fill of existing communications infrastructure • Expansion/in-fill of existing system components • This project represents expansion of existing central system capabilities • Signal synchronization depends on modern, full function traffic signal controllers • Signal synchronization may depend on robust communications infrastructure
42	**Sierra Street Traffic Synchronization –** Coordinate Traffic Signals Located on Sierra Street from 18th Avenue to 6th Avenue	• City of Kingsburg	• Traffic Management	• This project represents expansion of existing central system capabilities • Signal synchronization depends on modern, full function traffic signal controllers • Signal synchronization may depend on robust communications infrastructure

Project ID #	Project Description	Participating Agencies	Program Area	Interdependencies/ Other Notes
43	**Temperance Avenue Traffic Flow Improvements –** Deploy ITS technologies such as communications, controllers; cameras, and detection to support the Traffic Flow Improvements project.	• City of Clovis	• Traffic Management	• Expansion/in-fill of existing communications infrastructure • Expansion/in-fill of existing system components • This project represents expansion of existing central system capabilities
44	**ITS ATMS and ASCT Deployments City Wide –** Deploy ITS communications, controllers, cameras, infrastructure and Advanced Transportation Management System (ATMS) software for various corridors that do not currently have ITS technologies deployed for time of day synchronization. Also, deploy added ITS infrastructure, detection, and Adaptive Signal Control Technology (ASCT) software to implement adaptive synchronization on various corridors that have basic ITS communications and controllers throughout the City of Fresno. Potential Short Term candidate projects are listed in Table Note 4.	• City of Fresno	• Traffic Management	• Expansion/in-fill of existing communications infrastructure • This project represents expansion of existing central system capabilities • Signal synchronization and adaptive signal control depends on modern, full function traffic signal controllers • Signal synchronization and adaptive signal control may depend on robust communications infrastructure
45	**Citywide mechanical controller upgrades –** Deploy controllers, cabinets, detection, communications, and updated ped heads.	• City of Fresno	• Traffic Management	• Expansion/in-fill of existing system components

Project ID #	Project Description	Participating Agencies	Program Area	Interdependencies/ Other Notes
46	**Interconnect Gap Closure –** Deploy traffic signal interconnect to fill gaps in the system traffic signal communication system(s). Interconnect could be wireline or wireless as field conditions and funding dictate. Potential Short Term candidate projects include: Divisadero Street - P Street to H Street, Fulton Corridor, and potentially others.	• City of Fresno	• Traffic Management	• Expansion/in-fill of existing communications infrastructure
47	**Emergency Vehicle Preemption (EVP) –** Deploy emergency vehicle preemption technology(ies) in key corridors around the city. Consideration should be given to technologies that may also provide transit signal priority (TSP) functionality.	• City of Fresno	• Traffic Management • Emergency Management	• EVP depends on modern, full function traffic signal controllers • Future EVP deployments may utilize appropriate connected vehicle communications infrastructure and technologies
48	**Install New Traffic Signals –** Install new traffic signals, and interconnect to existing systems, wherever possible and feasible. All other applicable, feasible, and appropriate ITS amenities should be included in the installation, including but not limited to: communications, interconnect, full capability controllers, cameras, detection, cabinets, vaults, and signal synchronization.	• Caltrans • City of Fresno • City of Clovis • Fresno County • Other local agencies, as appropriate	• Traffic Management	• Expansion/in-fill of existing communications infrastructure • Expansion/in-fill of existing system components • This project represents expansion of existing central system capabilities

Project ID #	Project Description	Participating Agencies	Program Area	Interdependencies/ Other Notes
49	**Traffic Signal Upgrades –** Upgrade traffic signals that do not have the full functionality and capability of the most up to date intersections. Interconnect to existing systems wherever possible and feasible. All other applicable, feasible, and appropriate ITS amenities should be included in the installation, including but not limited to: communications, interconnect, full capability controllers, cameras, detection, cabinets, vaults, and signal synchronization.	• Caltrans • City of Fresno • City of Clovis • Fresno County • Other local agencies, as appropriate	• Traffic Management	• Expansion/in-fill of existing communications infrastructure • Expansion/in-fill of existing system components • This project represents expansion of existing central system capabilities
50	**Arterial Traffic Management Systems Expansion –** This project is a catch-all for expansion of existing arterial traffic management systems in the Fresno County Region. Expansion typically refers to geographic coverage as well as system expansion and additional field devices. System elements referenced by this project include, but are not limited to: enhancements to the central system(s), closed circuit television (CCTV) cameras and systems, highway advisory radio (HAR) systems and transmitters, arterial changeable message signs (CMS), traffic monitoring stations (TMS), communications infrastructure, etc.	• City of Fresno • City of Clovis • Fresno County • Caltrans • Other local agencies, as appropriate	• Traffic Management	• Expansion/in-fill of existing communications infrastructure • Expansion/in-fill of existing system components • This project represents expansion of existing central system capabilities

Project ID #	Project Description	Participating Agencies	Program Area	Interdependencies/ Other Notes
51	**Freeway Management Systems Expansion –** This project is a catch-all for expansion of the many and varied Caltrans freeway management systems and field elements that are monitored and controlled by Caltrans District 6 and CHP at the Central Valley Transportation Management Center Caltrans CVTMC. Expansion refers to geographic coverage as well as system expansion and additional field devices. System elements referenced by this project include, but are not limited to: enhancements to the central system(s), closed circuit television (CCTV) cameras and systems, highway advisory radio (HAR) systems and transmitters, road weather information systems (RWIS) and field sensors, changeable message signs (CMS), traffic monitoring stations (TMS), communications infrastructure, etc.	• Caltrans	• Traffic Management	• Expansion/in-fill of existing communications infrastructure • Expansion/in-fill of existing system components • This project represents expansion of existing central system capabilities
52	**Ramp Metering System Expansion –** Deploy additional ramp-metering capabilities along the freeway system within the Fresno County Region to improve freeway throughput and efficiency. Likely candidate corridors include, but are not limited to: State Routes 41, 99, 168, and 180 as growth in travel demands dictate.	• Caltrans	• Traffic Management	• Expansion of stand-alone systems depend on robust, localized communications systems • Expansion of centrally controlled systems depend on robust, wide area communications systems

Project ID #	Project Description	Participating Agencies	Program Area	Interdependencies/ Other Notes
53	**City of Fresno Traffic Operations Center facility expansion –** Expansion of the City of Fresno Traffic Operations Center facility.	• City of Fresno	• Traffic Management • Emergency Management	• Assuming the TOC remains in (or in proximity to) the existing TOC, this is a stand-alone project • Will require maintaining and/or re-connection of all communications links with external systems and/or devices
54	**Traffic Management Communications Infrastructure Expansion and Gap Closure –** Deploy robust communications infrastructure capable of providing backbone, interconnect, and redundant communications between ITS field devices and a central system, and between ITS filed devices in the field. This project is technology neutral (wireline communications or wireless communications), as each corridor and ITS field device location will present its own unique field conditions and challenges. Backbone and/or redundant links should also support information sharing between and among agencies within the Region. In addition to the mostly arterial projects identified in this project list, Caltrans is considering communications expansion/enhancement along State Routes 41, 99, 168, and 180; and to the Caltrans TMC, Fresno TOC, and Clovis TOC. Caltrans is also considering deployment of wireless communications systems outside of the Fresno-Clovis metropolitan area.	• Caltrans • City of Fresno • City of Clovis • Fresno County • Other local agencies, as appropriate	• Traffic Management	• Expansion/in-fill of existing communications infrastructure • Expansion/in-fill of existing system components • This project represents expansion of existing central system capabilities • This project may represent the ITS field infrastructure component of larger roadway construction projects

Project ID #	Project Description	Participating Agencies	Program Area	Interdependencies/ Other Notes
55	**Establishment of Center to Center Communications Links –** This project supports the Regional Transportation Data Archive project contained in this project list. The links would enable data sharing among a wide variety of traffic, transit and emergency management agencies in the Region. Communications links may interconnect the CVTMC to local agencies, emergency operations centers, and public safety agencies, such as law enforcement and other emergency responder entities.	• Caltrans • City of Fresno • City of Clovis • Fresno County • Other local agencies, as appropriate • Fresno COG • FAX • Clovis Transit	• Traffic Management • Emergency Management • Public Transportation	• Systems will depend on modern, full function communications systems (wireless and wireline) • Would likely depend on an entity (or small group) to take on network management responsibilities
56	**Social Media/511 –** This project would provide interfaces to various social media outlets, from which the public can access traveler information via cell phones, land lines, websites, and personal electronic devices.	• Caltrans • Other local agencies, as appropriate • Fresno COG • FAX • Clovis Transit	• Traveler Information • Traffic Management • Emergency Management	• Systems are dependent on robust transportation management systems (roadway and transit)to serve as the foundation to the traveler information systems • Systems will depend on modern, full function communications systems (wireless and wireline) • Will likely depend on an entity (or small group) to take on operation and management of the system

Project ID #	Project Description	Participating Agencies	Program Area	Interdependencies/ Other Notes
57	**Traffic Signal Re-timing/Re-synchronization –** This project is a generic project for any agency seeking to update signal timing, coordination and synchronization on a periodic basis to account for changes in population and traffic patterns.	• Caltrans • City of Fresno • City of Clovis • Fresno County • Other local agencies, as appropriate • Fresno COG	• Traffic Management	• Signal synchronization and adaptive signal control depends on modern, full function traffic signal controllers • Signal synchronization and adaptive signal control may depend on robust communications infrastructure
58	**Periodic Traffic Management Equipment Replacement –** This project covers periodic equipment replacement due to "wear and tear" and also covers replacement of equipment that is displaced due to periodic maintenance activities, such as pavement and sidewalk rehabilitation.	• City of Fresno • City of Clovis • Fresno County • Other local agencies, as appropriate • Caltrans • Fresno COG	• Traffic Management	• Replacement of existing communications infrastructure • Replacement of existing system components • This project represents maintenance of existing central system capabilities

Project ID #	Project Description	Participating Agencies	Program Area	Interdependencies/ Other Notes
Medium Term (6 – 10 years)				
59	**ITS Technologies to Support Bus Rapid Transit (BRT) -** Implement ITS technologies to support Bus Rapid Transit (BRT) service along heavily utilized transit corridors. Technologies may include, but not be limited to: Transit Signal Priority (TSP), transit traveler information system elements, traffic signal coordination, and off-board payment ticket vending machines. Potential Medium Term candidate corridors include: California Ave, and potentially others.	• FAX • City of Fresno • Fresno County • FCOG	• Public Transportation	• TSP will depend on full function, modern traffic signal controllers • Future TSP deployments may utilize appropriate connected vehicle communications infrastructure and technologies • Traveler information system(s) will depend on transit vehicle location systems, and full function transit management system(s)

Project ID #	Project Description	Participating Agencies	Program Area	Interdependencies/ Other Notes
60	**Downtown Fresno Circulator –** Implement ITS technologies to a Downtown Circulator bus service. Technologies may include, but not be limited to: Transit Signal Priority (TSP), transit traveler information system elements, traffic signal coordination, and off-board payment ticket vending machines.	• FAX • City of Fresno • FCOG	• Public Transportation	• TSP will depend on full function, modern traffic signal controllers • Future TSP deployments may utilize appropriate connected vehicle communications infrastructure and technologies • Traveler information system(s) will depend on transit vehicle location systems, and full function transit management system(s) • Signal synchronization depends on modern, full function traffic signal controllers • Signal synchronization may depend on robust communications infrastructure

Project ID #	Project Description	Participating Agencies	Program Area	Interdependencies/ Other Notes
61	**Regional Transit Server –** Interconnect transit management systems and centers within the Region. This project would enable transit agencies to exchange incident, vehicle location, and arrival status information among multiple transit operators. This would enable the agencies to share vehicle location information to better coordinate service at common service boundaries. This project may also facilitate more efficient universal fare payment, collection, and disbursement.	• FAX • Clovis Transit • FCRTA • FCOG • Other local agencies as appropriate	• Public Transportation	• System will depend on transit operators having robust, modern, full function transit management systems • System will depend on willingness of multiple agencies to connect and share data • System will depend on robust communications in the Region
62	**Expressway/Highway Auxiliary Lane Additions (Caltrans) –** Implement ITS technologies in support of Expressway/Highway Passing Lane Addition projects. Technologies may include, but not be limited to: signs, detection, surveillance, and potentially others. Potential Medium Term candidate projects include: SR-41 Tulare to O Street (Widen Auxiliary Lane/Improve Ramps), and potentially others.	• Caltrans • Other agencies, as appropriate • FCOG	• Traffic Management	• This project represents the ITS field infrastructure component of larger roadway construction projects
63	**Arterial Widening (Local Agencies) –** Implement ITS technologies to support arterial widening projects. Technologies may include, but not be limited to: signs, detection, surveillance, signal control, controller/firmware/software upgrades, interconnect, and potentially others. Potential Medium Term candidate projects are listed in Table Note 2.	• City of Fresno • City of Clovis • Fresno County • Other agencies, as appropriate (Huron, Kerman, Kingsburg, Reedley, Sanger, Selma)	• Traffic Management	• This project represents the ITS field infrastructure component of larger roadway construction projects

Project ID #	Project Description	Participating Agencies	Program Area	Interdependencies/ Other Notes
64	**Emergency Vehicle Preemption (EVP) –** Deploy emergency vehicle preemption technology(ies) in key corridors around the city. Consideration should be given to technologies that may also provide transit signal priority (TSP) functionality.	• City of Fresno	• Traffic Management	• EVP depends on modern, full function traffic signal controllers • Future EVP deployments may utilize appropriate connected vehicle communications infrastructure and technologies
65	**Install New Traffic Signals –** Install new traffic signals, and interconnect to existing systems, wherever possible and feasible. All other applicable, feasible, and appropriate ITS amenities should be included in the installation, including but not limited to: communications, interconnect, full capability controllers, cameras, detection, cabinets, vaults, and signal synchronization.	• Caltrans • City of Fresno • City of Clovis • Fresno County • Other local agencies, as appropriate	• Traffic Management	• Expansion/in-fill of existing communications infrastructure • Expansion/in-fill of existing system components • This project represents expansion of existing central system capabilities
66	**Traffic Signal Upgrades –** Upgrade traffic signals that do not have the full functionality and capability of the most up to date intersections. Interconnect to existing systems wherever possible and feasible. All other applicable, feasible, and appropriate ITS amenities should be included in the installation, including but not limited to: communications, interconnect, full capability controllers, cameras, detection, cabinets, vaults, and signal synchronization.	• Caltrans • City of Fresno • City of Clovis • Fresno County • Other local agencies, as appropriate	• Traffic Management	• Expansion/in-fill of existing communications infrastructure • Expansion/in-fill of existing system components • This project represents expansion of existing central system capabilities

Project ID #	Project Description	Participating Agencies	Program Area	Interdependencies/ Other Notes
67	**Golden State Corridor Improvements –** Deploy ITS technologies in support of corridor improvements from American to Tulare County Line(Measure C Project F in the Rural Regional Program)	• Fresno County Transportation Authority • Other agencies, as appropriate	• Traffic Management	• Expansion/in-fill of existing communications infrastructure • Expansion/in-fill of existing system components • This project represents expansion of existing central system capabilities • This project represents the ITS field infrastructure component of larger roadway construction projects

Project ID #	Project Description	Participating Agencies	Program Area	Interdependencies/ Other Notes
68	**Safety Warning Systems –** Deploy roadside technologies that support warning of specific hazards to motorists. This project (or projects) supports the USDOT Connected Vehicle program. The suite of technologies is located primarily in the vehicle, but also includes some technologies on the roadside. Examples may include but not be limited to: speed detection technologies, work zone safety warning systems, intersection collision warning systems, and downhill and curve warning systems.	• Caltrans • City of Fresno • City of Clovis • Fresno County • Other local agencies, as appropriate • FCOG	• Vehicle Safety	• These systems depend on appropriate connected vehicle communications infrastructure that would likely be deployed in conjunction with the individual project(s) • These systems will likely depend on appropriate connected vehicle communications and applications to be resident in the vehicle fleet • Some of these systems depend on modern, full function traffic signal controllers, equipped with appropriate connected vehicle communications equipment • Some of these projects may be stand-alone projects

Project ID #	Project Description	Participating Agencies	Program Area	Interdependencies/ Other Notes
69	**Commercial Vehicle Enforcement Support –** Deploy ITS technologies to support enforcement of commercial vehicle credentialing and operations. Technologies may include but not be limited to: roadside safety inspection stations equipped with automated safety and credential check systems, as well as portable enforcement systems and equipment.	• Caltrans • CHP • DMV • FCOG • Other agencies, as appropriate	• Commercial Vehicle Operations	• Systems will depend on modern, full function communications systems (wireless and wireline) • Systems will depend on interfaces between commercial vehicle credentialing and enforcement central systems and the mobile and/or remote equipment • Future commercial vehicle enforcement deployments may utilize appropriate connected vehicle communications infrastructure and technologies
70	**Response Management System –** Deploy systems that improve emergency response, such as emergency vehicle tracking using automated vehicle location (AVL) technology, computer aided dispatch (CAD), and other complementary systems.	• CHP • Caltrans • Police, Fire, and other first responder entities • Other agencies, as appropriate	• Emergency Management	• System is foundation for other emergency response ITS technologies • Systems will depend on modern, full function communications systems (wireless and wireline)

Project ID #	Project Description	Participating Agencies	Program Area	Interdependencies/ Other Notes
71	**Maintenance Vehicle Tracking –** Deploy automated vehicle location (AVL) technologies on state and local maintenance vehicles. Expand to additional technologies that monitor use of maintenance materials and report back to the maintenance center when materials are running low, and in need of replenishment, or additional materials.	• Caltrans • City of Fresno • City of Clovis • Fresno County • Other agencies, as appropriate	• Maintenance and Construction Management	• System is foundation for other maintenance operations ITS technologies • Systems will depend on modern, full function communications systems (wireless and wireline) • Maintenance material monitoring technologies will require appropriate sensor technologies that would likely be deployed with the individual systems/projects
72	**Emergency Management Contact System/Application –** The purpose of this project is to provide a map based web interface for maintenance and access of Emergency Management agency contact information. The map base would allow the use of Geographic Information Systems (GIS) capabilities, and would assist in quickly identifying emergency managers in specific geographic areas.	• Caltrans • CHP • Other Public Safety agencies • Other agencies, as appropriate	• Emergency Management • Maintenance and Construction Management	• System would rely on GIS mapping technologies and capabilities • System will depend on willingness of multiple agencies to connect and share data • System would rely on robust security safeguards to ensure individual privacy is maintained

Project ID #	Project Description	Participating Agencies	Program Area	Interdependencies/ Other Notes
Long Term (11 – 20 years)				
73	**ITS Technologies to Support Bus Rapid Transit (BRT) -** Implement ITS technologies to support Bus Rapid Transit (BRT) service along heavily utilized transit corridors. Technologies may include, but not be limited to: Transit Signal Priority (TSP), transit traveler information system elements, traffic signal coordination, and off-board payment ticket vending machines. Potential Long Term candidate corridors include: Cedar Ave, South East Growth Area (SEGA) BRT Extension, Median Running BRT on various corridors, as appropriate, and potentially others.	• FAX • City of Fresno • Fresno County • FCOG	• Public Transportation	• TSP will depend on full function, modern traffic signal controllers • Traveler information system(s) will depend on transit vehicle location systems, and full function transit management system(s)
74	**Transit Management Systems Replacement –** This project is a generic project for the eventual replacement of various transit management systems to include, but not be limited to: automated vehicle location (AVL) systems, remote vehicle mechanical health monitoring systems, scheduling and runcutting systems and other back office management systems utilized at transit operating agencies.	• FAX • Clovis Transit • FCRTA • Other local agencies, as appropriate	• Public Transportation	• These systems are foundation to full capability transit management functions • Systems will depend on modern, full function communications systems (wireless and wireline)
75	**Interchange Improvements (Caltrans) –** Implement ITS technologies to support interchange improvement projects. Technologies may include, but not be limited to: traffic signal controllers, traffic signal coordination, signal control software and firmware, Transit Signal Priority (TSP), transit traveler information system elements, traffic signal coordination, detection, surveillance, and potentially others. Potential Long Term candidate projects include: Van Ness / SR-41, SR 99 / SR-43 / Floral Rd, SR-99 / American Ave, SR-99 / Shaw, SR-99 North / Cedar, and potentially others.	• Caltrans • Other agencies, as appropriate • FCOG	• Traffic Management	• This project represents the ITS field infrastructure component of larger roadway construction projects

Project ID #	Project Description	Participating Agencies	Program Area	Interdependencies/ Other Notes
76	**Expressway/Highway Auxiliary Lane Additions (Caltrans) –** Implement ITS technologies in support of Expressway/Highway Passing Lane Addition projects. Technologies may include, but not be limited to: signs, detection, surveillance, and potentially others. Potential Long Term candidate projects include: SR 41-Ashlan to Shaw (NB Auxiliary Lane), SR 41-O Street to Shields (NB Auxiliary Lanes), and potentially others.	• Caltrans • Other agencies, as appropriate • FCOG	• Traffic Management	• Largely stand-alone projects from an ITS perspective • This project represents the ITS field infrastructure component of larger roadway construction projects
77	**Arterial Widening (Local Agencies) –** Implement ITS technologies to support arterial widening projects. Technologies may include, but not be limited to: signs, detection, surveillance, signal control, controller/firmware/software upgrades, interconnect, and potentially others. Potential Long Term candidate projects are summarized in Table Note 3.	• City of Fresno • City of Clovis • Fresno County • Other agencies, as appropriate	• Traffic Management	• This project represents the ITS field infrastructure component of larger roadway construction projects
78	**Emergency Vehicle Preemption (EVP) –** Deploy emergency vehicle preemption technology(ies) in key corridors around the city. Consideration should be given to technologies that may also provide transit signal priority (TSP) functionality.	• City of Fresno	• Traffic Management	• EVP depends on modern, full function traffic signal controllers • Future EVP deployments may utilize appropriate connected vehicle communications infrastructure and technologies

Project ID #	Project Description	Participating Agencies	Program Area	Interdependencies/ Other Notes
79	**Install New Traffic Signals –** Install new traffic signals, and interconnect to existing systems, wherever possible and feasible. All other applicable, feasible, and appropriate ITS amenities should be included in the installation, including but not limited to: communications, interconnect, full capability controllers, cameras, detection, cabinets, vaults, and signal synchronization.	• Caltrans • City of Fresno • City of Clovis • Fresno County • Other local agencies, as appropriate	• Traffic Management	• Expansion/in-fill of existing communications infrastructure • Expansion/in-fill of existing system components • This project represents expansion of existing central system capabilities
80	**Traffic Signal Upgrades –** Upgrade traffic signals that do not have the full functionality and capability of the most up to date intersections. Interconnect to existing systems wherever possible and feasible. All other applicable, feasible, and appropriate ITS amenities should be included in the installation, including but not limited to: communications, interconnect, full capability controllers, cameras, detection, cabinets, vaults, and signal synchronization.	• Caltrans • City of Fresno • City of Clovis • Fresno County • Other local agencies, as appropriate	• Traffic Management	• Expansion/in-fill of existing communications infrastructure • Expansion/in-fill of existing system components • This project represents expansion of existing central system capabilities
81	**Ashlan-Grade Separation @ UPRR & SR 99 Interchange Grade Separation –** Deploy ITS technologies in support of the grade separation project. ITS elements that may apply to these projects include: signs, signal control, controller/firmware/software upgrades.	• Caltrans • Other agencies, as appropriate	• Traffic Management	• This project represents the ITS field infrastructure component of larger roadway construction projects

Project ID #	Project Description	Participating Agencies	Program Area	Interdependencies/ Other Notes
82	**Incident Detection Systems (Freeways and Arterials) –** Implement incident detection systems that utilize algorithms that detect anomalies in traffic flow to detect incidents and alert operators to the incident. More sophisticated systems include decision support capabilities that activate closed circuit television (CCTV) cameras in the vicinity of the detected incident. The decision support system can then suggest other traffic management strategies, such as the content for posting messages on changeable message signs, as well as other functions. The detection system should be integrated with the traffic management center or other surveillance systems.	• Caltrans • Other local agencies, as appropriate	• Emergency Management	• Systems heavily dependent on vehicle detection technologies in the field • Systems largely dependent on robust, modern, full capability transportation management system being in place • Central system utilizes incident detection algorithms • Central system typically utilizes a decision support system to suggest response plans for operator review and approval • Central system may utilize a decision support system to autonomously implement response plans

Project ID #	Project Description	Participating Agencies	Program Area	Interdependencies/ Other Notes
83	Downtown Fresno Parking Guidance System – This project would interconnect parking facilities in the Downtown Fresno area for the purposes of information exchange, and ultimately, guiding downtown drivers to available parking. The Parking Guidance System would integrate revenue collection systems, and parking occupancy systems, and variable message signs.	• City of Fresno • FCOG • Other local agencies, as appropriate	• Traffic Management	• System would depend on interconnection of various parking and revenue control systems in the downtown area • System would require an "expert system" to track and distribute parking availability information in the downtown area • System may rely on a system of roadside dynamic message signs that would direct drivers to available parking • System may rely on dissemination of parking availability information to media and over the Internet • System depends on robust, modern, full function communications infrastructure
Table Note 1: Arterial Widening (Local Agencies) – Potential Short Term candidate projects include but are not limited to the following: Barstow, Behymer, Bullard, Butler, Clovis, Copper, DeWolf, Fowler, Gettysburg, Herndon, Leonard , Nees, Peach, Shaw, Locan, Sunnyside , Temperance, Tollhouse , Villa, Central, Millerton, Mountain View, Willow, Dante, Riverside, Santa Fe, Tulare, Ventura, 13th, Tornado, Simpson, 11th, Buttonwillow, Dinuba, Manning, Bethel, Dinuba, Highland, and potentially others.				

Project ID #	Project Description	Participating Agencies	Program Area	Interdependencies/ Other Notes
Table Note 2: Arterial Widening (Local Agencies) – Potential Medium Term candidate projects include but are not limited to the following: Alluvial, Armstrong, Ashlan, Behymer, Blythe, Bullard, Minnewawa, Chestnut, Divisidero, Fowler, Gettysburg, Golden State, Herndon, Kings Canyon, Locan, Parkway Drive, Shepherd, Sierra, Spruce, California, Whitesbridge, 10th, 18th, Academy Pkwy, Bethel, Frankwood, Reed, Academy, and potentially others.				
Table Note 3: Arterial Widening (Local Agencies) – Potential Long Term candidate projects include but are not limited to the following: Armstrong, Behymer, Belmont, Brawley, Broadway, Bryan, Copper, Manning, McCall, Reed, Shepherd, American, Auberry, Chestnut, Willow, California, Church, Clinton, East, Fig, Friant, Garfield, Grantland, Hayes, Hughes, Jensen, Madison, Maple, Marks, McKinley, Nielsen, North, O St, Olive, Orange, Peach, Polk, Shaw, Shields, Temperance, Valentine, Veterans, Walnut, Weldon, West, Whitebridge, Willow, Kamm, and potentially others.				
Table Note 4: ITS Adaptive Technology Deployment – Potential Short Term candidate projects include but are not limited to the following: • Herndon Ave – Willow to SR99 • Shaw Ave – Blackstone to SR99 • Clovis Ave - Jensen to Shields • Blackstone-Friant - Downtown to Copper • Willow-Chestnut Ave - Jensen to Copper • Kings Canyon Road - Downtown to Temperance (Phase 1 -Down Town-Chestnut; Chestnut to Clovis; Clovis to Temperance) • First Ave - Ventura to Friant • Ashlan Ave - Blackstone to Peach • McKinley Ave - SR99 to Clovis Ave • Nees Ave - Palm to Willow • Tulare Ave - Clovis to Downtown • Downtown Fresno St & Van Ness Ave • Bullard Ave - Marks to Willow • Shields Ave - West Ave to Willow • West Ave - McKinley to Herndon • Cedar Ave - Kings Canyon to Friant • Friant Road - Shepherd to Copper • Bullard Ave - Marks to Fig Garden Loop, connecting Herndon and Shaw • International-Cedar-Copper - Willow to Friant • Clinton Ave - Grantland to Blackstone • Marks Ave - Clinton to Jensen • Grantland Ave - Clinton to Veterans to Herndon • Palm Ave - Herndon to Belmont • Shepherd Ave - Willow to Friant • Champlain Drive - Shepherd to Friant • Copper Ave - Friant to Willow Shaw Ave - SR99 to Veterans			

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