San Mateo County

Intelligent Transportation Systems

Strategic Plan

20-YEAR ITS STRATEGIC PLAN
FINAL REPORT

C/CAG

CITY/COUNTY ASSOCIATION OF GOVERNMENTS

OF SAN MATEO COUNTY

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TRANSPORTATION SOLUTIONS

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E.1   Overview

Intelligent Transportation System (ITS) refers to the application of advanced technologies and management strategies to increase the safety and efficiency of the surface transportation system.   The San Mateo County ITS Strategic Plan represents an important element of a comprehensive transportation plan for the county.   Recognizing that physical and environmental constraints limit the potential for expanding the transportation system infrastructure, ITS offers the opportunity to make more efficient use of existing transportation facilities and services. Strategic use of ITS technologies will benefit a broad cross-section of interests, such as goods movement, transit travelers, and auto drivers. It will also help local agencies with their jobs of managing congestion, providing mobility improvements, and improving air quality.

E.2   **San Mateo County ITS Strategic Planning**

Although the County has seen the implementation of some basic technology-based strategies or ITS applications, there has not been a comprehensive, systematic look at ITS opportunities until now. The San Mateo County ITS Strategic Plan was a Countywide effort to provide direction in the application of advanced transportation technology in San Mateo County over the next twenty years. The overall goal of the project was to identify and prioritize potential ITS applications in the county based on existing and projected future travel and transportation needs and deficiencies. This Strategic Plan includes both auto or highway-oriented strategies and ways to reduce the auto travel, through enhancements to transit, traveler information, and incident management opportunities.

Because of the dynamic, evolving nature of ITS, it is important to understand the role of the ITS Strategic Plan — what it is intended to do and what it does not do. The Strategic Plan is viewed as a tool to guide agencies. It does not mandate what agencies must do, nor limit what they can do. But properly understood, the Strategic Plan can help agencies make the best use of transportation technology, providing the overall framework for purposeful, integrated ITS applications. It can help agencies avoid some of the potential pitfalls inherent in an arena for which many transportation agencies have little experience.

E.2.1 Planning Process

There is wide array of technology applications available to address a variety of transportation-related needs and challenges.   However, the objective is not to simply implement ITS projects because the technologies are available, but rather to identify those applications that make the most sense for San Mateo County. To this end, the first steps in the Strategic Plan development process involved gaining a firm understanding of the County's transportation system characteristics and needs.

These first steps, as shown in **Figure E-1** below, included conducting a comprehensive inventory of the County's transportation system and existing ITS initiatives, and identifying current and forecasted transportation-related needs and deficiencies. Recognizing that ITS strategies and projects should be designed specifically to address these needs and deficiencies, significant effort was put forth to identify these needs through a review of relevant documents and data, and interviews with a range of stakeholders. These needs and deficiencies were the foundation upon which the ITS Strategic Plan is built.
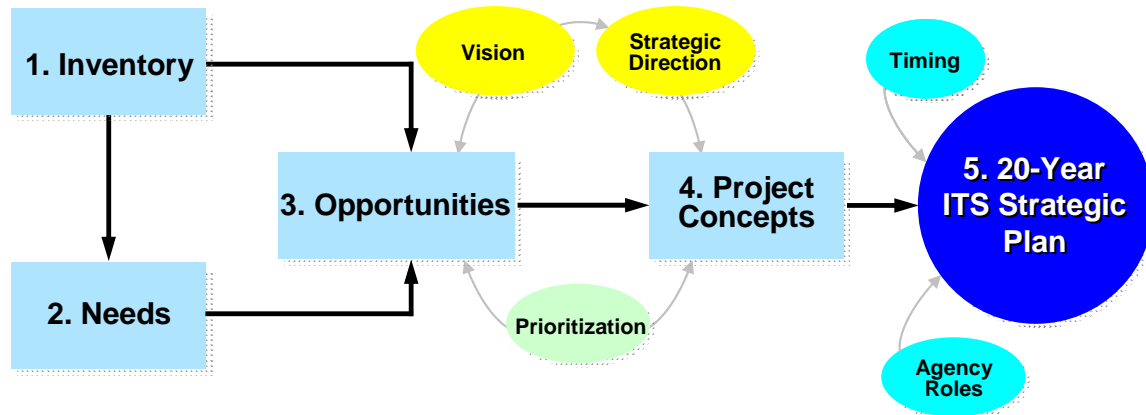
Figure E-1. San Mateo County ITS Strategic Plan Work Program

The inventory and needs information was then used to develop a range of ITS opportunities for the County. As part of this step, an overall vision and strategic direction for ITS deployment in the County was developed. Countywide priority ratings were then assigned to each of the ITS opportunities, and more specific project concepts defined for the higher priority opportunities.

The results of each step were then pulled together into this Strategic Plan report. The Plan also identifies the agency roles and timing related to the implementation of each ITS opportunity, and presents a set of steps to be undertaken in the near future to move the County toward further deployment of ITS.

E.2.2 Planning Participants

The San Mateo County ITS Strategic Plan resulted from a joint effort by governmental agencies. The ITS Strategic Plan was developed under the leadership of the City/County Association of Governments of San Mateo County (C/CAG) along with the San Mateo County Transportation Authority (SMCTA). It was developed under the guidance of the Working Group consisting of representatives from C/CAG, SMCTA, City of Belmont, City of Menlo Park, City of Redwood City, City of San Mateo, SamTrans, California Department of Transportation (Caltrans), and the Metropolitan Transportation Commission (MTC).

The Working Group was assisted by a consulting team led by DKS Associates. In addition to the Working Group members, input to the Strategic Plan was solicited from a large

number of agencies with a stake in the County's transportation system. It was particularly important to conduct the effort on a countywide and even regional basis because ITS applications are generally most effective if they are coordinated across jurisdictional boundaries and designed to be interoperable with each another.

E.3   San Mateo County ITS Strategic Plan

E.3.1 Vision and Goals

The ITS "vision" for San Mateo County describes the overall direction for the planning and deployment of ITS in the County. It expresses overarching themes that the Strategic Plan should consider as it is implemented. It is intended to help unify and coordinate the application of advanced transportation technologies in the County.

The following represents the ITS vision statement for San Mateo County:

> *"improve mobility, improve travel time reliability, and enhance the transportation system safety for all travelers in San Mateo County through the integrated and strategic use of advanced technologies and interagency cooperation"*

The vision statement contains two words that are particularly key to the overall strategy: integrated and strategic. By integrated we mean that ITS will not be something that is thought of independently of everything else we do. Rather, potential ITS applications will be considered as part of a comprehensive set of initiatives that may involve traditional improvements as well as technological ones. ITS cannot be expected to solve all the problems or to eliminate the need for capacity enhancements, transit capital investments, or safety improvements. By strategic we mean that ITS technologies should be applied where they make sense. They need to be applied to specific problems or respond to opportunities that are appropriate for San Mateo County.

The vision statement is just one part of the overall vision. This vision supported by a set of goals and a series of focus statements. The goals for ITS deployment in the County, as defined through the San Mateo County ITS Strategic Plan, are to:

- **Provide reliable and timely information to all travelers to support informed decision-making**
- **Enhance roadway network operations to ensure safe and reliable travel**
- **Enhance the ability to respond to emergencies and incidents to improve safety and reduce impacts to the transportation system**
- **Enhance the efficiency, safety and attractiveness of transit to increase transit mode share**
- **Enhance and support interagency operability and coordination to support efficient system management**

The overall vision and goals of the ITS Strategic Plan conform with the goals and objectives of the Countywide Transportation Plan since both plans desire to improve mobility, safety, and travel time reliability within the County.

E.3.2 ITS Opportunities and Priorities

The San Mateo County ITS Strategic Plan is structured around seven components or elements of the transportation systems. These elements are:

- **Freeway/Highway Management**
- **Arterial Management**
- **Transit Management**
- **Traveler Information**
- **Parking Management**
- **Emergency/Incident Management**
- **Supporting Elements**

For each of these transportation elements, improvement opportunities or project concepts were defined taking into consideration the identified needs and existing ITS initiatives. The improvement opportunities or project concepts are then prioritized within each of the seven elements. Details for each of the seven transportation elements are discussed in chapters 4 through 10, respectively, and are summarized in **Table E-1** through **Table E-7**.

Please note that some of the project concepts applied to more than one transportation element. For example, the project concept of "Install CCTV cameras at key locations throughout the County" are listed under the Arterial Management element as project concept #AM2 as well as under the Incident Management element as project concept #IM2. What this means is that the implementation of installing CCTV cameras will benefit both arterial management and incident management and should be developed accordingly by involving all agencies having responsibilities in those areas.

Table E-1:	Freeway/Highway Management			

OPPORTUNITY/PROJECT CONCEPT		Countywide Priority	Agency Participation[1,2]		Benefits
#	Description		Planning	Deployment	
FM1	**Bring already deployed ITS devices into full and stable operation**	H	C/CAG, Caltrans	Caltrans	**Improve traffic monitoring and incident verification capabilities. Maximize and optimize the use of existing ITS elements.**
FM2	**Make Regional transportation management center (TMC) fully-operational with respect to San Mateo County**	H	C/CAG, Caltrans	Caltrans	**Improve traffic monitoring and incident verification capabilities. Maximize and optimize the use of existing ITS elements.**
FM3	Deploy additional traffic monitoring and incident verification equipment where appropriate on the County's freeways and highways	M	Caltrans, C/CAG, MTC	Caltrans	Improve traffic monitoring and incident verification capabilities.
FM4	Install fog sensing equipment where appropriate on the County's highways	L/M	Caltrans, C/CAG	Caltrans	Improve traffic monitoring and incident verification capabilities.
FM5	Install additional changeable message signs (CMSs), including along I-280 and Highway 35 in Daly City and Pacifica	M	Caltrans, C/CAG	Caltrans	Enhance dissemination of real-time traveler information.
FM6	Install additional changeable message signs (CMSs) on US 101 and I-280 for route guidance to major attractions	M/L	C/CAG, Caltrans	Caltrans	Enhance dissemination of real-time traveler information.
FM7	**Bring ramp metering system, as approved, into operation and integrate with signal operations where appropriate**	M/H	**Caltrans, C/CAG, Local PW**	**Caltrans, Local PW**	**Improve coordination between freeway operations and local arterial street traffic operations. Improve management of traffic flow and congestion on the freeway system.**
FM8	Implement a center-to-center link between Caltrans' Transportation Management Center (TMC) and existing or future TMCs within San Mateo County	M/L	C/CAG, Local PW, Caltrans	Caltrans, Local PW	Improve coordination between freeway operations and local arterial street traffic operations. Provide local agency access to Caltrans' cameras and other freeway monitoring information.

Notes:

1 **Bold type** = high or high medium priorities.

2 Underlining denotes potential lead agency. for deployment, agencies will typically take lead for portion on facilities over which they have jurisdiction. Agencies - Local PW = City/County Public Works; County OES = County Office of Emergency Services; Local ESP = City/County police, fire, medical response, etc.; SFO = San Francisco International Airport; Private = private sector entities.

3 The San Mateo County Transportation Authority (SMCTA) will be a potential participant in the planning and deployment of all projects as funding partner.

Table E-2: Arterial Management				
OPPORTUNITY/PROJECT CONCEPT	**Countywide Priority**	**Agency Participation**[1,2]		**Benefits**
# / **Description**		**Planning**	**Deployment**	
AM1 **Upgrade existing traffic signal systems (e.g. replace antiquated equipment, expand coordinated systems, update signal timings, etc.)**	**H**	<u>Local PW, Caltrans</u>, **C/CAG**	<u>Local PW, Caltrans</u>	**Improve monitoring and incident detection capabilities. Improve management of traffic during major events. Improve traffic signal coordination. Improve coordination between arterial and freeway operations. Improve ability of local agencies to centrally monitor conditions and control signals.**
AM2 **Install CCTV cameras at key congested locations throughout the County**	**M/H**	**C/CAG**, Local PW, Caltrans	<u>Local PW, Caltrans</u>	**Improve monitoring and incident detection capabilities. Improve management of traffic during major events.**
AM3 Install additional detection stations along major arterials	L/M	<u>C/CAG</u>, Local PW, Caltrans	<u>Local PW, Caltrans</u>	Improve monitoring and incident detection capabilities. Improve management of traffic during major events.
AM4 Install changeable message signs (CMSs) on major arterials	L	<u>C/CAG</u>, Local PW, Caltrans	<u>Local PW, Caltrans</u>	Improve management of traffic during major events. Improve coordination between arterial and freeway operations.
AM5 Design and implement Smart Corridor(s) in selected areas	L/M	<u>C/CAG</u>, Local PW, Caltrans	<u>Local PW, Caltrans</u>	Improve monitoring and incident detection capabilities. Improve management of traffic during major events. Improve traffic signal coordination. Improve coordination between arterial and freeway operations.
AM6 Use predictive traffic control systems adjacent to at-grade railroad crossings	L/M	<u>Local PW, Caltrans</u>, Caltrain	<u>Local PW, Caltrans</u>	Improve traffic signal coordination.
AM7 **Provide link between traffic signal systems operated by local agencies and by Caltrans (CTNet)**	**H/M**	**C/CAG**, Local PW, Caltrans	<u>Local PW, Caltrans</u>	**Improve traffic signal coordination. Improve ability of local agencies to centrally monitor conditions and control signals.**
AM8 Establish Countywide Transportation Management System (through a single TMC or series of sub-area TMCs)	L	<u>C/CAG</u>, Local PW	<u>Local PW</u>	Improve coordination between arterial and freeway operations. Improve ability of local agencies to centrally monitor conditions and control signals.
AM9 Implement a center-to-center link between San Mateo TMC(s) and other regional systems	L	<u>C/CAG</u>, Local PW, Caltrans, adjacent counties	<u>Local PW, Caltrans</u>, adjacent counties	Improve traffic signal coordination. Improve coordination between arterial and freeway operations.
AM10 Evaluate and implement other advanced control strategies (e.g. adaptive) along key congested corridors	M	<u>Local PW, Caltrans</u>, C/CAG	<u>Local PW, Caltrans</u>	Improve monitoring and incident detection capabilities. Improve management of traffic during major events. Improve traffic signal coordination.
Notes:				
1	**Bold type** = high or high medium priorities.			
2	<u>Underlining</u> denotes potential lead agency. for deployment, agencies will typically take lead for portion on facilities over which they have jurisdiction. Agencies - Local PW = City/County Public Works; County OES = County Office of Emergency Services; Local ESP = City/County police, fire, medical response, etc.; SFO = San Francisco International Airport; Private = private sector entities.			
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Table E-3: Transit Management				
OPPORTUNITY/PROJECT CONCEPT	**Countywide Priority**	**Agency Participation[1,2]**		**Benefits**
# / **Description**		**Planning**	**Deployment**	
TM1 **Implement AVL systems on Caltrain rail vehicles**	H	**Caltrain**	**Caltrain**	**Enhance coordination among the different transit providers.**
TM2 Implement transit vehicle collision warning systems	L	SamTrans	SamTrans	Improve the safety of the transit vehicles and patrons.
TM3 **Explore applications for transit signal priority (TSP) along key transit corridors**	H	**SamTrans, Local PW, C/CAG, Caltrans**	**SamTrans**, Local PW, Caltrans	**Improve transit travel times (faster and more reliable).**
TM4 **Install electronic information signs at transit transfer and major activity centers**	H	**SamTrans, Caltrain, BART, Muni, AC Transit, VTA, MTC**	**SamTrans, Caltrain, BART, AC Transit, VTA, Muni**	**Enhance transit riders' experience and convenience.**
TM5 Install electronic information signs at all transit stops	M/L	SamTrans	SamTrans	Enhance transit riders' experience and convenience.
TM6 **Install in-vehicle electronic signs on transit vehicles**	H	**Caltrain**	**Caltrain**	**Enhance transit riders' experience and convenience.**
TM7 **Expand deployment of TransLink electronic fare system**	H/M	**MTC, SamTrans, Caltrain, BART**	**SamTrans, Caltrain, BART**	**Enhance coordination among the different transit providers. Enhance transit riders' experience and convenience.**
TM8 Implement center-to-center link between SamTrans and local TMCs	L	C/CAG, SamTrans, Local PW	SamTrans, Local PW	Enhance coordination among the different transit providers. Enhance transit riders' experience and convenience.
TM9 Implement center-to-center link between all transit agencies operating in San Mateo County	M	SamTrans, Caltrain, BART, Muni, AC Transit, VTA, MTC	SamTrans, Caltrain, BART, AC Transit, VTA	Enhance coordination among the different transit providers.
TM10 **Provide amenities such as access to the Internet on rail transit vehicles**	H	**Caltrain**	**Caltrain**	**Enhance transit riders' experience and convenience.**
Notes:				
1 **Bold type** = high or high medium priorities.				
2 Underlining denotes potential lead agency. for deployment, agencies will typically take lead for portion on facilities over which they have jurisdiction. Agencies - Local PW = City/County Public Works; County OES = County Office of Emergency Services; Local ESP = City/County police, fire, medical response, etc.; SFO = San Francisco International Airport; Private = private sector entities.				
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Table E-4:   Traveler Information

OPPORTUNITY/PROJECT CONCEPT		Countywide Priority	Agency Participation[1,2]		Benefits
#	**Description**		**Planning**	**Deployment**	
TI1	**Implement CMS's at key locations along the I-280, I-380 and US 101 freeways**	H	<u>C/CAG</u>, Caltrans	<u>Caltrans</u>	**Enhance en-route traveler information.**
TI2	**Implement CMS's at key locations along Highways 92, 84, 35 and 1**	H/M	<u>C/CAG</u>, Caltrans	<u>Caltrans</u>	**Enhance en-route traveler information.**
TI3	Implement CMS's at key locations along major arterials throughout the County	L	<u>C/CAG</u>, Local PW, Caltrans	<u>Local PW, Caltrans</u>	Enhance en-route traveler information.
TI4	Expand the Highway Advisory Radio (HAR) system within San Mateo County	L	<u>Caltrans</u>	<u>Caltrans</u>	Enhance en-route traveler information.
TI5	Implement traveler Information kiosks within the SFO baggage claim area	L	<u>MTC</u>, SFO, C/CAG	<u>SFO</u>, MTC	Enhance pre-trip traveler information services.
TI6	Install electronic travel information signs at major activity centers	M	<u>C/CAG</u>, Local PW, Caltrans, SamTrans, MTC, Private	<u>Local PW, Caltrans, SamTrans</u>, MTC, Private	Enhance pre-trip traveler information services. Enhance en-route traveler information.
TI7	Install electronic information signs at railroad at-grade crossings	L	<u>Local PW, Caltrans</u>	<u>Local PW, Caltrans</u>	Enhance en-route traveler information.
TI8	**Enhance distribution of traveler information to the media for real-time dissemination**	H	**<u>CHP</u>, Caltrans, MTC, Local PW, Local Police**	**<u>CHP</u>, Caltrans, MTC, Local PW, Local Police**	**Enhance pre-trip traveler information services. Enhance en-route traveler information.**
TI9	Publish traveler information on local agency websites	L/M	<u>Local PW</u>, C/CAG, MTC	<u>Local PW</u>	Enhance pre-trip traveler information services.
TI10	Implement a link between local traffic monitoring systems and the regional 511 traveler information system	M/L	<u>C/CAG</u>, MTC, Local PW	<u>Local PW</u>, MTC	Enhance pre-trip traveler information services. Enhance en-route traveler information. Enhance inter-agency sharing of both freeway and arterial information.
TI11	Provide a link between local TMCs and the CHP CAD system for real-time incident information	L	<u>C/CAG</u>, CHP, Local PW	<u>Local PW</u>, CHP	Enhance inter-agency sharing of both freeway and arterial information.
TI12	Publicize and provide education to the public regarding traveler information systems	L	<u>MTC</u>	<u>MTC</u>	Enhance the effectiveness and public awareness of traveler information systems.

Notes:

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2 <u>Underlining</u> denotes potential lead agency. for deployment, agencies will typically take lead for portion on facilities over which they have jurisdiction. Agencies - Local PW = City/County Public Works; County OES = County Office of Emergency Services; Local ESP = City/County police, fire, medical response, etc.; SFO = San Francisco International Airport; Private = private sector entities.

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Table E-5:	Parking Management				
OPPORTUNITY/PROJECT CONCEPT		**Countywide Priority**	**Agency Participation**[1,2]		**Benefits**
#	**Description**		**Planning**	**Deployment**	
PM1	Prepare a Parking Management System Study for various locations	L	<u>Local PW</u>	See PM #2	Improve parking management in larger downtown areas, around special event centers, and at major shopping centers.
PM2	Implement a real-time Parking Information and Guidance System , where appropriate	L	<u>Local PW</u>	<u>Local PW</u>	Improve parking management in larger downtown areas, around special event centers, and at major shopping centers.
PM3	Implement an electronic fee payment system utilizing FasTrak technology.	L	<u>MTC</u>, Caltrans, Local PW, Private	<u>Local PW, Private</u>, MTC, Caltrans	Improve parking management in larger downtown areas, around special event centers, and at major shopping centers.
Notes:					
1	**Bold type** = high or high medium priorities.				
2	<u>Underlining</u> denotes potential lead agency. for deployment, agencies will typically take lead for portion on facilities over which they have jurisdiction. Agencies - Local PW = City/County Public Works; County OES = County Office of Emergency Services; Local ESP = City/County police, fire, medical response, etc.; SFO = San Francisco International Airport; Private = private sector entities.				
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Table E-6:	Incident Management				

OPPORTUNITY/PROJECT CONCEPT		Countywide Priority	Agency Participation[1,2]		Benefits
#	Description		Planning	Deployment	
IM1	**Develop and implement Countywide incident management plans**	H	**C/CAG, Local PW, Caltrans, MTC, Local ESP, County OES, CHP**	**Local PW, Caltrans, Local ESP, County OES, CHP**	**Improve inter-agency communications at incident scenes. Enhance the ability of transportation agencies and emergency services agencies to exchange information.**
IM2	**Install CCTV cameras at key locations throughout the County**	M/H	**C/CAG, Local PW, Caltrans, County OES**	**Local PW, Caltrans**	**Enhance ability to detect, verify and manage incidents along major roads.**
IM3	Implement Incident Management software to support efficient incident response	M	C/CAG, County OES, Local PW, Local ESP	County OES, Local PW, Local ESP	Improve emergency vehicle response time.
IM4	Implement center-to-center links between transportation agencies and emergency service agencies	M	C/CAG, Local PW, Caltrans, Local ESP, County OES, CHP	Local PW, Caltrans, Local ESP, County OES, CHP	Enhance the ability of transportation agencies and emergency services agencies to exchange information.
IM5	Implement Automated Vehicle Location (AVL) systems for all maintenance and emergency vehicles	M	Local PW, Local ESP, C/CAG	Local PW, Local ESP	Improve emergency vehicle response time.
IM6	**Standardize emergency vehicle pre-emption (EVP) equipment countywide and implement on major routes**	H	**C/CAG, Local PW, Local ESP**	**Local PW, Local ESP**	**Improve emergency vehicle response time.**
IM7	**Coordinate Incident Management Plans with adjacent counties**	H	**C/CAG, County OES**		**Improve inter-agency communications at incident scenes. Enhance the ability of transportation agencies and emergency services agencies to exchange information.**

Notes:

1 **Bold type** = high or high medium priorities.

2 Underlining denotes potential lead agency. for deployment, agencies will typically take lead for portion on facilities over which they have jurisdiction. Agencies - Local PW = City/County Public Works; County OES = County Office of Emergency Services; Local ESP = City/County police, fire, medical response, etc.; SFO = San Francisco International Airport; Private = private sector entities.

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Table E-7:   Supporting Elements

# / Description	Countywide Priority	Agency Participation[1,2] Planning	Deployment	Benefits
SE1 **Prepare an overall Communications Network Plan for the County ITS Program.**	**H**	C/CAG, Local PW, Caltrans, MTC	See SE #2	**Fill gaps in the existing communications network.**
SE2 **Design and upgrade the existing communications infrastructure**	**H**	See SE #1	Local PW, Caltrans, MTC	**Upgrade existing faulty or outdated communications systems. Enhance coordination, information sharing and cooperation between agencies.**
SE3 Expand the existing RCN fiber network and expand franchise agreements with Comcast	M	See SE #1	See SE #2	Fill gaps in the existing communications network.
SE4 Connect into Caltrans' proposed fiber optic backbone on US101	M	See SE #1	See SE #2	Fill gaps in the existing communications network.
SE5 Evaluate the feasibility of utilizing private infrastructure to form part of the overall communication network	M	See SE #1	See SE #2	Fill gaps in the existing communications network.
SE6 Utilize the County's microwave system to provide communications between agency systems	M	See SE #1	See SE #2	Fill gaps in the existing communications network.
SE7 Develop a standard set of communications protocols and communication channels	M	C/CAG, Local PW, Caltrans, MTC, Local ESP, County OES, CHP	Local PW, Caltrans, MTC, Local ESP, County OES, CHP	Enhance coordination, information sharing and cooperation between agencies. Ensure continued O&M of all ITS elements and the communications network.
SE8 Designate staff dedicated to transportation management	L	Local PW	Local PW	Enhance coordination, information sharing and cooperation between agencies.
SE9 Establish cooperation between the agencies to work together under the San Mateo County ITS Program	M	C/CAG, all others	C/CAG, Local PW, Caltrans	Enhance coordination, information sharing and cooperation between agencies.
SE10 **Allocate funding and resources for the O&M of ITS elements and communication network**	**H**	C/CAG, Local PW, Caltrans, MTC, Local ESP, County OES, CHP		**Ensure continued O&M of all ITS elements and the communications network.**
SE11 Deploy monitoring devices at select locations for the purpose of collecting historical planning data	M	C/CAG, Local PW, Caltrans	Local PW, Caltrans	Improve availability of transportation data.
SE12 Incorporate data processing and archiving features into all monitoring systems	M	C/CAG, Local PW, Caltrans, MTC	Local PW, Caltrans	Improve availability of transportation data.

Notes:

1 **Bold type** = high or high medium priorities.

2 Underlining denotes potential lead agency. for deployment, agencies will typically take lead for portion on facilities over which they have jurisdiction. Agencies - Local PW = City/County Public Works; County OES = County Office of Emergency Services; Local ESP = City/County police, fire, medical response, etc.; SFO = San Francisco International Airport; Private = private sector entities.

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E.4   Next Steps

E.4.1 ITS Program and Funding

The Metropolitan Transportation Commission (MTC) has already adopted a policy which states that all major new freeway projects shall include traffic operations system elements to effectively operate the region's freeway system and coordinate with local transportation management systems. San Mateo County will continue and increase implementation of ITS strategies on all major highway projects including those funded by the sales tax measure.

C/CAG will develop a policy on funding ITS projects as identified in this ITS Strategic Plan using Federal and State transportation funds allocated to San Mateo County. Potential funding sources include State Transportation Improvement Program (STIP), Surface Transportation Program (STP), Congestion Management and Air Quality Program (CMAQ), San Mateo County Sales Tax Program (Measure A), Regional Freeway Operations Program, State Highway Operation and Protection Program (SHOPP), etc.   C/CAG, in partnership with local agencies, transit agencies, and other appropriate agencies, will seek Federal, State, and regional ITS-eligible grant funds as well.

It is also recommended that an ITS Coordinating Group be established to help guide further planning and implementation of ITS projects in San Mateo County. This group should meet on a periodic basis to provide input to issues pertaining to the design and implementation of the projects identified in this San Mateo County ITS Strategic Plan. It should be a forum for assessing the status of strategic plan implementation, facilitating coordination among the various agencies within the region as well as with the adjacent regions, and for working out inter-agency agreements.   As a minimum, the ITS Coordinating Group should include C/CAG, SMCTA, local jurisdictions, SamTrans, Caltrans, and MTC.   The ITS Working Group which guided the development of this ITS Strategic Plan would be a good foundation for the ITS Coordinating Group.

E.4.2 Near Term Implementation Projects

Through the San Mateo County ITS Strategic Plan effort, momentum has been gained for the deployment of ITS in the County of San Mateo.   It is important that this energy and momentum be maintained. As part of this, individual agencies or entities will need to step forward to lead or "champion" individual ITS projects based on their level of interest and need. The successful implementation of ITS also requires top level leadership that focuses on an overall ITS program for San Mateo County.

A number of the ITS opportunities and project concepts listed in this Plan are shown as being implemented in the near-term (within the next five years). This list includes a number of projects that are already underway. The inclusion of these projects is aimed at providing a more complete picture of the planned activities and an understanding of the integration needs.

The next steps for ITS in San Mateo County therefore involve moving toward implementing these near-term strategies and projects. In some cases, the projects are fairly well-defined and the focus may be placed on capital investment and deployment. In other cases, significant planning is still necessary and will require the commitment of staff resources from participating agencies. A detail list of the near term projects can found in Table 12-1 of Chapter 12 and are summarized below:

- Freeway Management Project #1: Bring already deployed freeway ITS devices into full and stable operation. (C/CAG, SMCTA, Caltrans)
- Arterial Management Project #1: Upgrade existing traffic signal systems – fill critical gaps in signal inter-connect network. (C/CAG, local agencies, SMCTA and Caltrans)
- Arterial Management Project #7: Provide a link between traffic signal systems operated by local agencies and by Caltrans (Local agencies, Caltrans, SMCTA and C/CAG).
- Transit Management Project #3: Explore applications for transit signal priority along key transit corridors. (on-going by SamTrans)
- Transit Management Project #4: Install electronic information signs at transit transfer and major activity centers. (on-going by SamTrans)
- Transit Management Project #7: Expand deployment of TransLink electronic fare system. (on-going by MTC)
- Incident Management Project #1: Develop Countywide incident management plans. (C/CAG in cooperation with local agencies, emergency service providers, Office of Emergency Services, Caltrans, MTC, CHP, etc.)
- Support Element Project #1: Prepare an overall Communications Network Plan for the San Mateo County ITS Program. (C/CAG, local agencies, transit operators, SMCTA, Caltrans, MTC, etc.)

1 INTRODUCTION

The development of the San Mateo County Intelligent Transportation System (ITS) Strategic Plan was a multi-agency effort to provide direction for the application of advanced transportation technology in the county. This report is the synthesis of a series of technical memoranda prepared as part of the development of the San Mateo County ITS Strategic Plan. The ITS Strategic Plan defines the technological applications that make the most sense for San Mateo County over the next twenty years and provides an action plan for implementing those strategies.

The ITS Strategic Plan represents an important element of a comprehensive transportation plan for the county. Recognizing that physical and environmental constraints limit the potential for expanding the transportation system infrastructure, ITS offers the opportunity to make more efficient use of existing transportation facilities and services. The Strategic Plan serves as a blueprint for how technology may be used to enhance the transportation system in both the short and long term. Meanwhile, the strategic planning exercise itself has served as a valuable activity in bringing together the diverse set of stakeholders in the region.

The San Mateo County ITS Strategic Plan resulted from a joint effort by governmental agencies to develop an approach for making the most of ITS opportunities throughout the county. The ITS Strategic Plan was developed under the leadership of the City/County Association of Governments (C/CAG) of San Mateo County working with the San Mateo County Transportation Authority (SMCTA) and by an ITS Working Group consisting of selected stakeholder agencies. The Working Group was assisted by a consulting team led by DKS Associates.

The ITS Strategic Plan is an important tool for integrating a variety of possible actions, both local and regional, that will move the area forward in the application of advanced transportation technology. It was particularly important to conduct the effort on a countywide and even regional basis because ITS applications are generally most effective if they are coordinated across jurisdictional boundaries and designed to be interoperable with each other.

The ITS Strategic Plan considers both the near- and long-term time frames. It also addresses both auto or highway-oriented strategies and ways to reduce the auto travel, through enhancements to transit, traveler information, and incident management opportunities.

1.1 Purpose/Background

The ITS Strategic Plan is a Countywide effort to provide direction in the application of advanced transportation technology in San Mateo County. The overall goal of the project was to identify and prioritize potential ITS applications in the county based on existing and projected future travel and transportation needs and deficiencies.

Because of the dynamic, evolving nature of ITS, it is important to understand the role of the ITS Strategic Plan — what it is intended to do and what it does not do. The Strategic Plan is viewed as a tool to guide agencies. It does not mandate what agencies must do, nor limit what they can do. But properly understood, the Strategic Plan can help agencies make the best use of transportation technology, providing the overall framework for purposeful, integrated ITS applications. It can help agencies avoid some of the potential pitfalls inherent in an arena for which many transportation agencies have little experience. In this respect, the San Mateo County ITS Strategic Plan:

- **exists to improve the delivery of transportation service.** It seeks to provide new and better ways of running the transportation system.

- **shows a connection between the transportation-related problems/issues being faced by those in San Mateo County and ITS opportunities.** The objective was not merely to find

ways to use the latest technological innovations, but rather to identify ways that this technology could be used to effectively address transportation needs in the County.

- **reinforces the integration of ITS into the mainstream planning process.** ITS technologies are just another set of tools available for the solution of recognized transportation problems.

- **envisions no significant shifts in institutional arrangements.** However, implementation of the plan will require increasing institutional coordination. This will include increasing coordination between Caltrans, CHP, county agencies, local agencies, and the private sector.

- **recognizes that basic infrastructure deployment is fundamental to the development of some future ITS services.** ITS is generally dependent on electronic communications, and while wireline systems are generally well developed, wireless communications are changing and developing rapidly and may offer more cost-effective solutions in some cases.

- **should be viewed as a living document**, one that the agencies should be ready to change as the direction of technology, transportation, and public policy unfolds.

The overall work program for the San Mateo County ITS Strategic Plan is illustrated in **Figure 1-1** below. The purpose of this Strategic Plan is to summarize the results of the four steps in this process.
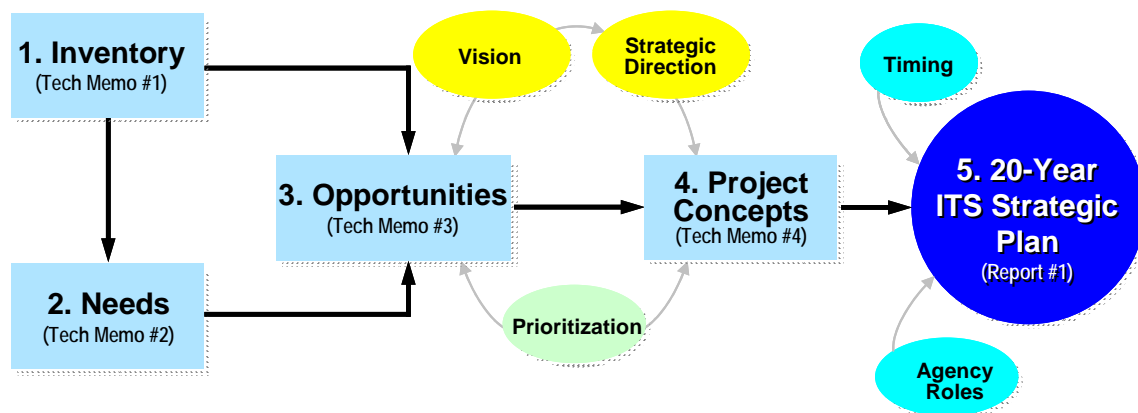
Figure 1-1. San Mateo County ITS Strategic Plan Work Program

1.2 What is ITS?

Intelligent Transportation Systems (ITS) is somewhat different from other types of transportation improvements because it emphasizes enhancement of travel on existing infrastructure, and is not a mode of travel itself. ITS can be viewed as efficient management of our resources. ITS has been defined as:

> "the application of advanced sensor, computer, electronics, and communication technologies and management strategies in an integrated manner to increase the safety and efficiency of the surface transportation system."

This definition encompasses a broad array of technologies and approaches that can make highways and transit systems operate more safely and efficiently. They include more immediately recognizable features such as: Changeable message signs, closed circuit television (CCTV) cameras, traffic signal synchronization and preemption, and Highway Advisory Radio; and also more advanced technologies including Traffic Operations Centers, Road Weather Information Systems, automatic vehicle location devices, information kiosks, and electronic payment services for transit and tolls. While ITS

incorporates many new and emerging technologies, a number of these technologies have been deployed in San Mateo County.

The expectation is that strategic use of ITS technologies will benefit a broad cross-section of interests, such as tourism, goods movement, transit travelers, and auto drivers. It will also help public agencies with their jobs of managing congestion, providing mobility improvements, and improving air quality. To be most effective, the systems need to be integrated, sharing information that can be used within and outside of San Mateo County to improve travel mobility and safety.

1.3   Strategic Plan Documents

The documents produced as part of the four steps leading up to the Strategic Plan include the following:

- Technical Memorandum #1:   A comprehensive inventory of existing and planned transportation systems, as well as currently and planned technology uses.

- Technical Memorandum #2: A summary of the identified transportation-related deficiencies and needs in San Mateo County.

- Technical Memorandum #3: A summary of the ITS opportunities that have been identified to address the perceived transportation-related needs in San Mateo County.

- Technical Memorandum #4: A summary of the results of the ranking process, and provides detailed descriptions of the ITS opportunities ranked high to medium/high priority by the Working Group.

These technical memoranda are included as appendices to this Strategic Plan report.

1.4   Project Participants

The San Mateo County ITS Strategic Plan Working Group developed the ITS Strategic Plan in a coordinated and cooperative manner. During the course of the Strategic Plan development, the Working Group met on a regular basis to develop goals and objectives, review needs and opportunities, and discuss proposed program areas and priorities, and review deliverables. The Working Group consisted of:

- C/CAG
- San Mateo County Transportation Authority (SMCTA)
- City of Belmont
- City of Menlo Park
- City of Redwood City
- City of San Mateo
- San Mateo County Transit District (SamTrans)
- Peninsula Corridor Joint Powers Board (Caltrain)
- California Department of Transportation (Caltrans)
- Metropolitan Transportation Commission (MTC)

In addition to the Working Group members, input to the Strategic Plan was solicited from a large number of agencies with a stake in the County's transportation system. The following agencies and jurisdictions represent the stakeholders for this ITS Strategic Plan.

- Town of Atherton
- City of Belmont

- City of Brisbane
- City of Burlingame
- Town of Colma
- City of Daly City
- City of East Palo Alto
- City of Foster City
- City of Half Moon Bay
- Town of Hillsborough
- City of Menlo Park
- City of Millbrae
- City of Pacifica
- Town of Portola Valley
- City of Redwood City
- City of San Bruno
- City of San Carlos
- City of San Mateo
- County of San Mateo
- City of South San Francisco
- Town of Woodside
- SamTrans
- Caltrain
- C/CAG
- SMCTA
- Santa Clara Valley Transportation Authority (VTA)
- City/County of San Francisco
- MTC
- Peninsula Traffic Congestion Relief Alliance
- Caltrans
- California Highway Patrol (CHP)
- Federal Highway Administration (FHWA)

Within the jurisdictions, representations typically consist of Public Works Directors, City Traffic Engineers, Transportation Managers, as well as representatives from the emergency services (i.e. Fire, Police). It is recognized that there are many other organizations and agencies that have an interest in the County's transportation system. Outreach in the form of workshops and interviews were conducted throughout the strategic planning process to solicit input from these groups.

1.5   Outline of Report

To facilitate development of this Strategic Plan, the County's transportation system was viewed as being comprised of the following seven elements:

- **Freeway/Highway Management** – refers to the management of traffic traveling on uninterrupted roadways such as freeways and rural highways;
- **Arterial Management** – refers to the effective management of traffic along surface streets and through intersections;
- **Transit Management** – refers to the management of public transit vehicles and services;
- **Traveler Information** – involves the collection and dissemination of information between systems and to the travelers of the various modes of transportation;

- **Parking Management** – includes a variety of strategies that encourage more efficient use of existing parking facilities;
- **Emergency/Incident Management** – involves a coordinated or planned approach for responding to incidents that occur on either the freeways or arterials; and
- **Supporting Elements** – includes elements such as the communications network, ITS standards, operating procedures and protocols, and data archiving.

Much of the discussion in this report, as well that in the technical memoranda, is structured around these elements.

Chapter 2 of this report provides an overview of San Mateo County, including its transportation systems, travel characteristics, and existing ITS initiatives. Most of the material in this chapter is derived from Technical Memorandum #1

Chapter 3 summarizes the overall ITS vision and goals for San Mateo County, including how it relates to the Countywide Transportation Plan 2010. This vision is the culmination of the process involving the identification of transportation-related needs within the County (Step 2), development of possible ITS opportunities (Step 3), and the prioritization and further definition of these opportunities (Step 4).

Chapters 4 through 10 describe in greater detail the needs, opportunities and priorities associated with each of the seven transportation system elements listed above. These chapters draw upon information presented in all of the technical memoranda prepared as part of this Strategic Plan effort.

Chapter 11 contains an initial Implementation Plan for the ITS opportunities identified in this Strategic Plan and introduces a number of key factors that should be considered when deploying ITS projects.

Chapter 12 highlights several opportunities that may be considered "early winner" projects and identifies the next steps that should be taken to move these projects further down the road to implementation.

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2   SETTING

San Mateo County is located on the San Francisco Peninsula, bounded by the Pacific Ocean on the west, San Francisco Bay on the east, and the major regional center of San Francisco and Silicon Valley (Santa Clara County) to the north and south respectively. While the western portions of the County are primarily rural in character, the bayside portion of the County is urbanized and largely built-out.   The urbanized area is largely residential, with many County residents commuting to adjacent counties, primarily San Francisco and Santa Clara for work. The past decade, however, has seen a significant growth in employment within the County, especially along the US 101 corridor. As of 2000 the population was 707,161. The county seat is Redwood City.

The remainder of this chapter provides an overview of the study area, including a description of the major transportation elements, general travel characteristics, and existing ITS initiatives in the County. Additional detail on these topics is provided in Appendix A: Technical Memorandum #1: Inventory of Existing and Planned Systems.

2.1   *Transportation Network*

San Mateo County's transportation system consists of multiple components that function as separate but related systems.   In terms of the volume of travel served, the primary components of the County's transportation system are the roadway network and transit system.   These components are described in greater detail below.

2.1.1   Roadway Network

Figure 2-1 (a-d) illustrates the roadway network in San Mateo County. The roadway network consists of two north-south freeways, two bridge links, a single, contiguous north-south arterial and a host of local routes within each city.   Due to the topography of mountains on one side and the Bay on the other, the roadway network is, for the most part, built out within the urban areas of the County. Currently, there are only three continuous north-south routes that run the entire length of the County, El Camino Real, US 101 and I-280. The US 101 and I-280 freeways carry the most regional traffic to and through the County with access to the two bridges (Highway 92 and 84). From a Countywide perspective, these are the most important links within the County.

US 101 is the primary travel corridor connecting the North Bay to the San Jose region. It is an eight- to ten-lane north-south freeway in San Mateo County that carries between 200,000 and 262,000 vehicles per day.

Interstate 280 is a state highway that provides regional access between San Francisco and the San Jose region. It is a 6- to 12-lane freeway in San Mateo County that carries between 104,000 and 229,000 vehicles per day.

Figure 2-1a
Road Network

DKS Associates
TRANSPORTATION SOLUTIONS
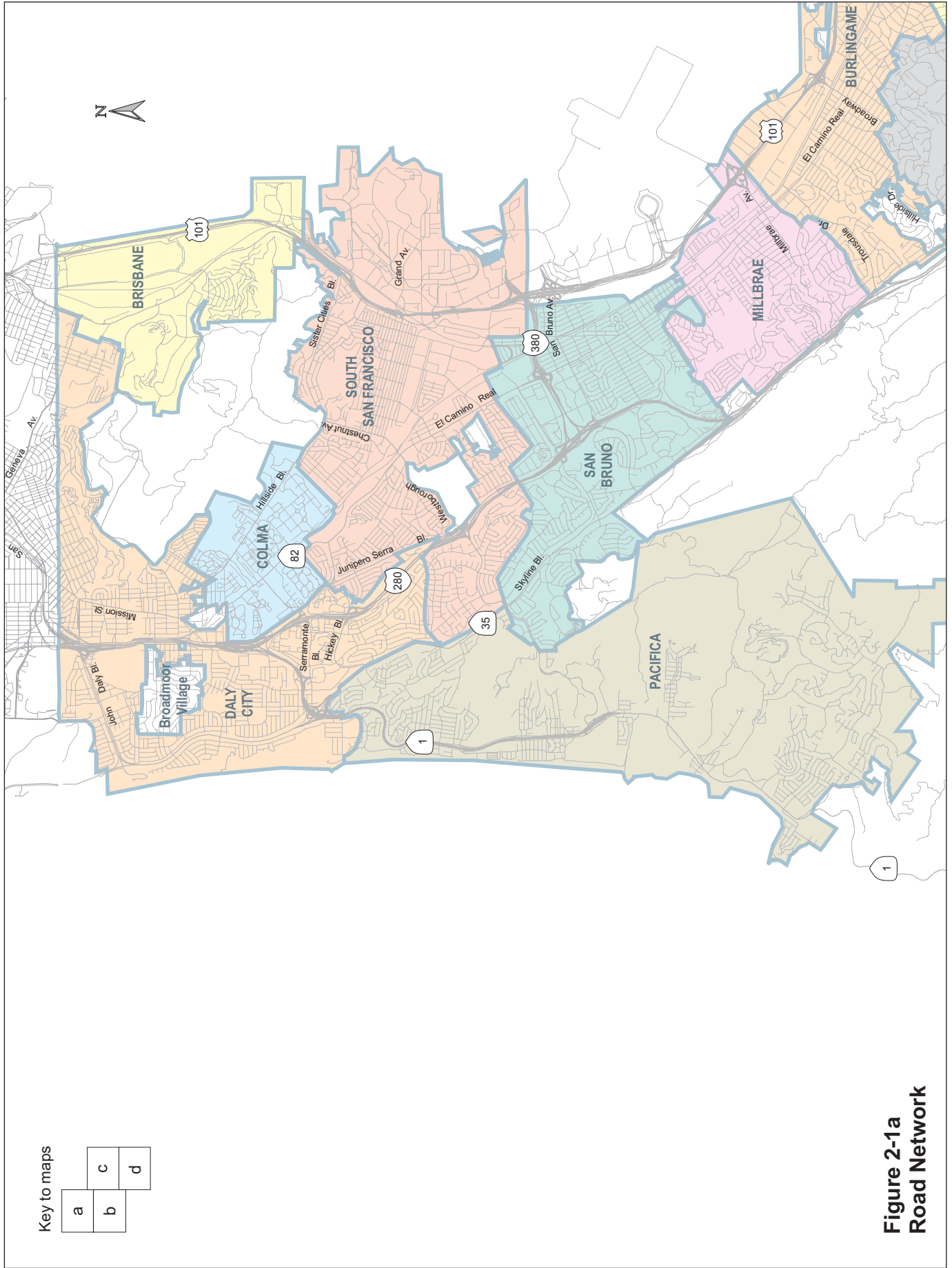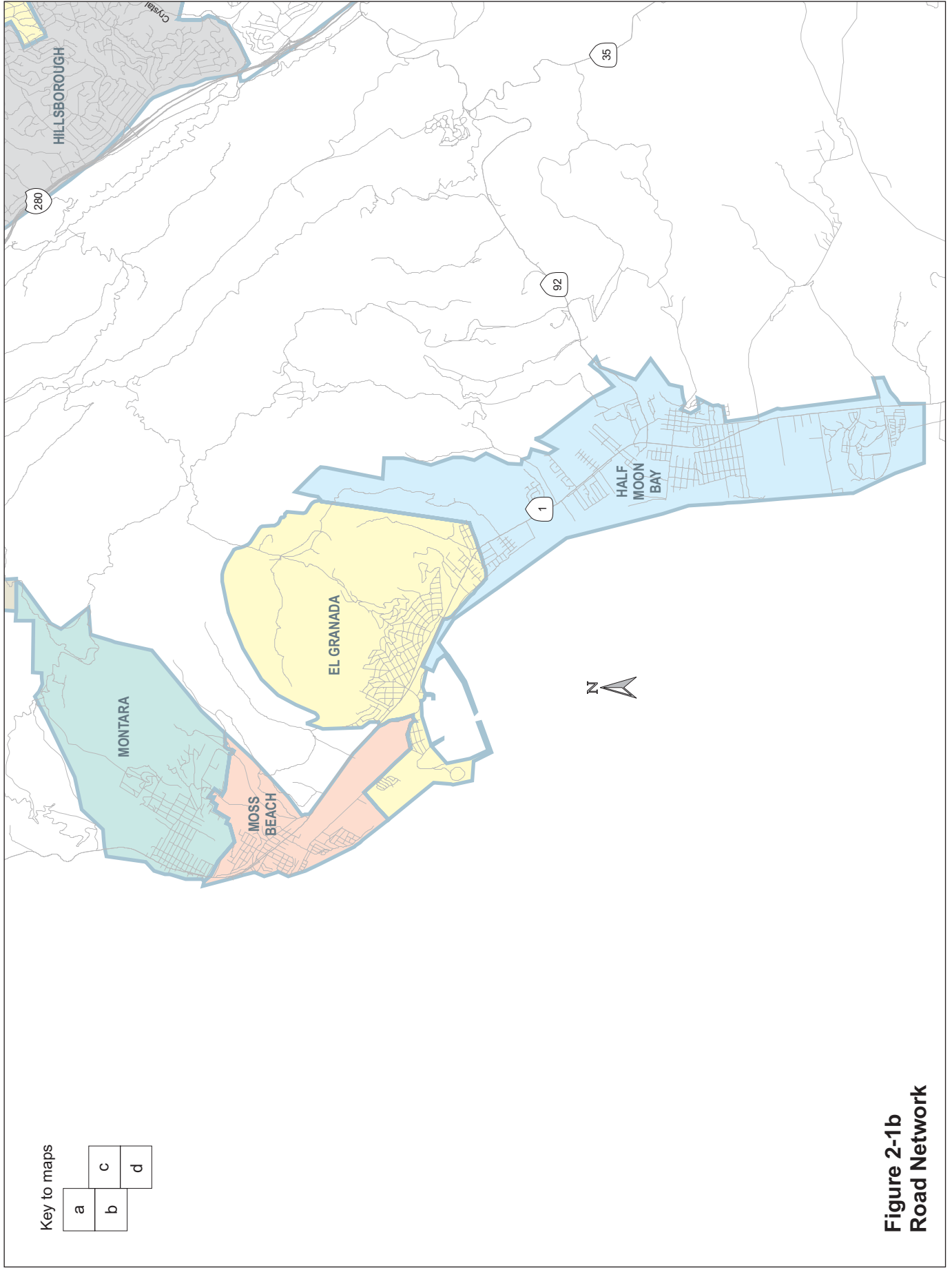
P031 48

Key to maps

a	
b	c
	d

Figure 2-1b
Road Network

DKS Associates
TRANSPORTATION SOLUTIONS

Figure 2-1c
Road Network

DKS Associates
TRANSPORTATION SOLUTIONS

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Key to maps

a	
b	c
	d

N

West Menlo Park

MENLO PARK

Valparaiso Av.

Santa Cruz Av.

Atherton Av.

Sand Hill Rd.

280

PORTOLA VALLEY

35

WOODSIDE

Canada Rd.

Woodside Rd.

84

35

Figure 2-1d
Road Network

DKS *Associates*
TRANSPORTATION SOLUTIONS
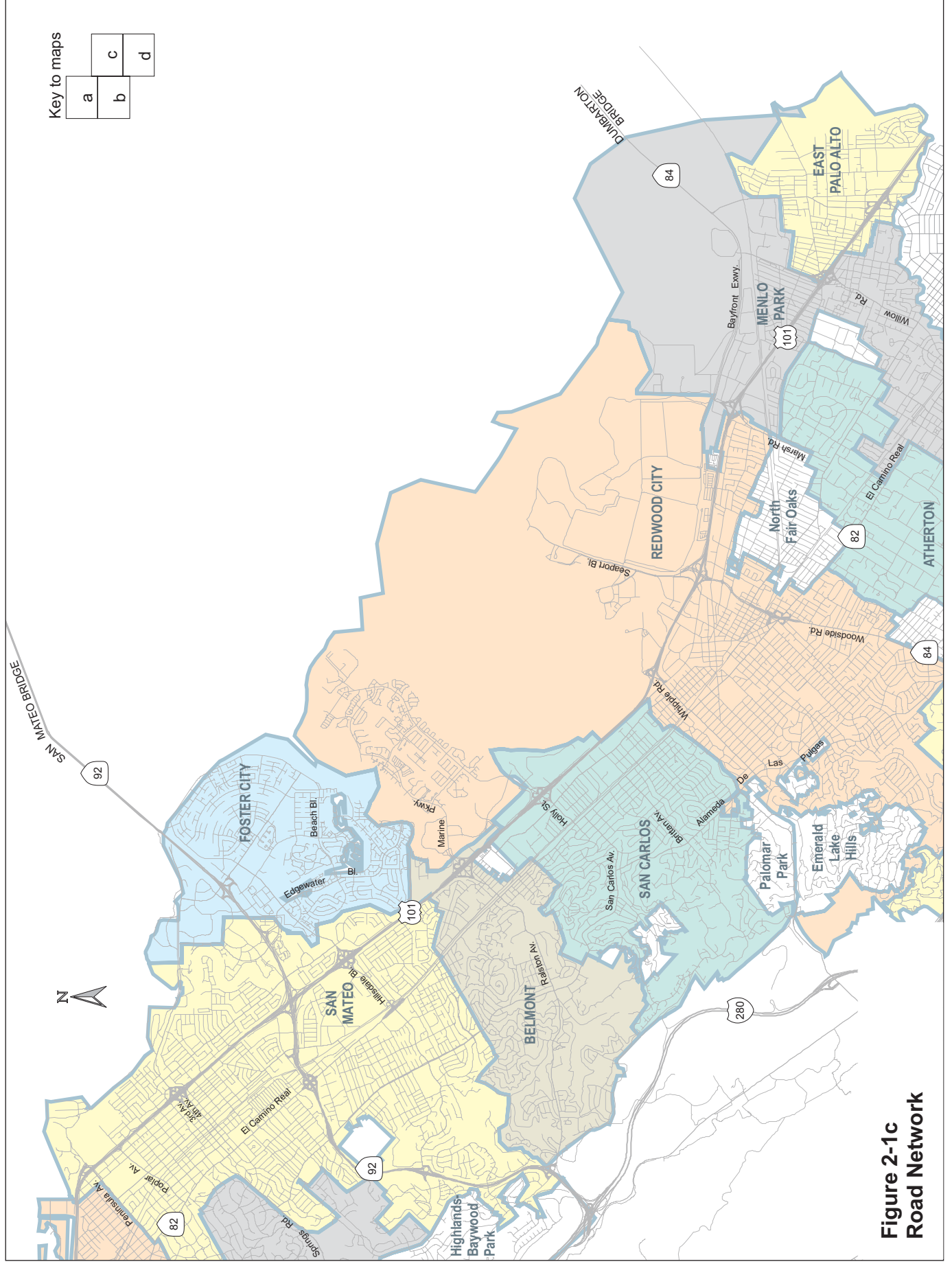
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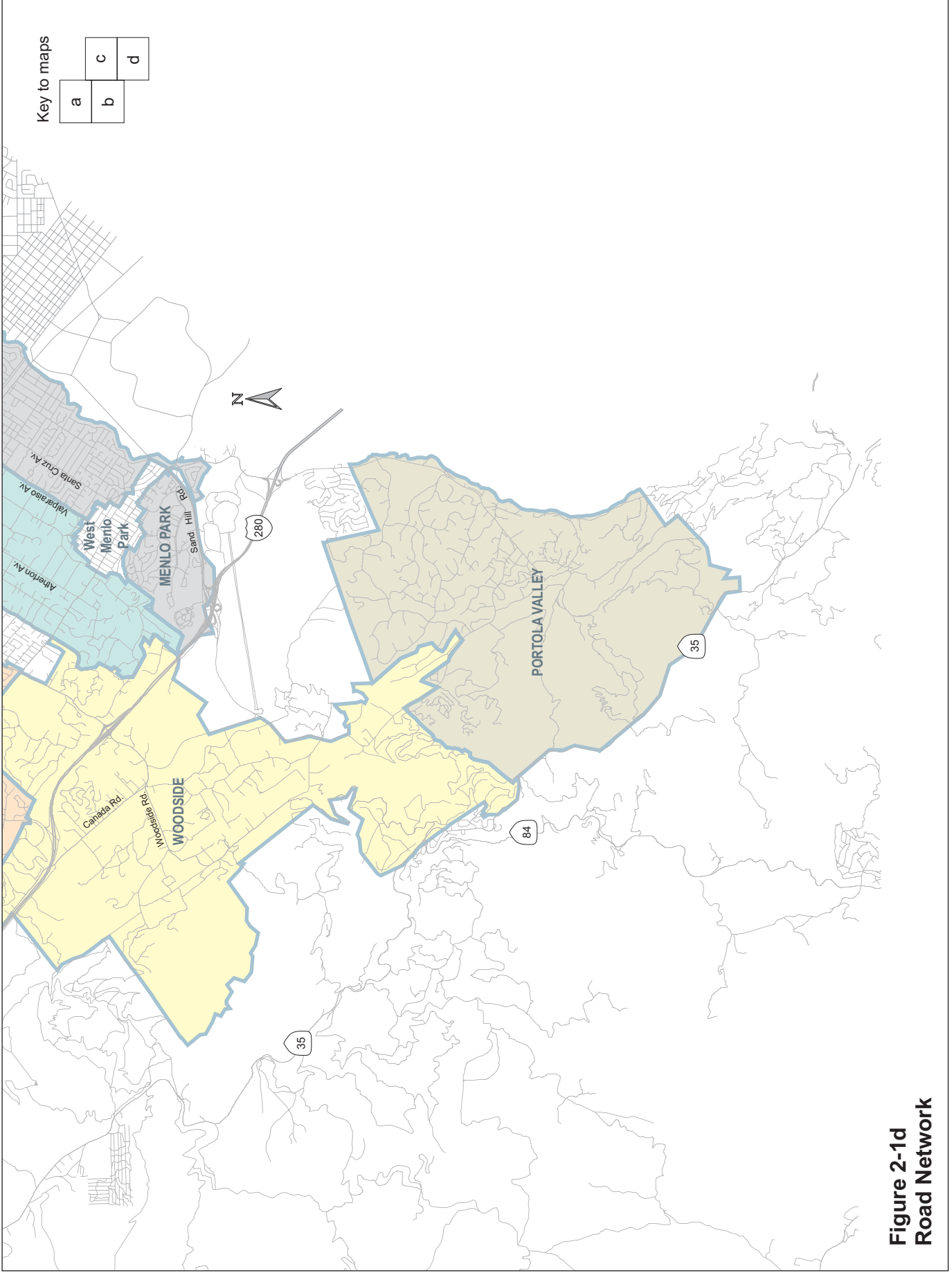
El Camino Real (State Route 82) runs continuously through the County, providing secondary regional access to the freeway system. It carries between 35,000 and 54,000 vehicles per day and traverses through most of the local cities in the County.

Highway 92 provides an east-west freeway connection to US101 and I-280 within the central part of the County. It carries about 123,000 vehicles per day and is a primary route for travelers to and from the East Bay (Alameda County).

Highway 84 provides another east-west freeway connection across the Bay to and from the East Bay (Alameda County). It carries about 50,000 vehicles per day. Within San Mateo County, Highway 84 is a secondary arterial becoming Woodside Road through Redwood City.

I-380 provides a direct freeway link between US 101 and I-280 in the City of San Bruno. It is an important link for the SFO Airport as well as regional commuters traveling between the two freeways. As far as linking the two north-south freeways, this is the only direct access facility.

Highway 1 runs in the north-south direction along the coast, providing access to cities west of the Santa Cruz Mountains. At the southern part of the County, Highway 1 is a two-lane conventional highway, becoming a four-lane highway between Linda Mar Boulevard and State Route 35. North of John Daly Boulevard, Highway 1 continues as a six-lane freeway across the San Francisco County line. It carries between 30,000 to 48,000 vehicles per day.

State Route 35 is a north-south route that runs through the Santa Cruz Mountains. It carries approximately 30,000 vehicles per day and acts as an alternate route to I-280.

Viewed as a network, US 101 and I-280 create a strong north-south backbone throughout the County. East-west connections between these facilities are provided by I-280, SR 92 and SR 84, as well a number of local arterial streets. However, the frequency and directness of these connections varies and are fairly limited in the southern part of the County.

As reported in C/CAG Final Congestion Management Program for 2003 report, US 101 generally operates at LOS E or better, except for the segments between Peninsula Avenue and SR 92, and between Whipple Avenue and the Santa Clara County Line. I-280 generally operates at LOS B or better, except for areas north of I-380, which operate at LOS E and F. Also, I-380 operates at LOS F from US 101 to I-280.

Furthermore, the 2003 CMP report states that the LOS for SR 1 generally operates at LOS E or better, except for the segment from Linda Mar Rd. to the San Francisco County Line. SR 35 operates at LOS B, except for the segment from Sneath Lane to I-280. SR 84 operates at LOS D or better, except for the segments east of US 101, which operate at LOS E and F. SR 92 operates at LOS E or better between SR 1 and the Alameda County Line.

While the County has a good north-south roadway system (I-280, US 101, and El Camino), there are limited options for east-west connections between I-280 and US 101, especially in the southern portion of the County. The northern portion of the County has I-380 and SR 92 as feasible options for traveling between the two freeways.

2.1.2   Transit System

San Mateo County is currently served by five different transit systems. The bulk of the local and Countywide service is provided by SamTrans, with Caltrain and BART providing commuter rail and rapid transit facilities.

In the future, as part of Regional Measure 2, commuter ferry service is planned for South San Francisco as well as commuter rail service along the Dumbarton Bridge. In addition, long range plans include a bullet train from San Francisco to Los Angeles, with possible stops in San Mateo County.

2.1.3   San Mateo County Transit District (SamTrans)

SamTrans, designed to serve travelers on the Peninsula between Palo Alto and San Francisco, operates 54 routes. On average, SamTrans buses travel more than 30,000 miles each weekday and carry more than 48,000 passengers. Some points of interest that SamTrans buses travel to include the Bay Meadows race track and the Ano Nuevo State Reserve near Santa Cruz. The district also provides special service to and from Monster Park for 49ers football games and the San Francisco Examiner's Bay to Breakers foot race.

In addition to managing the bus system, SamTrans also administers the Caltrain rail service, operates a shuttle program, and are partners with BART to operate the BART to SFO extension to the new Millbrae Intermodal Station.

2.1.4   Caltrain

Caltrain provides commuter rail service between San Francisco and Gilroy (77 miles of track). Of the 34 stations along the Peninsula, 14 are located within San Mateo County. SamTrans connects with Caltrain at 12 of the train stations (within San Mateo County), or connects within one block of the train station.

In 1992, the Peninsula Joint Powers Board (JPB) began to operate Caltrain and agreed to shoulder 100 percent of the operating subsidy a year later. The JPB is made up of three representatives each from San Francisco, San Mateo, and Santa Clara counties. Three of SamTrans Board of Directors represent San Mateo County on the JPB.

2.1.5   Bay Area Rapid Transit (BART)

The BART-SFO extension was completed in 2003. On June 21, 2003 BART started direct service from the airport to downtown San Francisco and the East Bay. The SFO BART station is located in the International Terminal Main Hall and links to the airport's automated people mover system for access to all the terminals, garages, and rental car center. There are six stations within San Mateo County located at Daly City, Colma, South San Francisco, San Bruno, SFO and Millbrae. The Millbrae station includes a cross platform transfer for northbound connections between BART and Caltrain. A mixture of 17 SamTrans bus routes and 19 shuttle routes serve the County's BART stations.

2.1.6   San Francisco Municipal Railway (Muni)

Muni provides two routes to the Daly City BART station: 28 and 54. Route 28 travels between the Marina District in San Francisco and the BART station. Route 54 travels between the Hunter's Point District in San Francisco and the BART station.

2.1.7   Alameda – Contra Costa Transit District (AC Transit)

AC Transit currently provides limited transit service across the Bay between Alameda County and San Mateo County. Line M travels over the San Mateo Bridge during commute hours with a terminus point at the Hillsdale Shopping Center.

2.1.8   Dumbarton Express

Dumbarton Express provides weekday express bus service across the Dumbarton Bridge, connecting Fremont, Menlo Park, Newark, Palo Alto and Union City (BART station). The service is provided through a consortium of AC Transit, BART, Union City Transit and Santa Clara Valley Transportation Authority.

2.2   *Travel Patterns and Land Use*

According to the 2000 census, the population of San Mateo County was 707,161. It is projected that the County's population will reach 813,300 by 2025[1]. In 2000, the mean travel time to work was 27 minutes, with 85 percent driving (including those who carpooled). Just over seven percent of the County's population took public transportation to work. Most of the residents drove to work alone due to the shift of jobs away from San Francisco, which are served by transit, to widely dispersed job sites in San Mateo County, Santa Clara County, and the East Bay where transit service is limited.

Approximately 60 percent of the employed residents in San Mateo County work within the County, with the remaining employed residents working in neighboring counties. In the next few years, the number of jobs in San Mateo County is projected to grow nearly twice as large than the number of county residents seeking employment[2] (23 percent versus 14 percent). The projections indicate that the jobs in the County will be filled by employees who reside outside of the County. As a result, the number of commute trips from neighboring counties is expected to increase.

2.2.1   Major Activity Centers

The County of San Mateo offers a variety of retail centers and attractions that generate significant traffic. There are three major shopping centers, a race course, an arena/exhibit hall, and San Francisco International Airport located within San Mateo County. Serramonte Shopping Center is located in Daly City off of I-280. Hillsdale Shopping Center, the largest shopping center in the County, is located just west of El Camino Real in the City of San Mateo. Tanforan Shopping Center is located in San Bruno off of I-380 at El Camino Real. Bay Meadows Race Course is the longest continually operating race track in California. The race course is located east of El Camino Real in the City of San Mateo. Also located within the County is Cow Palace. Cow Palace is in Daly City and borders the County's northern border with San Francisco. Some of their tenants include the Grand National Rodeo, Ringling Brothers Barnum & Bailey Circus, the San Francisco Sport and Boat Show, the Golden Gate Kennel Dog Show, and Disney on Ice. Other attractions that are located just outside of San Mateo County include Monster Park in San Francisco and Stanford Shopping Center in Palo Alto. Both generate major events and traffic that effect the County.

2.3   *Existing ITS Initiatives*

ITS is not a new concept in the Bay Area and San Mateo County. Several ITS applications have been deployed in the County, with several more in various stages of the planning process. An understanding of the existing ITS applications was critical to the development of the Strategic Plan. These applications can potentially form the building blocks for an integrated regional Intelligent Transportation System.

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[1] Projections 2002: Forecasts for the San Francisco Bay Area for the Year 2025, Association of Bay Area Governments, December 2001.

[2] Final Congestion Management Program for 2003, City/County Association of Governments of San Mateo County.

These existing initiatives include a number of activities being undertaken on a regional basis, as well as several specific to San Mateo County. Regional initiatives are summarized in the section below, followed a brief description of the ITS activities being undertaken by agencies specifically within San Mateo County. More detail of each initiative is discussed in subsequent chapters and also provided in Appendix A: Technical Memorandum #1: Inventory of Existing and Planned Systems.

2.3.1   Regional Initiatives

The regional initiatives described below include those that impact San Mateo County as well as other parts of the Bay Area. These activities are typically sponsored by agencies such as MTC, Caltrans, and CHP. It should be noted that in addition to these regional initiatives, various ITS activities are underway in localities and counties throughout the Bay Area, including those in the adjacent counties of San Francisco and Santa Clara. Regional ITS initiatives of particular relevance to San Mateo County include:

- **Bay Area Regional ITS Plan and Architecture** – The Regional ITS Plan and Architecture was recently completed under the sponsorship of MTC. It is a roadmap for transportation systems integration in the Bay Area over the next 10 years. The Plan provides methods to make the most out of technological advances by defining a strategy for deployment and a framework, or architecture, for linking the region's transportation systems. The development of the Regional ITS Architecture ensures that the Bay Area meets the FHWA Final Rule on National ITS Architecture conformity. The relationship between the Regional ITS Plan/Architecture and the San Mateo County ITS Strategic Plan is described in Chapter 3 of this report. (With respect to the San Mateo County ITS Strategic Plan, the Bay Area ITS Plan and Architecture may be viewed as falling under the "Supporting Elements" category.)

- **Freeway Traffic Operations System (TOS)** – The freeway TOS program is an on-going initiative being undertaken by Caltrans District 4. The program has included the construction of a Regional Transportation Management Center (TMC) at Caltrans' District 4 office and the deployment of various ITS field devices along the region's freeways. These devices include traffic monitoring stations, CCTV cameras, changeable message signs (CMSs), extinguishable message signs (EMSs), highway advisory radio (HAR) transmitters, and ramp metering equipment. Within San Mateo County, most of these devices have been installed along US 101, although some are installed along I-280 (north of I-380), I-380, SR 92 (east of I-280), and SR 84 (East of US 101). (Freeway Management and Traveler Information)

- **Freeway Concept of Operations** – The purpose of this project, being directed by MTC, Caltrans and CHP, is to help improve the Freeway Operations policies, procedures and practices, and build consensus on the roles, responsibilities and resource needs for Freeway Operations. Several key initiatives were developed as part of the Concept of Operations, and one in particular was most relevant to San Mateo County, namely to Develop a Common Radio Frequency for Emergency Operators. (Freeway Management and Emergency/Incident Management)

- **Freeway Service Patrol/Call Box System** – This system involves the deployment of call boxes and roving service vehicles along all freeways and highways in the Bay Area. The system is a joint project of the MTC Service Authority for Freeways and Expressways (MTC SAFE), CHP, and Caltrans. The system is designed to provide roadside assistance to vehicles, especially those that create congestion hot spots by blocking travel lanes. (Freeway/Highway Management)

- **FasTrak** – The FasTrak system is an Electronic toll collection system that has been installed at all eight Bay Area bridges. It utilizes transponders or tags located within vehicles and tag readers located at the bridge's toll plazas. With the exception of the Golden Gate Bridge, Caltrans administers all the toll bridges in the Bay Area. (Freeway Management)

- **Caltrans Central Signal Control system (CTNet)** – CTNet is an advanced arterial traffic management system Caltrans uses for managing their traffic signals in the Bay Area. It includes a central operating system at Caltrans offices in Oakland and communication links to traffic signals operating by Caltrans. (Arterial Management)

- **Regional Signal Timing Program (RSTP)** – The RSTP is a grant program sponsored by MTC that provides funding to local agencies for the re-timing of traffic signals within the Bay Area. (Arterial Management)

- **TransLink** – TransLink is a regional transit fare collection program initiated by MTC. It is intended to provide transit riders with a single point of transaction for their travels. The transit riders use a single TransLink smart card instead of paying fares using cash, passes or tickets. The program is now moving to regional deployment of the smart cards. (Transit Management)

- **511 (TravInfo)** – The 511 system is a toll-free phone and web service that consolidates Bay Area transportation-related information into a single resource for travelers of all modes. At this time, roadway information is focused on the region's freeways, and includes construction notices, incident reports, and travel time estimates. The 511 also provides details on public transportation routes and fares, instant carpool and vanpool referrals, and bicycling information. It features a regional transit trip planner, schedules, routes, and fares. 511 is managed by a partnership of public agencies led by MTC, CHP, and Caltrans. (Traveler Information)

- **Interim Center-to-Center System** – This project will enable the Regional Smart Corridors, 511 and Caltrans to exchange valuable data and share video feeds. It entails the development of a common communications protocol that will link the Smart Corridors with the Regional TMC (Caltrans). (Supporting Element)

- **Freeway Performance Measurement System (PeMS)** – The PeMS is the primary data archiving activity underway that includes San Mateo County. This system involves the compilation of freeway loop detector data. The PeMS is a system to collect, filter, process, aggregate and examine information collected via Caltrans loop detectors from TMCs throughout the state. It is a joint effort by Caltrans, the University of California, Berkeley, and PATH, the Partnership for Advanced Technology on the Highways. (Supporting Element)

2.3.2   Local Initiatives

In addition to the regional initiatives described above, local agencies within San Mateo County have undertaken or are pursuing a number of ITS-related activities. These local initiatives are briefly described below, while **Table 2-1** summarizes the extent to which these various ITS elements have been implemented by agencies within the County.

- **Advanced traffic signal operations** – This area includes a number of activities or initiatives including providing communications between signal controllers to enhance coordinated operation, installing centralized traffic control systems whereby local traffic signals communicate with and can be controlled by central monitoring, and implementing advanced signal control strategies such as adaptive control. (Arterial Management)

- **Video detection and monitoring** – A number of cities currently use video detection technology to control the operation of traffic signals. Currently, only Caltrans uses CCTV cameras to monitor traffic conditions, although the City of Belmont is considering this application. (Arterial Management)

- **Railroad pre-emption** – Several cities have deployed systems that use detectors along the railroad tracks to sense the presence of a train and initiate adjustments to signal timing operation at intersections near downstream crossings. (Arterial Management)

- **Automatic vehicle location (AVL) system** – SamTrans currently has AVL systems installed and operating on 317 fixed route and 76 paratransit buses. The AVL system provides real-time vehicle location information for real time fleet control, fleet performance tracking, fleet security, and Passenger Information Systems (arrival and departure information) purposes. (Transit Management)

- **Automatic passenger counting (APC) system** – An APC system uses various technology to track passengers as they board or alight a vehicles. Samtrans currently has APC devices on 30 percent of their fleet. (Transit Management)

- **Transit traveler information** – SamTrans is in the process of testing a predictive arrival/departure system that uses input from the Advanced Communications System (ACS). ACS consists of interrelated radio and computer components that include a district-wide radio system, computer aided dispatching, automatic vehicle locators using GPS, and a "Next Stop" announcement system. As part of this effort, Samtrans has installed three kiosks and dual panel LCD displays within each bus bay at the Millbrae BART Station. These devices provide real-time arrival times for SamTrans buses. (Traveler Information/Transit Management)

- **Collision Avoidance system** – SamTrans has been working with the Federal Transit Administration (FTA) on a frontal collision warning system. The system is radar-based and is able to screen out false-positives (e.g. shelters). It has been installed on two buses for testing. (Transit Management)

- **Transit signal priority** – SamTrans is working with FTA, Caltrans, and PATH on an adaptive signal priority system on El Camino Real. The system works with the master controller over several signals. (Transit Management)

- **Emergency vehicle pre-emption** – Several jurisdictions have deployed emergency vehicle pre-emption systems. These systems include a transmitter on the emergency vehicles, a receiver at the traffic signal controller, and an operating program that processes the pre-emption request and adjusts the traffic signal operation accordingly. (Emergency/Incident Management)

- **Emergency Management Center** –The San Mateo County Public Safety Communications Center provides dispatching services for fire, Emergency Medical Dispatch (EMS), and law enforcement in the County. The dispatch center is located in Redwood City. The dispatch center has a state-of-the art CAD System and operates on 900MHz. The County has also created an Office of Emergency Services (OES) within the County Sheriffs Department. While the OES has not directly constructed any physical infrastructure, it does serve as a focal point for inter-agency coordination during major emergencies. (Emergency/Incident Management)

- **Communication networks** – A primary component of many ITS applications is the ability to control and communicate with field devices from a central location. Various local agencies have signal interconnect networks using various media, with the most common

being twisted-pair copper. A number of the jurisdictions within the County have entered into franchise agreements for local cable providers to lease fibers within the networks installed by the companies. The County has also deployed a microwave system that is shared with SamTrans. There are four transmitter sites within San Mateo County. (Supporting elements)

Table 2-1: System Inventory Summary

Agency	Signalized Intersections (local/Caltrans)	Signal System	Signal Interconnect — City	Signal Interconnect — Caltrans	Adaptive Control	Video Detection	CMS	HAR	CCTV	EMS — Emergency Vehicle Preemption	Transit — Transit Priority	Transit — Automated Passenger Counters	Transit — Automatic Vehicle Location	Transit — Collision Avoidance System
Atherton	4/2													
Belmont	6/9	●	◉	○					■	●				
Brisbane	9/0	●	◉											
Burlingame	14/8	●	○	◉						●				
Colma	6/5													
Daly City	39/23		◉	◉		●								
East Palo Alto	7/1			●										
Foster City	19/3	●	●			●								
Half Moon Bay	0/4													
Hillsborough	0													
Menlo Park	23/21		○	◉	●	●				●				
Millbrae	4/8		○	◉						●				
Pacifica	5/6		○											
Portola Valley	0													
Redwood City	60/25	●	●	●										
San Bruno	10/19	●	◉	●						●				
San Carlos	15/11		○	◉						●				
San Mateo	60/29	●	◉	○		●				●				
San Mateo County	20/5		○	○										
South San Francisco	60/20		◉	◉										
Woodside	1/2													
Caltrans	202			◉		●	●■	●	●■					
SamTrans	0										■	■	●	■

Legend:
● ITS element within agency/all or most of the signals are interconnected
◉ Some of the signals are interconnected
○ A few of the signals are interconnected
■ Planned ITS element (either new or adding to existing)

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3   ITS Vision for San Mateo County

A vision simply states how we see the future from our current position. Planning visions are almost never 100 percent accurate, but they can provide overall direction to the planning process. Without a vision for the future, agencies might continue indefinitely with the status quo or with slower-than-necessary progress in implementing advanced transportation technologies.

The ITS "vision" for San Mateo County describes the overall direction for the planning and deployment of ITS in the County.   It is intended to help unify and coordinate the application of advanced transportation technologies in the County.   Without a vision for the future, individual agencies might be reluctant to proceed on their own with the implementation of advanced transportation technologies.   Without a clear vision individual agencies that do pursue ITS technologies are also more likely to pursue applications that do not complement the technology investments of other agencies.

This Strategic Plan and the ITS vision for San Mateo County were guided by two key principles:

- **Address transportation system need**s – ITS deployment in San Mateo County must respond to the needs of the transportation system users and managers within the county. ITS deployment should not merely involve "technology in search of a problem". To this end, a comprehensive needs assessment was conducted as part of the Strategic Plan process.
- **"Mainstream" ITS into the transportation planning process** – The vision for ITS must not stand alone in the Strategic Plan.   It must be fully integrated into the traditional transportation planning process for all agencies in the County.   This includes being consistent with the existing goals and policies as stated in documents such as the Countywide Transportation Plan (CTP).   At the same time, the ITS Strategic Plan needs to be reflected in the CTP as well as other countywide and local plans and programs that are developed and updated on a regular basis.   As part of this, ITS strategies should be considered along with more traditional improvements such as roadway widening and new transit service when addressing transportation deficiencies at both the countywide and local levels.   This may occur during the development of local general plans and capital improvement programs, as well as during the identification of potential mitigation measures as part of environmental or traffic impact studies.   Furthermore, potential ITS components should be considered in the design of other infrastructure projects.

The following section presents the vision and goals statements for ITS in San Mateo County. This is followed by a series of focus statements summarizing the strategic direction for ITS in San Mateo County relative to the seven elements of the transportation system identified earlier: Freeway/Highway Management, Arterial Management, Transit Management, Traveler Information, Parking Management, Emergency/Incident Management, and Supporting Elements. The third section of this chapter examines the CTP and how it relates to this Strategic Plan, while the final section discusses the relationship with the Bay Area Regional ITS Plan and Architecture.

3.1   *Vision and Goals*

A vision statement is one part of the overall vision. It expresses overarching themes that the Strategic Plan should consider as it is implemented. The following represents the ITS vision statement for San Mateo County:

> *"improve mobility, improve travel time reliability, and enhance the transportation system safety for all travelers in San Mateo County through the integrated and strategic use of advanced technologies and interagency cooperation"*

The vision statement contains two words that are particularly key to the overall strategy: integrated and strategic. By integrated we mean that ITS will not be something that is thought of independently of everything else we do. Rather, potential ITS applications will be considered as part of a comprehensive set of initiatives that may involve traditional improvements as well as technological ones. ITS cannot be expected to solve all the problems or to eliminate the need for capacity enhancements, transit capital investments, or safety improvements. By strategic we mean that ITS technologies should be applied where they make sense. They need to be applied to specific problems or respond to opportunities that are appropriate for San Mateo County.

This overall statement is supported by a set of goals and focus statement. The goals are used to provide more specific guidance and direction to the vision, while the focus statements serve as a bridge between the goals and the types of solutions that may be contemplated.

The goals of the San Mateo County ITS Strategic Plan are to:
- Provide reliable and timely information to all travelers to support informed decision-making
- Enhance roadway network operations to ensure safe and reliable travel
- Enhance the ability to respond to emergencies and incidents to improve safety and reduce impacts to the transportation system
- Enhance the efficiency, safety and attractiveness of transit to increase transit mode share
- Enhance and support interagency operability and coordination to support efficient system management

The overall vision and goals of the ITS Strategic Plan conform with the goals and objectives of the Countywide Transportation Plan since both plans desire to improve mobility, safety, and travel time reliability within the County.

3.2   Focus Statements

As noted earlier, the ITS Strategic Plan for San Mateo County has been structured around seven transportation system elements. In addition to the overall vision and goals stated above, focus statements have been developed to further define the strategic direction proposed for each of these elements.

In general, the focus of the San Mateo County ITS Strategic Plan and of ITS deployment in the county is on the movement of people, and on regional or countywide initiatives. Thus, the priorities within this Strategic Plan emphasize those elements or areas that impact the greatest proportion of travel and comprise the regional transportation system: freeways/highways and transit. The key for the other elements is to emphasize those opportunities that best support these primary areas.

The focus statements for each transportation system element are summarized below. The types of ITS opportunities available within each element, and the strategic priority of these opportunities, is further discussed in subsequent chapters.

3.2.1   Freeway/Highway Management

Due to the high volume of travel served by these facilities, Freeway/Highway Management is a vital element of San Mateo County's ITS Strategic Plan. The overall strategic objective for this element is to have a state-of-the-art system that has comprehensive coverage, is fully operational, and is actively

managed. The objective of having a state-of-the-art system is to focus on the needs of the customer and provide the driver with the real-time information to allow him/her to make informed decisions while traveling on the freeway/highway system. In the near-term, the priority for implementation is to ensure that existing infrastructure is fully operational and utilized on a corridor-wide basis and not just at spot locations.

3.2.2 Arterial Management

While the County's arterial roadway typically carry much lower traffic volumes than the freeways, these roadways still play an important role in the movement of people and goods.   At the same time, the limited resources available within many local agencies to deploy and operate ITS applications have been recognized. The Arterial Management strategy focuses on two key components: supporting freeway operations through coordination on key corridors near interchanges and the ability to serve in a reliever function, and providing cross-coordination between the local streets and El Camino Real. As part of the near-term strategy, the approach is to emphasize providing links on key corridors between signal systems in the field (i.e. provide communication links directly between the signals) rather than through centralized systems of TMCs.

3.2.3 Transit Management

Consistent with the CTP, a primary goal of this Strategic Plan is to promote transit as a viable alternative to maintain or enhance mobility and help manage/reduce congestion. This Strategic Plan includes a number of ITS applications to make transit as attractive, efficient and convenient as possible. In the short-term, the objective is to expand deployment of current ITS initiatives including those related to automated vehicle location systems, transit information, and electronic fare payment.

3.2.4 Traveler Information

One way to help increase the efficient use of the County's transportation system is to ensure that travelers have the information they need about travel options to make informed decisions. Within this Strategic Plan, great emphasis is placed on systems that collect and disseminate traveler information. In the short-term, this Plan focuses on the deployment of en-route traveler information devices (CMSs, HAR) along key routes, and the enhancement of existing regional systems such as 511. At the same time, the development of separate local information systems is de-emphasized.

3.2.5 Parking Management

Through this strategic planning process the view was taken that parking management was largely a localized as opposed to countywide issue. As such parking management was de-emphasized within the Strategic Plan, although it is recognized that local ITS initiatives related to this element may be appropriate and should be supported.

3.2.6 Emergency and Incident Management

For this element, the primary focus within this Strategic Plan is on the use of technology to enhance the detection of and response to incidents, and to use ITS initiatives to enhance coordination between agencies. In turn, these applications can help support freeway and transit management activities by improving traveler safety and reducing congestion related to incidents. The near-term emphasis within emergency/incident Management is on developing and implementing emergency/incident management plans, procedures and protocols, and on standardizing emergency vehicle pre-emption equipment and implementing on major routes.

3.2.7   Supporting Elements

By nature, the focus of this category is on the technical infrastructure and procedures needed to support the initiatives and priorities identified within the other elements. In the short-term, the emphasis is placed on the communication network needed to support the operation of various ITS applications, and on securing the necessary funding to operate and maintain these ITS systems.

3.3   Relationship to the Countywide Transportation Plan

One aspect of integrating ITS into the county transportation planning process is ensuring that the ITS Strategic Plan is consistent with existing transportation policies and goals. At the countywide level, this means being consistent with the Countywide Transportation Plan (CTP).

As stated in the *Countywide Transportation Plan 2010*, the primary transportation-related goal is to "**reduce traffic congestion in San Mateo County**". This overall goal is further elaborated on through the following secondary goals:

- Improve mobility
- Reduce congestion
- Increase access
- Improve air quality
- Increase economic vitality
- Improve the coordination of land use and transportation planning
- Increase reliability
- Increase safety

Related to these goals, the major objectives stated in the *CTP 2010* are:

- Increase capacity and performance (safety, reliability, convenience) of all transportation systems
- Increase demand for transit travel
- Decrease demand for automobile travel, especially single-occupant

In support of these goals and objectives, the CTP describes a five prong strategy to address congestion that involves:

- Roads - Increase the efficiency of the existing highway system
- Transit - Increase capacity, service levels and safety of transit systems
- Land Use - increasing the supply and density of housing and employment in transit corridors
- Transportation systems Management - increasing programs to reduce demand for single-occupant automobile travel
- Pricing – initiate modest pricing programs that cause a shift from automobile to transit travel.

Finally, the CTP presents key policies within each of the strategy areas listed above, and summarizes the effectiveness of these policies in relieving congestion.

ITS can play a vital role in achieving these goal and objectives. ITS can help travelers use the transportation system more efficiently and allow operators to manage the system more effectively. The result can be reductions in congestion and emissions, more reliable travel times, and improved safety.

The San Mateo County ITS Strategic Plan was guided by these goals, objectives and policies. Indeed, many of these principles have been incorporated directly into the vision for ITS as presented in this Strategic Plan. Furthermore, ITS applications address or serve as critical components to many of the strategies and policies presented in the CTP. Table 3-1 summarizes the relationship between the CTP and the ITS Strategic Plan

Table 3-1 Relationship to Countywide Transportation Plan

CTP Element	ITS Strategic Plan Relationship
Goals	
Improve mobility	Common goal
Reduce congestion	Common goal
Increase access	No direct relationship
Improve air quality	Indirect – efficiency improvements and congestion reductions achieved through ITS can improve air quality
Increase economic vitality	No direct relationship
Improve the coordination of land use and transportation planning	No direct relationship
Increase reliability	Common goal
Increase safety	Common goal
Objectives	
Increase capacity and performance (safety, reliability, convenience) of all transportation systems	Similar performance objectives are included in the ITS Strategic Plans vision and goals.
Increase demand for transit travel	A Strategic Plan is to deploy ITS to enhance the efficiency, safety and attractiveness of transit to increase transit mode share. Various ITS measures are intended to enhance the performance of the transit systems operating in the County, in turn leading to increased transit ridership
Decrease demand for automobile travel, especially single-occupant	No direct relationship
Strategies & Policies	
Roads - Increase the efficiency of the existing highway system	A key goal of this Strategic Plan is to deploy ITS to enhance roadway network operations
Transit - Increase capacity, service levels and safety of transit systems	A key goal of this Strategic Plan is to deploy ITS to enhance the efficiency, safety and attractiveness of transit to increase transit mode share. Various ITS applications correspond to policies to improve system performance, decrease transit travel times and increase system integration.
Land Use - increasing the supply and density of housing and employment in transit corridors	No direct relationship
Transportation Systems Management - increasing programs to reduce demand for single-occupant automobile travel	ITS applications, including ramp metering and interconnected signals, are specifically called for under this CTP strategy. ITS applications such as traffic monitoring and incident management applications support the rapid removal of accidents.
Pricing – initiate modest pricing programs that cause a shift from automobile to transit travel	ITS applications can be critical components of any automated pricing or toll program. For example, the existing FasTrak electronic bridge toll system may be used as the foundation for a corridor congestion pricing program.
Source: DKS Associates, 2005	

3.4   *Relationship to Bay Area Regional ITS Plan & Architecture*

As noted previously, ITS applications are generally most effective if they are coordinated across jurisdictional boundaries and designed to be interoperable with each other. To this end, MTC

sponsored the development of the San Francisco Bay Area Regional ITS Plan and Architecture to help facilitate the orderly, cost-effective development and integration of ITS projects within the region.

The Regional ITS Plan and Architecture focus on the regional transportation system and provide a roadmap for transportation systems integration in the Bay Area over the next 10 years. The Plan provides a strategy for regional ITS deployment and a framework, or architecture, for linking the region's transportation systems. The development of the Regional ITS Architecture ensures that the Bay Area meets the FHWA Final Rule on National ITS Architecture conformity[1]. The Regional ITS Plan and Architecture can be found at http://www.iteris.com/mtcits/.

The Bay Area Regional ITS Plan identifies a set of regional ITS goals, summarizes existing and planned ITS elements, and identifies regional priorities for the deployment of various ITS services and market packages within the region. The Regional Plan also provides a high-level view of the operation of ITS within the region through a listing of the roles and responsibilities of various stakeholders (i.e. operational concepts), and the functional requirements of various systems. The Regional Plan also describes a number of potential regional ITS projects, and includes a discussion of the current status of ITS standards and the types of inter-agency agreements that may be appropriate to support ITS deployment and integration.

The Regional ITS Architecture provides the framework for linking or integrating the various systems and functions described in the Regional ITS Plan. The Regional Architecture includes an inventory of existing and planned systems and market packages, and highlights the inter-relationships and information flows that can and should exist between them. The architecture also provides a link to information about current standards for each system and inter-connect. The Regional Plan includes specific guidance on how to use the Regional Architecture in the planning, design, and deployment of ITS elements.

It is critical that the ITS Program in San Mateo County be consistent with the Regional ITS program. Doing so not only helps support the orderly and effective implementation of ITS in the region, but facilitates the use of federal funding for ITS projects. Federal regulations require that ITS projects be consistent with the regional architecture in order to be eligible for federal funding.

The San Mateo County ITS Strategic Plan reflects many of the same goals, priorities and projects presented in the Bay Area Regional ITS Plan. Table 3-2 lists the ITS goals as presented in the regional plan, and indicates the level of consistency with the goals and objectives presented in this Strategic Plan. While the phrasing may differ between the two documents, Table 3-2 does illustrate the fact that the Regional ITS Plan and the San Mateo County ITS Strategic Plan share a common set of goals and objectives for ITS deployment.

Table 3-2 Relationship to Bay Area Regional ITS Plan

Bay Area Regional ITS Action Goals	Consistent with the San Mateo County ITS Plan Goals and Objectives
Mitigate Congestion • Improve travel times in congested corridors	√ √

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[1] USDOT ITS Architecture, Final Rule (Federal Register, 23 CFR Part 940, January 8, 2001) requires ITS projects funded through the Highway Trust Fund to conform to the National ITS Architecture and applicable standards.

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Bay Area Regional ITS Action Goals	Consistent with the San Mateo County ITS Plan Goals and Objectives
• Improve the reliability of the transportation system Enhance Transit Use • Increase coordination and convenience of transit	√
Expand Travel Options • Provide travelers with good information	√

Improve Safety and Security
  • Ensure the safety of motorists
  • Ensure the safety and security of transit system users
  • Ensure effective transportation operations and coordination during emergencies
	√
	√
	√

Source: DKS Associates, 2005	

Further consistency is shown in the ITS opportunities and projects presented in each plan. The San Mateo County ITS Strategic Plan recognizes and builds off of many of the ITS initiatives presented in the Bay Area Plan. Indeed, a number of high priority countywide projects emphasize continued or expanded deployment of regional systems within San Mateo County. The San Mateo County Plan adds value to the Regional Plan by providing support for and greater detail regarding the deployment of these systems within San Mateo County, and identifying other ITS applications that may be of benefit within the county. Some of the high priority projects contained in both plans include:

- integrating the Caltrans Transportation Management System with other traffic management systems, as appropriate;
- expanding the Caltrans Traffic Operations System (TOS);
- deploying traffic signal system interconnections across jurisdictional boundaries, as appropriate; and
- continued and enhanced deployment of the TransLink electronic transit fare payment systems and the regional 511/TravInfo system.

While the Countywide Plan does specifically call out operational concepts and functional requirements, those inherent in the projects and agency responsibilities described in the plan are again consistent with those described in the Regional Plan.

In addition to consistency at the planning level, ITS deployments within San Mateo County must also be consistent with the Regional ITS Architecture. Much of this consistency is reflected in the commonality of the goals, projects, responsibilities and requirements described above. However, more specific detail regarding the desired linkages and interconnections of proposed systems is provided in the Regional Architecture. The Regional Architecture should be viewed as a tool for stakeholders to use in planning ITS projects. The Regional ITS Plan/Architecture provides specific guidance on how to use this tool during the planning, design, procurement, and deployment processes.

Finally, it is important that the County ITS program and stakeholders recognize, participate in, and take advantage of the regional activities presented in the Regional Plan. Such activities include the development of various standards for use by Bay Area agencies, and the formation of committees that can serve as forums for sharing of information and experience.

4 FREEWAY MANAGEMENT

The Freeway/highway management category refers to the management of traffic traveling on uninterrupted roadways in order to maximize its efficiency by enhancing flow and reducing delays during the most congested periods.

4.1 Existing Initiatives

There are several existing ITS initiatives that assist Caltrans in managing the freeway and highway system. These include the Freeway Traffic Operations System (TOS), the Freeway Concept of Operations, FasTrak, and the Freeway Service Patrol/Call Box system. Additional information about these initiatives is provided in Technical Memorandum #1: Inventory of Existing and Planned Systems.

4.1.1 Freeway TOS

Caltrans District 4 manages the freeway system in the Bay Area. To support this effort, Caltrans has deployed a variety of ITS elements along the freeways, and constructed a transportation management center (TMC). The ITS field elements deployed by Caltrans includes traffic monitoring detectors, closed circuit television (CCTV) cameras, ramp meters, highway advisory radio (HAR), changeable message signs (CMSs), extinguishable message signs (EMSs), and electronic toll collectors (ETCs). Caltrans has deployed numerous ITS field elements in San Mateo County and more are desired in the future along all the freeways and highways in the County. Located at Caltrans' District 4 office in Oakland, the TMC provides a central location for the collection, processing, and dissemination of information used for management activities. Caltrans has the capabilities to manage various ITS elements along the freeway system.

CCTV cameras are used to provide visual images of highway operations. These images can then be used to verify incidents, and determine what type of emergency response or type of management strategy should be deployed or dispatched.

The CMSs and EMSs are used to provide written messages to passing motorists. These signs are located along the highways, and provide information to drivers at key decision points.

HAR systems provide traveler information to the motorists via the car radio. HAR systems consist of transmission sites that are positioned along the roadway network at strategic locations to disseminate dynamic traveler information messages to the motoring public regarding transportation, incident, and emergency situations (e.g., roadway conditions, accidents ahead, alternate routes, etc.). A HAR can transmit data by using a live message or pre-selected taped messages.

Currently, Caltrans has installed a number of ITS field devices within San Mateo County. Most of these devices have been installed along US 101, although some are installed along I-280 (north of I-380), I-380, SR 92 (east of I-280), and SR 84 (east of US 101). According to a Traffic Operations System (TOS) Inventory provided by Caltrans in January of 2005, the ITS field devices deployed within San Mateo County include 61 CCTV cameras, 11 CMSs, 14 extinguishable message signs (EMS), 9 HARs, 50 ramp metering locations, 161 detectors, and 9 ETC readers. However, a number of these devices are not fully operational for a variety of reasons. **Figure 4-1(a-d)** illustrates the locations of ITS elements along the freeway system in San Mateo County, while **Table 4-1** summarizes the status of these devices. It should be noted that Caltrans is in the process of fixing the items that are not fully operational.

Table 4-1: Freeway System ITS Field Devices

Device	Status[1]					Total
	Operational	Functional	Incomplete	Out of Order	Under Construction	
CCTV	22	5	9	17	8	61
CMS	8		1		2	11
EMS	3		5	2	4	14
HAR	3		2	1	3	9
Ramp Meters	1	17	20		12	50
Detector	139		3		19	161
ETC Reader	6				3	9
TOTALS	**176**	**22**	**40**	**20**	**48**	**315**

Notes:

1. According to Caltrans, the definitions of each status category are as follows:
Operational: Equipment communicates with and can be operated by the TMC.
Functional: Equipment works locally, but needs communication to the TMC.
Incomplete: A construction project is needed to complete the equipment to make it operational.
Out of Order: Routine maintenance by Caltrans is needed to restore operational   status.
Under construction: Equipment is currently being installed as part of a construction project.

Source: Caltrans Traffic Operations System (TOS) Inventory (January, 2005)

While the coverage of the I-280 corridor is currently quite limited, Caltrans has plans to install 40 ramp meters, 17 CCTV cameras, six CMSs, and 10 traffic monitoring stations along this corridor.

Communication to existing equipment is typically via leased lines. Communication to CCTV cameras is via Integrated Services Digital Network (ISDN). Communication to ramp meters is via General Packet Radio Service (GPRS) and communication to CMSs is via ISDN.

Key to maps

a	
b	c
	d

N

Legend:

- ● Operational Meters
- ○ Meters Installed (Not Operational)
- ▭◀ CCTV
- ⚓ San Mateo County Repeater Sites
- Ⓗ Highway Advisory Radio
- CM Changeable Message Sign
- EM Extinguishable Message Sign

**Figure 4-1a
Existing Freeway ITS Elements**

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Map labels: Candlestick, Cow Palace, BRISBANE, San Geneva Av., Mission St., Daly Bl., John Daly Bl., EM, 101, Broadmoor Village, Civic Center, DALY CITY, COLMA, Hillside Bl., 82, Serramonte Shopping Center, Serramonte Bl., Hickey Bl., Junipero Serra Bl., 280, Chestnut Av., SOUTH SAN FRANCISCO, Sister Cities Bl., City Hall, Grand Av., 1, Westborough, El Camino Real, 35, Skyline Bl., Tanforan Shopping Center, 380, San Bruno Av., SAN BRUNO, City Hall, PACIFICA, MILLBRAE, Millbrae Av., EM, 101, CM, El Camino Real, Trousdale Dr., Broadway, BURLINGAME, City Hall, Hillside Dr., 1

Key to maps

a	
b	c
	d

MONTARA

MOSS BEACH

EL GRANADA

HILLSBOROUGH

HALF MOON BAY

280

1

92

35

N

Legend:

● Operational Meters

○ Meters Installed (Not Operational)

📹 CCTV

San Mateo County Repeater Sites

Highway Advisory Radio

CM Changeable Message Sign

EM Extinguishable Message Sign

Figure 4-1b
Existing Freeway ITS Elements

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Key to maps

a	
b	c
	d

Legend:

- ● Operational Meters
- ○ Meters Installed (Not Operational)
- ▭ CCTV
- ▲ San Mateo County Repeater Sites
- Ⓗ Highway Advisory Radio
- CM Changeable Message Sign
- EM Extinguishable Message Sign

**Figure 4-1c
Existing Freeway ITS Elements**

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Key to maps

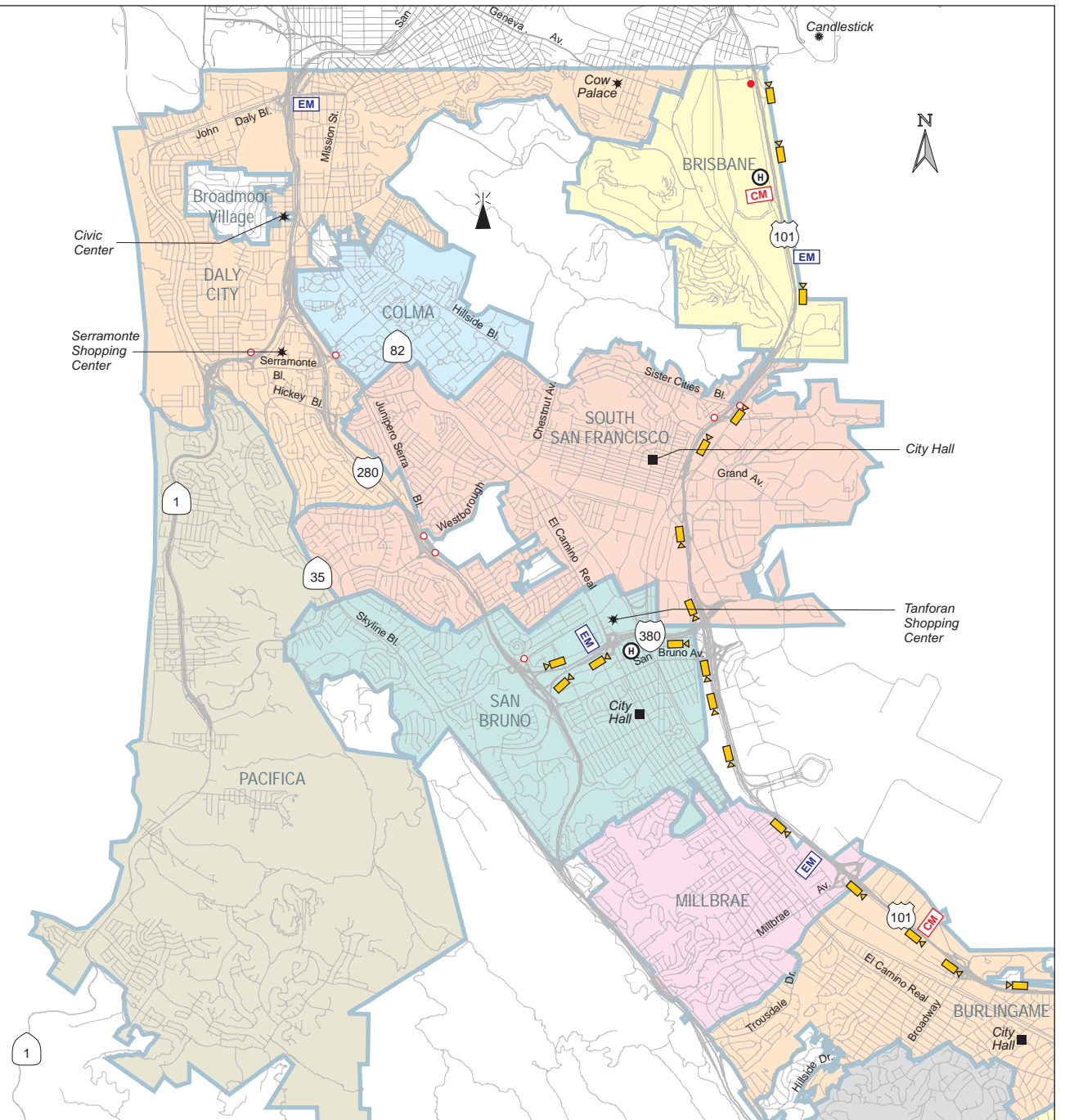| a		
b		c
		d

Legend:

● Operational Meters

○ Meters Installed (Not Operational)

📹 CCTV

San Mateo County Repeater Sites

Ⓗ Highway Advisory Radio

CM Changeable Message Sign

EM Extinguishable Message Sign

**Figure 4-1d
Existing Freeway ITS Elements**

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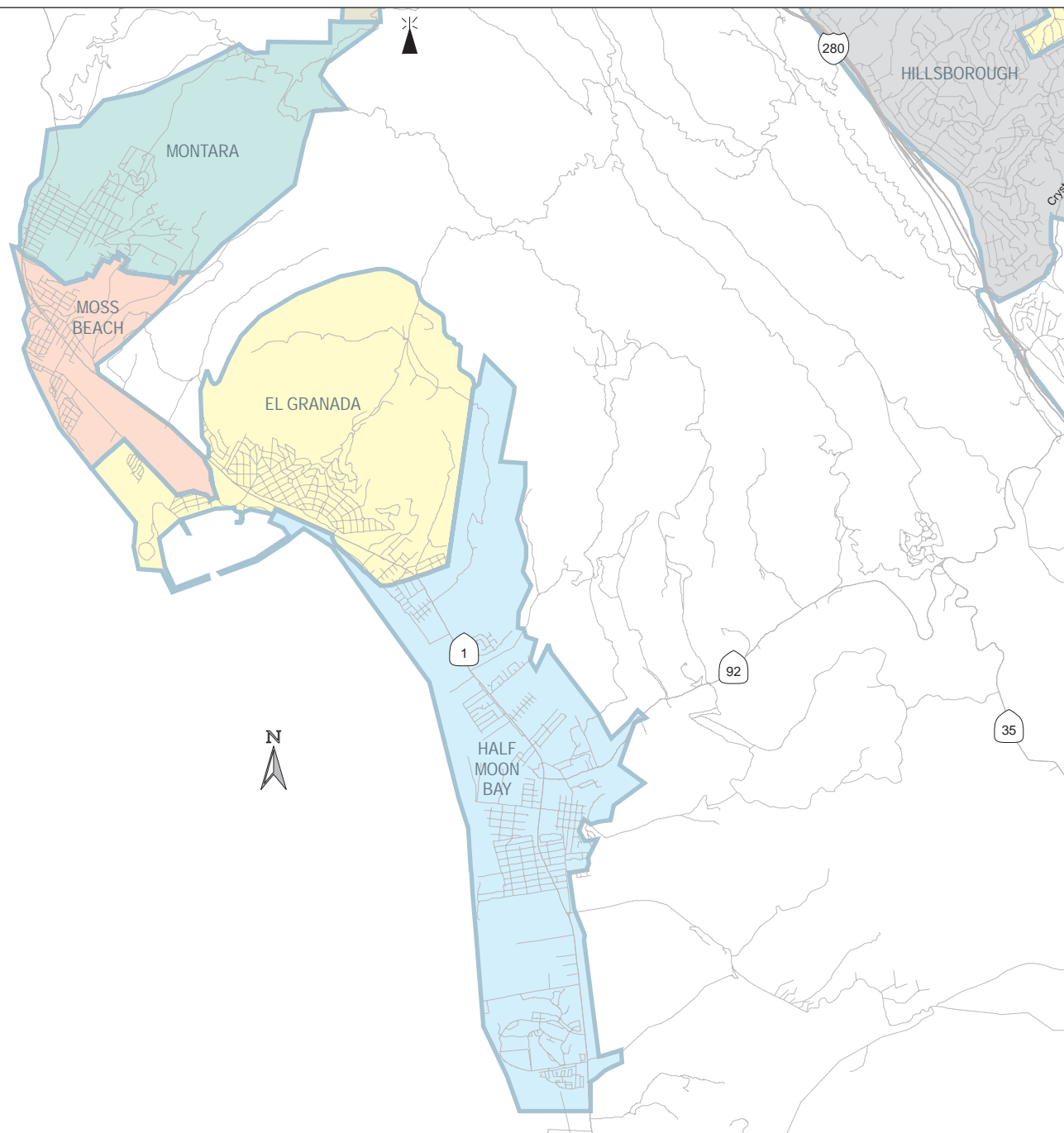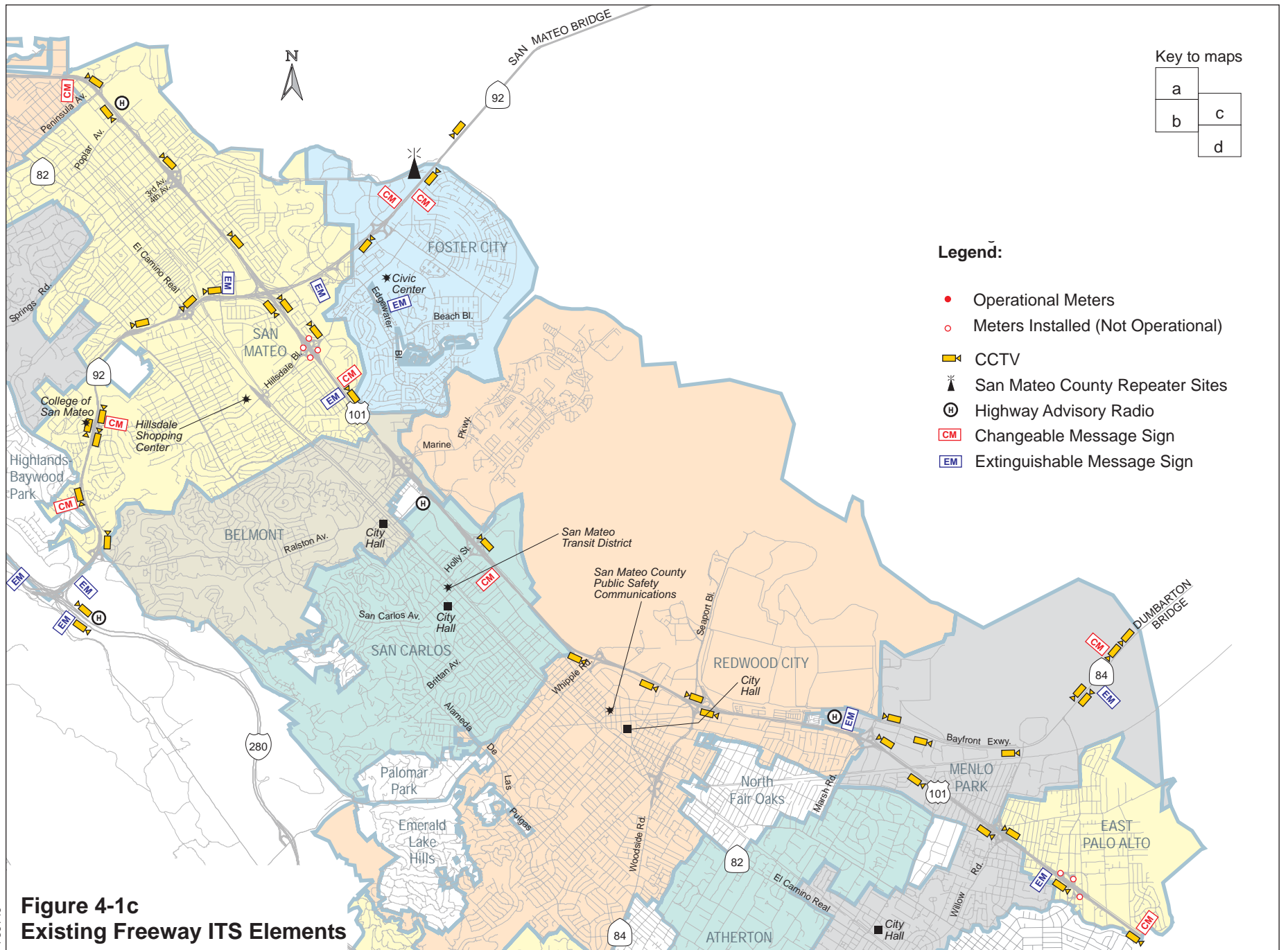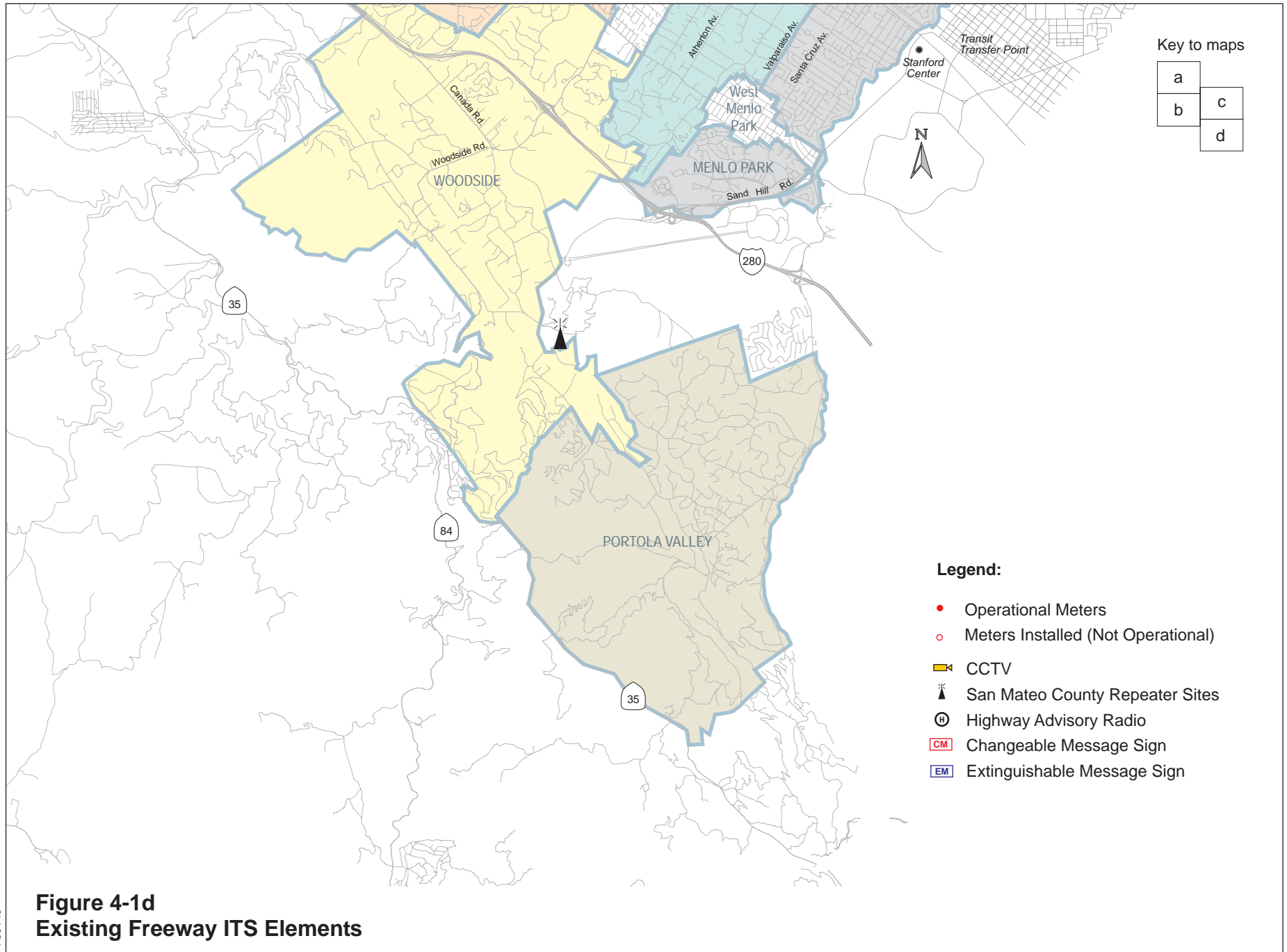TRANSPORTATION SOLUTIONS

4.1.2   Freeway Concept of Operations

MTC is leading the efforts for the Freeway Concept of Operations project. The purpose of the project is to help improve the Freeway Operations policies, procedures and practices, and build consensus on the roles, responsibilities and resource needs for Freeway Operations. The Concept of Operations focuses on the activities that support the operations and management components of the Freeway Management Program. The objectives are aimed at establishing policies and improving procedures across jurisdictions, developing strategies and specific action items to support continued operations and best practices for freeway operations. The overall Concept was grouped into the following four categories:

- Planning
- Freeway Operations Infrastructure
- Operational Policies and Procedures
- Organization, Staffing and Funding

Several key initiatives were developed as part of the Freeway Concept of Operations project. One in particular was most relevant to San Mateo County, namely to develop a common radio frequency for emergency operators. San Mateo County was selected as a demonstration test bed for this initiative primarily due to the close interaction between the CHP and local authorities when dealing with incidents and emergencies.

4.1.3   FasTrak

The FasTrak system is an electronic toll collection system that has been installed at all eight Bay Area bridges. It utilizes transponders or tags located within vehicles and tag readers located at the bridge's toll plazas. Currently, there are more than 250,000 holders of tags which accounts for about 25 percent of the total trips on the freeway system. On a typical weekday, there are up to 90,000 FasTrak transactions.

With the exception of the Golden Gate Bridge, Caltrans administers all the toll bridges in the Bay Area, including the Dumbarton and San Mateo Bridges, both of which are within San Mateo County.

4.1.4   Freeway Service Patrol/Call Box

The Freeway Service Patrol (FSP) consists of 74 trucks that cover approximately 425 miles throughout the Bay Area. The system is designed to provide roadside assistance to vehicles, especially those that create congestion hot spots by blocking travel lanes. The system logs in about 115,000 roadside assists a year. The Call Box system consists of about 3,500 call boxes located along 1,000 miles of freeway. The system receives about 80,000 calls per year. The FSP is a joint project of the Metropolitan Transportation Commission Service Authority for Freeways and Expressways (MTC SAFE), CHP, and Caltrans.

4.2   Needs

With the high volumes of traffic they carry, the freeways represent the primary component of the County's transportation system. While the County's highways may carry much lower volumes of traffic, they do represent vital links between the coastal and bayside regions of the County.

In addition to recurring congestion, these facilities are also subject to incident-related congestion that can significantly impact the County's transportation system. While a typical incident may only close

one or two lanes, the resulting congestion and delays can be significant due to the high level of traffic demand.

Ensuring the efficient operation of the County's freeways and highways is critical to the movement of people and goods in the County. Thus, it is important to be able to manage these roadways, to quickly detect and respond to incidents, and to inform drivers about the prevailing conditions. To this end, Caltrans has deployed a variety of ITS elements (e.g. traffic detector stations, CCTV cameras, CMSs, ramp meters) in San Mateo County. However, most of these elements are located along US 101 and SR 92, east of I-280. and according to the District 4 Office of Traffic Operations TOS Map received in June, 2004, there are several CCTV cameras along US 101 north of SR 92, that are either out of order or incomplete. According to the map, there are no CCTV cameras installed along I-280, SR 1, SR 35 within the County.

In order to provide better coverage on the other freeways and highways within the County, additional CCTV cameras, detection stations, and CMS's need to be installed along SR 92, west of I-280, along I-280 south of I-380 and along SR 1, and SR35. According to Caltrans staff, 17 CCTV cameras, 6 CMS's, 10 new detector stations and 18 miles of fiber optic communication cable have been proposed for the I-380/I-280 corridor in the north area of the County. Additional coverage along the freeways and highways at the major interchanges and between exit and entrance ramps in the County would maximize the efficiency of the freeway system and reduce the impacts of incident-related congestion.

Because of the interaction between the freeways or highways and the arterials, coordination in the operation of all these facilities is important. For example, if local agencies are aware of incidents and/or congestion on the freeway system, they can better manage traffic on their local streets. Thus, one desire often mentioned by local agencies was for the ability to access Caltrans' CCTV cameras as well as other freeway monitoring information. Improved coordination between Caltrans and local agencies, and sharing of traffic information and data between each agency also maximizes the use of existing ITS elements.

The need to include operations and maintenance as part of an integrated freeway management system is important because without it, the system would cease to operate. It is important that elements of the system function as they were designed for and are maintained. It is critical that the integrity of the system is not compromised since information provided to the public needs to be accurate.
In summary, freeway/highway management deficiencies and needs include:

- Improve traffic monitoring and incident verification capabilities on all freeways and highways within the County;
- Maximize and optimize the use of existing ITS elements on the freeway system;
- Enhance dissemination of real-time traveler information regarding congestion levels, incidents, road closures, and adverse weather conditions;
- Improve coordination between freeway operations and local arterial street traffic operations;
- Provide local agency access to Caltrans' closed circuit television (CCTV) cameras and other monitoring information related to the freeways and highways within the County.

4.3   Opportunities

The opportunities in the freeway management category are based on goals mentioned in chapter 3 for this category and the needs mentioned in the previous section. The following lists the ITS Opportunities under the Freeway/Highway Management System:

1. Bring already deployed ITS devices into full and stable operation to maximize the utility of existing equipment and investment.

2. Make the Caltrans District 4 Regional TMC fully-operational with respect to San Mateo County.

3. Deploy additional traffic monitoring sensors and incident verification equipment (e.g. CCTV cameras, vehicle detectors (sensors), and toll tag readers) along selected portions of I-280, US101, Hwy 92, Hwy 84, Hwy 35 and Hwy 1.

4. Install fog sensing equipment along roadways within specific areas of the County including, but not limited to, Highway 35, between Lake Merced and I-280, Highway 1 through Pacifica, and Highway 92 west of I-280.

5. Install additional changeable message signs (CMS) along freeway and highway segments within the County to inform motorists of congestion levels, incidents, road closures and fog conditions, including along I-280 and Highway 35 in Daly City and Pacifica.

6. Install additional changeable message signs on US 101 and I-280 for route guidance to major facilities such as the Cow Palace, Expo Center and other event facilities.

7. Bring ramp metering system, as approved, into operation to help manage traffic flow on the freeways, where appropriate and integrate traffic signal operations with future ramp meters, if implemented, including provisions for real-time information on congestion at freeway interchanges throughout the County.

8. Implement a center-to-center link between Caltrans' Transportation Management Center (TMC) and other transportation centers within San Mateo County, including local TMCs and the San Francisco International Airport, to provide for real-time exchange of traffic data and video.

4.4   Goals and Priorities

Due to the high volume of travel served by these facilities, Freeway/Highway Management is a vital element of San Mateo County's ITS Strategic Plan. The overall strategic objective for this element is to have a state-of-the-art system that has comprehensive coverage, is fully operational, and is actively managed. The focus of the freeway management system is to be the existing Regional TMC located at Caltrans District 4 offices. The recommended strategy also involves expanded deployment of various ITS field devices along the freeways and highways within the county. In the near-term, the priority for implementation is to ensure that existing infrastructure is fully operational and utilized.

Within this category, eight ITS opportunities were identified for consideration by the Working Group. Of these, three ITS opportunities were rated by the Working Group as Medium/High or above. These priorities reflect the fact that near-term focus should be on making the most efficient and effective use of existing equipment and capabilities. As such, the highest rated opportunities involve making sure that existing equipment is fully functional, and that the equipment is utilized to the fullest extent possible to help manage freeway and highway operations. The freeway/highway management ITS opportunities and the priorities assigned by the Working Group are summarized in **Table 4-2.**

4.4.1 High Priority Freeway Management Project Concepts

The three Freeway Management ITS project concepts ranked by the San Mateo County Working Group from High to Medium/High are summarized below. Expanded descriptions of these project concepts are provided in Technical Memorandum #4: Project Concept Descriptions and in Appendix E: Project Fact Sheets.

FM #1: Bring already deployed ITS devices into full and stable operation, and allocate funding and resources for operations and maintenance (O&M) (high priority).

Currently, Caltrans has installed a number of ITS field devices within San Mateo County. Most of these devices have been installed along US 101, although some are installed along I-280 (north of I-380), I-380, SR 92 (east of I-280), and SR 84 (East of US 101). However, a number of these devices are not fully operational, for a variety of reasons. It should be noted that Caltrans is in the process of fixing the items that are not fully operational, however a specific timetable has not been established.

Table 4-2 - FREEWAY/HIGHWAY MANAGEMENT OPPORTUNITY PRIORITIES

#	OPPORTUNITIES	NEEDS					RATING
		Improve traffic monitoring and incident verification capabilities	Maximize and optimize the use of existing ITS elements	Enhance dissemination of real-time traveler information	Improve coordination between freeway operations and local arterial street traffic operations	Provide local agency access to Caltrans' cameras and other freeway monitoring information	
FM1	Bring already deployed ITS devices into full and stable operation	●	●				H
FM2	Make Regional TMC fully-operational with respect to San Mateo County	●	●				H
FM3	Deploy additional traffic monitoring sensors and incident verification equipment where appropriate on the County's freeways and highways	●					M
FM4	Install fog sensing equipment where appropriate on the County's freeways and highways	●					L/M
FM5	Install additional changeable message signs (CMS), including along I-280 and Highway 35 in Daly City and Pacifica			●			M
FM6	Install additional changeable message signs on US 101 and I-280 for route guidance to major attractions			●			M/L
FM7	Bring ramp metering system, as approved, into operation, and integrate with signal operation where appropriate				●		M/H
	Integrate traffic signal operations with future ramp meters, if implemented				●		Incorporated into FM#7
FM8	Implement a center-to-center link between Caltrans' Transportation Management Center (TMC) and existing or future TMCs within San Mateo County				●	●	M/L

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This project would upgrade to operational status the ITS equipment that is classified as functional, incomplete, or out of order. In order to upgrade the ITS field devices to operational status, existing hardware that is outdated or broken would be replaced, locations needing communications links to the TMC would be identified and new hardware would be installed to enable communication to the TMC, and locations that require power or telephone service connection would be identified and the necessary work implemented.

Elements that would be involved in this project include:

- Investigating with Caltrans each specific location that is not fully operational;
- Identifying what is needed to bring each device to operational status:
    - Replacing or repairing "out of order" devices,
    - Determining what infrastructure already exists and what is remaining to be installed for devices labeled "incomplete", and
    - Identifying options for providing remote communications with devices labeled as "functional";
- Implementing corrective measures; and
- Providing funding for on-going operations and maintenance.

FM #2: Make Caltrans Regional Transportation Management Center (TMC) fully-operational with respect to San Mateo County (high priority).

The field devices described above communicate with the TMC operated by Caltrans. From there, information on traffic conditions is monitored and traffic management devices such as CMSs and ramp meters are controlled. However, effective management of the entire Bay Area freeway system requires significant resources.

However, Caltrans does not have enough resources to manage the entire Bay Area effectively. Additional Caltrans staff resources housed inside the Caltrans TMC would focus on managing freeway operations in San Mateo County, monitoring traffic and verifying incidents occurring within the County.

Elements that would be involved include:

- Providing financial support for additional TMC staff to manage the freeway, highway, and arterial system in San Mateo County; and
- Installing additional hardware at the TMC as necessary, such as workstations and monitors for viewing the video from the freeway cameras.

FM #7: Bring ramp metering system, as approved, into operation, integrate traffic signal operations with future ramp meters, and allocate funding and resources for the O&M (medium/high priority).

Ramp metering is a strategy to help manage traffic flow on the freeway. The Peninsula Corridor Ramp Metering Study is analyzing potential benefits and impacts of ramp metering along US 101 and the northern segment of I-280 between I-380 and the County line. The study is expected to be finalized in early 2005 and lead to recommendations on whether to pursue ramp metering within San Mateo County.

If ramp metering is implemented, the integration of the future ramp meters with the local traffic signal operations will improve agency coordination between the freeway operations and the local arterial street traffic operations, increase the efficiency of the roadway network adjacent to the ramp metering locations and improve the flow of traffic along the arterials that are adjacent to the on and off-ramp signals.

If ramp metering is approved for use in San Mateo County, elements that would be involved include:

- Installing ramp metering field equipment where needed;
- Providing necessary communication hardware, software and infrastructure to:
    - Establish communications to the Caltrans TMC, and
    - Integrate ramp meters with traffic signals;
- Developing MOU's between Caltrans and the local agencies affected by ramp metering; and
- Providing funding for on-going operations and maintenance.

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5   ARTERIAL MANAGEMENT

Similar to freeway management systems, arterial management refers to the management of traffic on the road network.   Arterial management systems primarily focus on monitoring traffic on local roadways and streets.   Traffic signals are the principal form of technology application for arterial management within the County.   However, the system also includes similar components as those found in freeway management systems including detector stations, CCTV cameras, and CMS.   The arterial management category is more a local effort since the agencies/jurisdictions in San Mateo County have a strong voice on any initiative that is brought forth.

5.1   *Existing Initiatives*

Local agencies within San Mateo County have undertaken or are pursuing a number of ITS-related activities.   These initiatives include providing communications between signal controllers to enhance coordinated operation, installing centralized traffic control systems whereby local traffic signals communicate with and can be controlled by central monitoring, and implementing advanced signal control strategies such as adaptive control.   A number of cities also currently use video detection technology to control the operation of traffic signals, although only Caltrans currently uses CCTV cameras to monitor traffic conditions.   The following sections summarize the arterial Management ITS initiatives currently being undertaken by Caltrans and by the local jurisdictions.

5.1.1   Caltrans Central Signal Control System (CTNet)

In addition to the freeway system, there are a number of Caltrans-owned roadways within San Mateo County.   Caltrans controls over 200 traffic signals on El Camino Real (SR 92), Skyline Boulevard (SR 35), Woodside Road (SR 84), Junipero Serra Boulevard (SR 1), Willow Road (SR 114), and Bayfront Expressway (SR 84).   Most of the signals on El Camino Real are coordinated within each jurisdiction, but the signals are not typically coordinated across jurisdictions.   Currently, the traffic signals operate off of field masters.

In addition to the field elements, Caltrans has also established a central signal control system.   CTNet is an advanced arterial traffic management system Caltrans uses for managing their traffic signals in the Bay Area.   It includes a central operating system at Caltrans offices in Oakland and communication links to traffic signals operating by Caltrans via Integrated Services Digital Network (ISDN).

5.1.2   Local Signal Operations

Local agencies control the field elements installed within their local road network.   A few of the agencies have a central location from which they can control and monitor their traffic signals (a scaled-down version of Caltrans' TMC).   Some of the other cities have interconnect (via twisted-pair, fiber, or radio), between signals along an arterial, and have an on-street master controlling the group of signals.   Currently, none of the cities have any CCTV cameras, HARs, or CMSs installed.   A few of the cities have video detection.

A summary of the arterial management status within each local jurisdiction is provided below. **Figure 5-1(a-d)** illustrates the locations of ITS elements along the arterials in San Mateo County, while **Table 2-1**in Chapter 2 summarizes the extent to which these various ITS elements have been implemented by agencies within the County.   Most of the information was collected as part of MTC's Arterial Database Inventory Project.   The information was updated through our interviews with the local agency.

Atherton

The City of Atherton operates three signalized intersections and one pedestrian crossing. Caltrans owns two other signals within the city limits. All the traffic signals operate as isolated intersections. The City has not installed any other ITS elements.

Belmont

All of the 6 City owned traffic signal controllers in the City of Belmont are Model 170, including the nine traffic signals Caltrans owns. With the exception of one traffic signal, all of the City's traffic signals are interconnected via fiber and controlled by an on-street master.

The City is currently preparing plans and specifications for the installation of four CCTV cameras on Ralston Avenue. The video would be transmitted back to City Hall via an existing 48-strand single-mode fiber optic cable. The city also uses 3M's Opticom Emergency Vehicle Preemption system. The City has not installed any other ITS elements.

Brisbane

The City currently has six of their nine traffic signal controllers running Traconet. The controllers are connected to an on-street master by radio telemetry. The remaining three traffic signal controllers operate as isolated signals. Inductive loops are used for vehicle detection at all the signalized intersections. The City has not installed any other ITS elements.

Burlingame

The City has a total of 14 intersections, most of which are on one of three existing interconnect systems: Bayshore System (4 signals), California System (5 signals), and California System (2 signals). The City has a BI Tran QuicNet system. The remaining 2 traffic signals operate as isolated signals. With the exception of two locations, inductive loops have been installed at each of the signalized intersections. The city also uses 3M's Opticom Emergency Vehicle Preemption system. The City has not installed any other ITS elements.

Key to maps

a	
b	c
	d

Legend:

Signals
- Interconnected
- Non-Interconnected

Type of Interconnect
— Coaxial Cable
— Fiber Optic
— Microwave
— Phone Drop
— Spread Spectrum
— Twisted-Pair Copper

◁ Video Detection

Figure 5-1a
Existing Arterial ITS Elements

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Key to maps

a	
b	c
	d

Legend:

Signals
- • Interconnected
- • Non-Interconnected

Type of Interconnect
- — Coaxial Cable
- — Fiber Optic
- — Microwave
- — Phone Drop
- — Spread Spectrum
- — Twisted-Pair Copper

- ◻️ Video Detection

N

Figure 5-1b
Existing Arterial ITS Elements

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Key to maps

a	
b	c
	d

Legend:

Signals
- Interconnected
- Non-Interconnected

Type of Interconnect
- Coaxial Cable
- Fiber Optic
- Microwave
- Phone Drop
- Spread Spectrum
- Twisted-Pair Copper

◻️ Video Detection

**Figure 5-1c
Existing Arterial ITS Elements**

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Key to maps
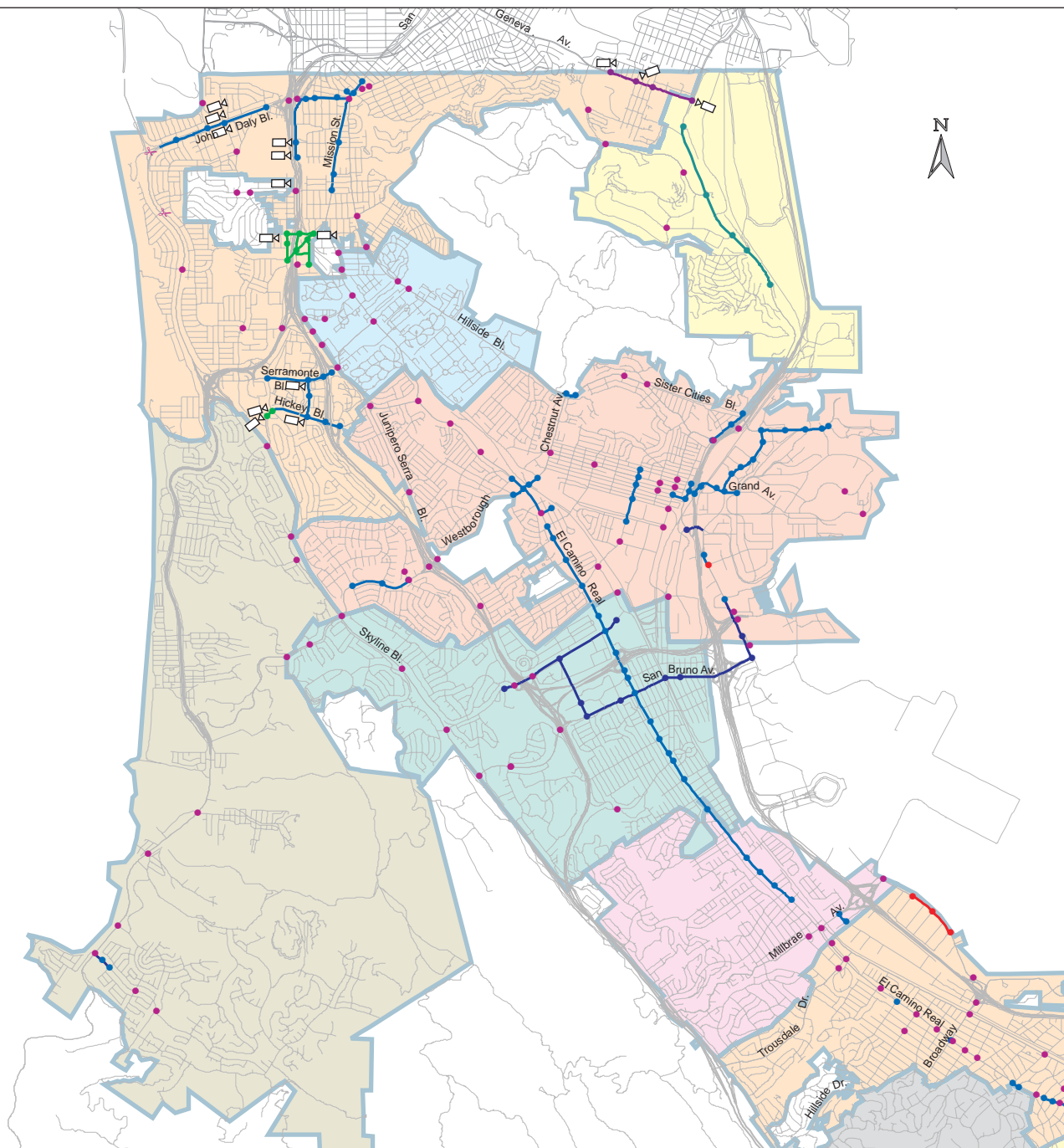
a	
b	c
	d

Legend:

Signals
- Interconnected
- Non-Interconnected

Type of Interconnect
— Coaxial Cable
— Fiber Optic
— Microwave
— Phone Drop
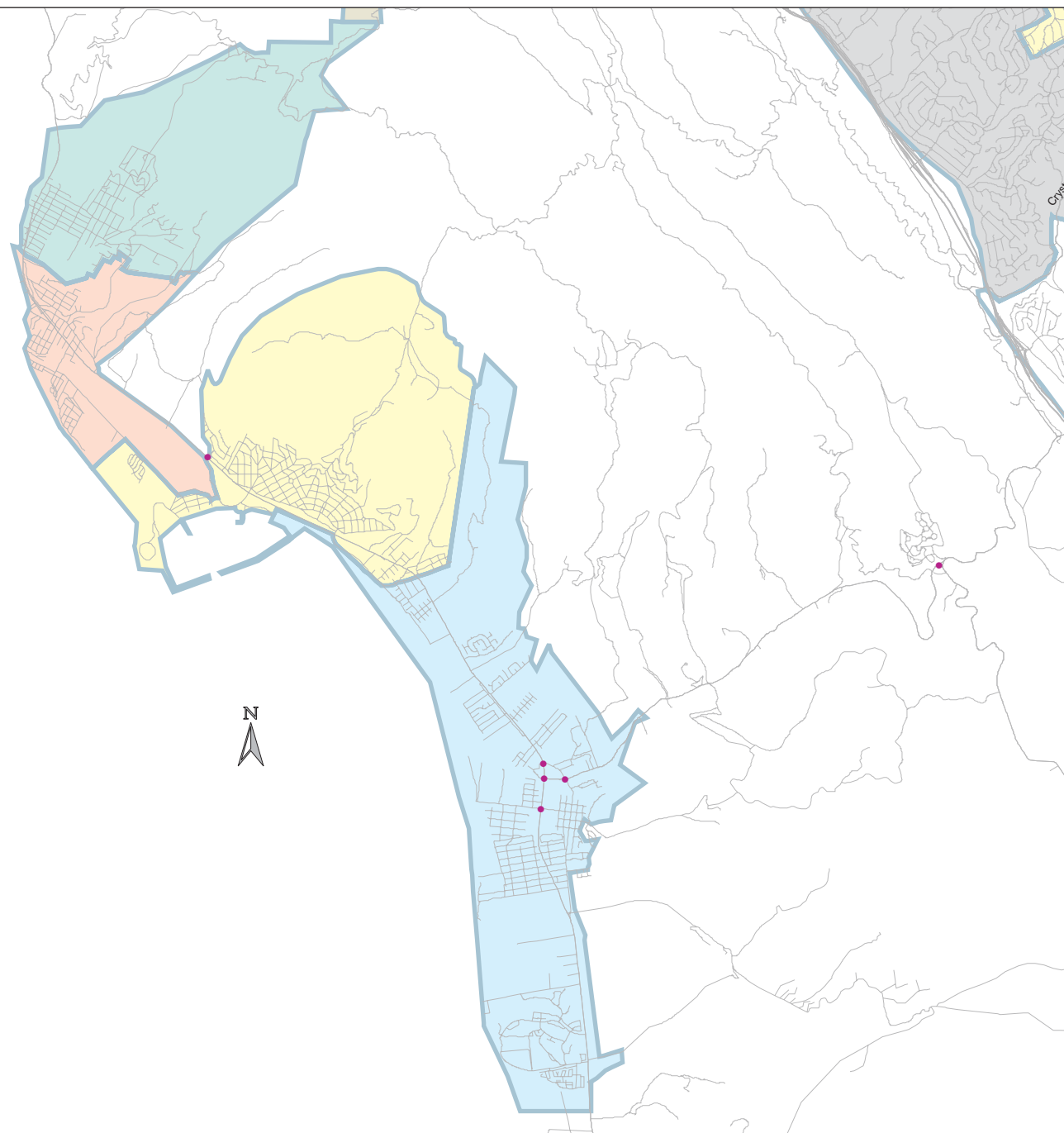— Spread Spectrum
— Twisted-Pair Copper

◁ Video Detection

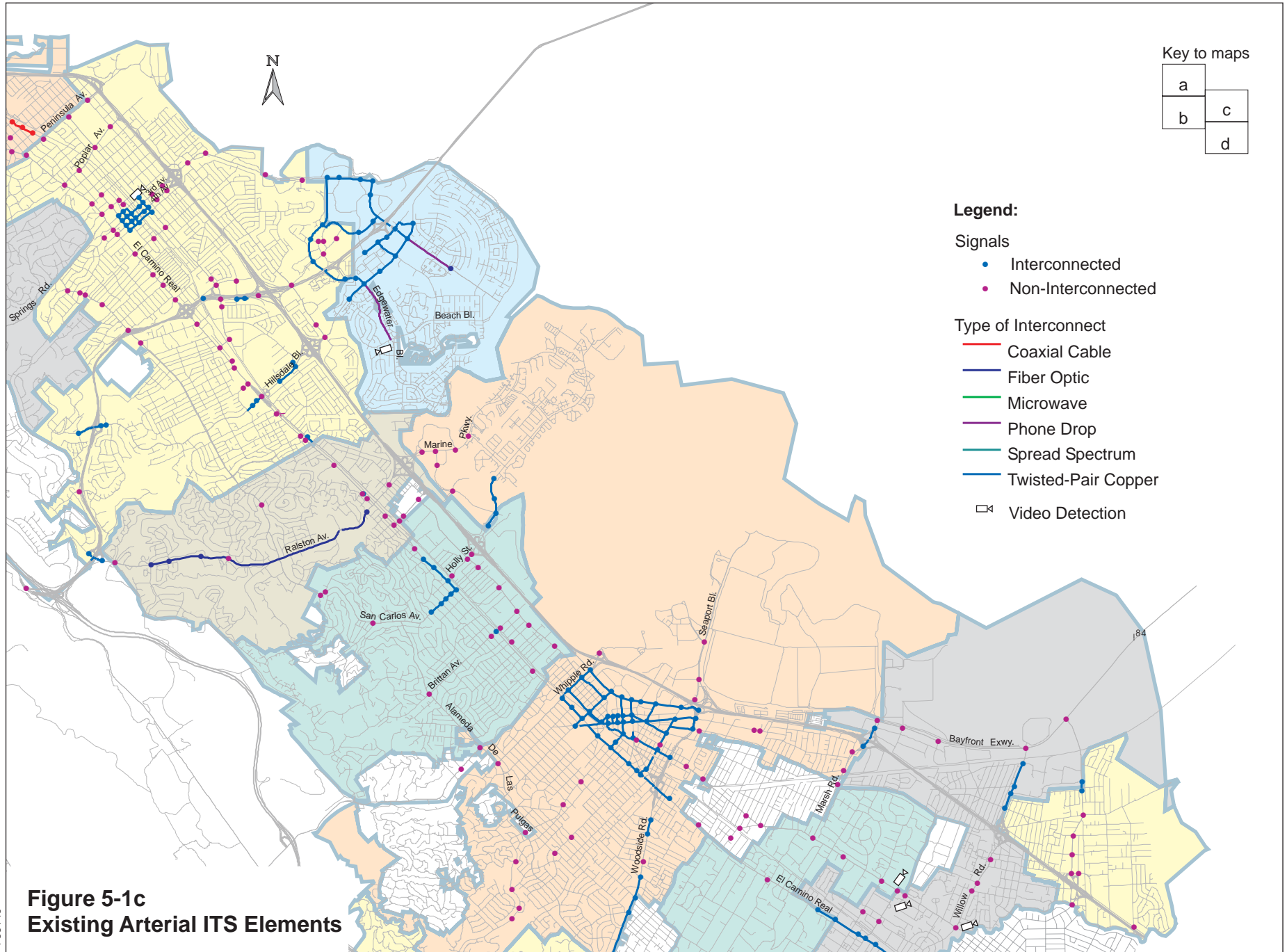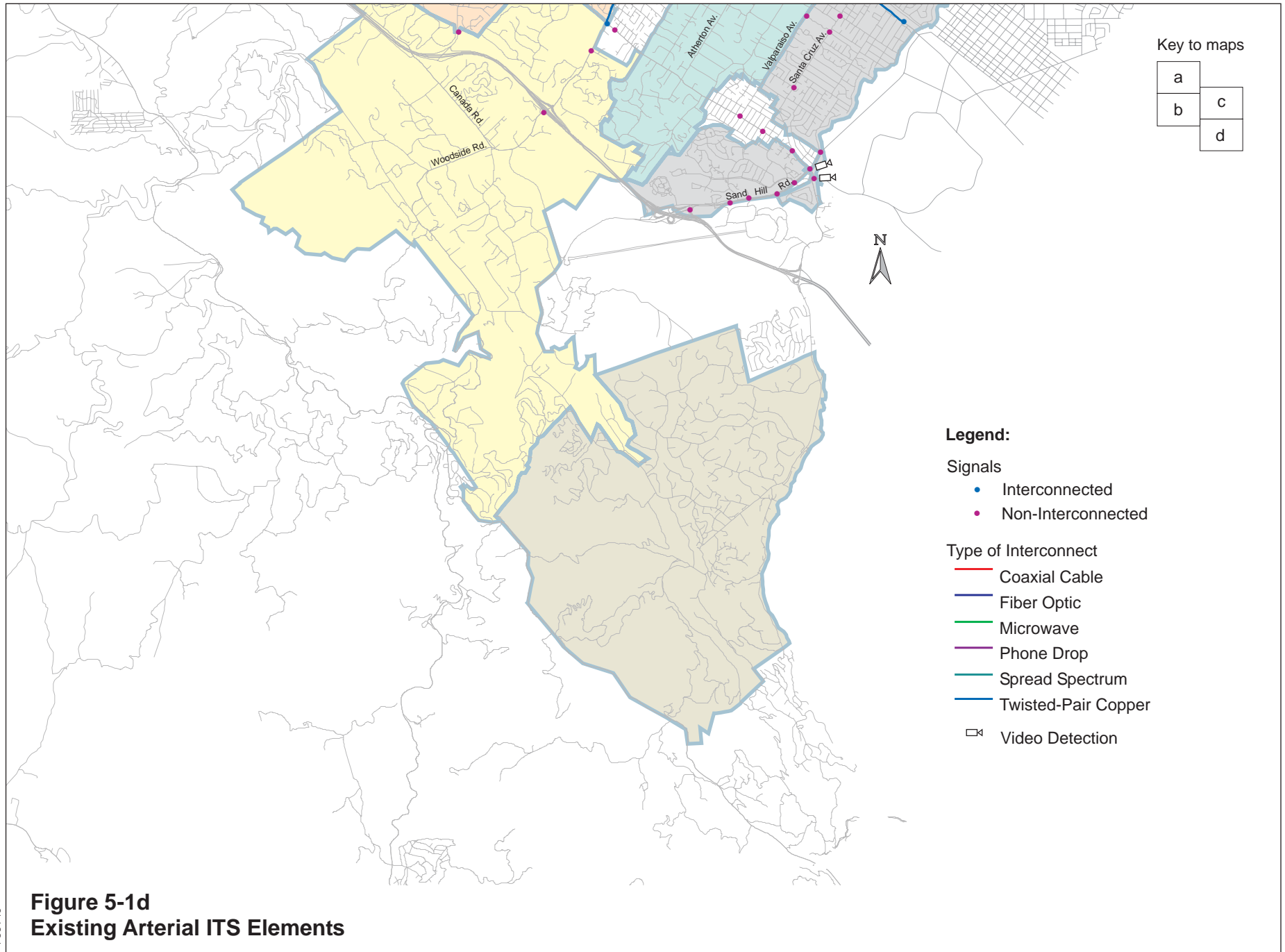**Figure 5-1d**
Existing Arterial ITS Elements

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Colma

Town of Colma currently operates six traffic signals. Within the town, Caltrans owns five traffic signals. All the traffic signal controllers are Model 170s and there are pavement loops at all the signalized intersections. None of the traffic signals are interconnected. The City has not installed any other ITS elements.

Daly City

There are 62 traffic signals within the city, 39 of which are owned by City. Most of the City's traffic signals are interconnected via copper twisted-pair, phone drop, or microwave. A few years ago, the City started installing video cameras for detection and are not installing any more loops for detection. The City has both Type 170 and NEMA type traffic signal controllers. Some of the traffic signals are controlled by an on-street master. The City does not have a centralized signal system. The City has not installed any other ITS elements.

East Palo Alto

The City of East Palo Alto currently has seven traffic signals locally controlled, with one Caltrans traffic signal controller. Most of the locally controlled intersections within the city are not interconnected and operate as isolated intersections. The City has not installed any other ITS elements.

Foster City

There are 22 traffic signals within the city, 3 of which are owned by Caltrans. The City has NEMA-type traffic signal controllers. All the traffic signals are interconnected to their Traconet signal system located at City Hall. With the exception of one intersection, loop detection is used at all of their signalized intersections. The City installed video detection at the intersection of Edgewater Boulevard and Beach Park Boulevard a few years ago, but has decided not to use video detection. The City has not installed any other ITS elements.

Half Moon Bay

All four signalized intersections within the city limits are controlled by Caltrans. The City has not installed any other ITS elements.

Hillsborough

Hillsborough does not have any signalized intersections owned by the City. Within the City limits, there is one signalized intersection that is state-controlled. However, near two of the public schools, the City has installed flashing school beacons and a flashing four-way stop sign. The City has not installed any other ITS elements.

Menlo Park

The City of Menlo Park controls 23 signalized intersections and does not currently have a central system. Only the traffic signals on Marsh Road are interconnected. The City does not have a city-wide communications system. Two speed monitors have been installed on Sand Hill Road. At each of the speed monitor installations, a speed detection and electronic sign has also been installed. The state controls 21 signalized intersections within the City. Most of the state-owned intersections are interconnected to an on-street master via cooper twisted-pair interconnect. The City has Type 2070 "lite", Type 170 and NEMA type traffic signal controllers. Loop detection is predominantly used at the signalized intersections; however, video detection has been installed at some intersections.

The City selected SCATS (Sydney Coordinated Adaptive Traffic System), an integrated computerized traffic signal control system. Ten intersections (eight in Menlo Park and two in Palo Alto) on El Camino Real are included in the traffic adaptive project. Based on the data collected at the individual

intersections, the system selects cycle length, splits, and offsets for all the intersections on a cycle-by-cycle basis. Data is sent back to a server located at Caltrans for analysis. As part of the traffic adaptive project, a workstation has been installed at Caltrans, the City of Menlo Park, and the City of Palo Alto. In addition, new detector loops were installed for most of the intersections. Previously, Caltrans operated the traffic signals on a time-of-day schedule.

The City has received funding to install 3M's Emergency Vehicle Pre-emption equipment on Willow Road, including a few Caltrans intersections. The City has not installed any other ITS elements.

Millbrae
There are a total of twelve signalized intersections within the City of Millbrae, 8 of which are owned by Caltrans. Some of the signals are connected to an on-street master via twisted pair interconnect. With the exception of one intersection, Model 170 controllers are used at all the signalized intersections in the City. The city also uses 3M's Opticom Emergency Vehicle Preemption system. The City has not installed any other ITS elements.

Pacifica
There are five locally controlled signalized intersections and six state-controller signalized intersections within the City of Pacifica. Both NEMA type and Model 170 controllers are used. Inductive loops are installed at the five locally controlled signalized intersections. Only two of the signalized intersections are interconnected. The City has not installed any other ITS elements.

Portola Valley
Portola Valley does not have any traffic signals nor any other ITS elements.

Redwood City
The City of Redwood City owns 60 traffic signals (including four pedestrian crossings) ,while Caltrans owns 25 traffic signals within the city limits. The City does not interface with any of the state-owned intersections. Loops are used for vehicle detection at most of the city signalized intersections. The City recently upgraded their signal system and currently has ICONS for their central signal system. Twisted-pair interconnect is used to interconnect the traffic signal controllers. The City is planning to install pedestrian countdown signals. The City has not installed any other ITS elements.

San Bruno
There are 10 locally-controlled signalized intersections and 19 state-controlled signalized intersections within the city limits. Most of the locally-controlled signalized intersections are interconnected via fiber. Most of the state-controlled signalized intersections are interconnected via copper twisted-pair and are controlled by an on-street master. With the exception of one city location, all the signalized intersections are controlled by Model 170 controllers. The City does not use video detection at any of their intersections. The city also uses 3M's Opticom Emergency Vehicle Preemption system. The City has not installed any other ITS elements.

San Carlos
The City of San Carlos controls 15 traffic signals while Caltrans controls 11 traffic signals within the city limits. In addition, the City has installed a flashing beacon at one location. At most of the city intersections, loops are used for vehicle detection. Only four of the city-owned traffic signals are interconnected via copper twisted-pair. The remaining city-owned traffic signals operate as isolated signals. The city has both Type 170 and NEMA type traffic signal controllers installed. The city also

uses 3M's Opticom Emergency Vehicle Preemption system. The City has not installed any other ITS elements.

City of San Mateo

There are a total of 89 traffic signals in the City of San Mateo. Sixty of the traffic signals are controlled by the city and 29 are controlled by Caltrans. Although some of the intersections in the downtown area are actuated, most of the intersections are fixed time with pedestrian recall. Both loops and video are used for vehicle detection at the city-owned intersections. More than half of the city traffic signal controllers are interconnected via twisted-pair. The city uses OSAM at their on-street master controllers.

Currently, most of the city traffic signals are Multisonics (NEMA type) controllers. However, the City is currently using 2070 controllers for its Bay Meadows and 19th Avenue/Delaware systems. Seven of the city traffic signals near Bay Meadows are connected to the ICONS central signal system via fiber. The 19th Avenue/Delaware system consists of four signals that are also on the ICONS system. Both signal groupings on the ICONS system are interconnected with Caltrans Type 170 controllers. A frame relay was installed at City Hall to permit communication between icons and CTNet but that capability has not been available. The fiber interconnect has been brought back to City Hall and the Yard. The City will be replacing controllers throughout the City using 2070's outside of the downtown. A decision has not been made regarding what to use as replacements downtown. There is an ICONS workstation at City Hall.

The police department is setting up a "wi-fi" network. The network will be used for streaming video from security cameras. Equipment will be installed on traffic signal poles. The city also uses 3M's Opticom Emergency Vehicle Preemption system. The City has not installed any other ITS elements.

South San Francisco

The City of South San Francisco controls 60 traffic signals while Caltrans controls 20 traffic signals within the city limits. There is a mixture of NEMA type and Model 170 controllers installed at the signalized intersections. Most of the city-controlled intersections are interconnected via twisted-pair interconnect. A few of the city-controlled intersections are via fiber cable. With the exception of a few locations, pavement loops are used for vehicle detection. The City does not use video detection nor has a central signal system. Pedestrian countdown signals have been installed at some of the intersections. The City has not installed any other ITS elements.

Woodside

The City of Woodside owns one traffic signal and Caltrans owns two traffic signals within the city limits. All three signalized intersections are controlled by Model 170 controllers. Loops are used for vehicle detection at the city-owned intersection. None of the signals are interconnected. The City has not installed any other ITS elements.

5.2   Needs

The C/CAG CMP Report for 2003 identifies 16 designated CMP intersections, of which eight are located along El Camino Real (SR 82), four on Bayfront Expressway (SR 84), two on SR 92, one along Skyline Blvd. (SR 35) and one along Geneva Ave. According to the CMP report, all of the CMP intersections operate at levels of service better than their LOS standard and no LOS standard violations were identified. However, this assessment does not fully capture the operating conditions on the County's arterials.

A number of arterial intersections, especially those near freeway interchanges along US 101, were identified by stakeholders as being subject to recurring congestion during the peak periods. Furthermore, arterials can be significantly impacted by non-recurring congestion related to special events or seasonal activities, and incidents.

San Mateo County is home to a number of major event centers such as the County Fairgrounds and the Cow Palace, and regional shopping centers such as the Serramonte Shopping Mall. During special events or the holiday shopping season, arterials in the vicinity of these centers can become congested. During special events, rather than being able to monitor traffic conditions and control traffic signal timing from a remote location, police officers are often used to help control traffic. As a result of the manual effort, there is not always good coordination provided between the traffic signals.

Arterial operation can also be impacted by incidents that occur on the facilities themselves, or as is often the case by incidents on the freeways. The ability to monitor conditions and implement corrective measures during periods of both recurring and non-recurring congestion is critical to the effective management of the County's arterials. As part of this, improved coordination between the local traffic signal systems and freeway operations, the local agency can better manage motorists on the local streets and advise drivers of alternate routes.

Most cities have installed some traffic signal interconnect. However, there is a lack of signal interconnect between traffic signals on key north-south and east-west corridors within individual cities. For example, some parts of El Camino Real, Junipero Serra Boulevard, and some of the east-west arterials, such as Woodside Road, Willow Road, Millbrae Avenue.

At present, none of the cities have deployed detector stations or CCTV cameras. (Note: the City of Belmont is in the process of designing CCTV cameras for installation along Ralston Avenue in the near future). While the cities with a larger number of traffic signals have a central traffic signal control system in place, none have established management centers capable of monitoring traffic, detecting incidents and remotely changing traffic signal timing plans. Currently, there isn't a central location in the County from which traffic conditions can be monitored or controlled.

There are several factors that further complicate the ability to efficiently manage a number of the major arterials in the County. The first of these is that many arterials pass through multiple jurisdictions. The difficulty in coordinating traffic signals across jurisdictional boundaries is part institutional as well as physical. The agencies need to agree with each other about coordinating the signals adjacent to their boundaries. There also needs to be a physical communication link between the two traffic signals, and the traffic signal controllers need to be compatible with each other. Examples of areas where improved traffic signal coordination across jurisdictional boundaries would benefit motorists include, but not limited to: Middlefield Road between Atherton and Menlo Park, Junipero Serra between Daly City, Colma, and South San Francisco, and Hickey Boulevard from Daly City to South San Francisco BART station.

Related to the above is the fact that several of the major arterials within the County are state routes and are operated by Caltrans. As a result, many of the cities look to Caltrans for assistance in managing traffic on State-owned arterials. An example is El Camino Real, which is the primary arterial through San Mateo County and also is a Caltrans facility. Caltrans owns approximately one third of the signalized intersections in the County. The level of coordination between the city and state intersections varies and is dependent on location.

A third issue is the lack of continuous north-south arterials. El Camino Real is the only continuous north-south arterial that runs the entire length of the County, and serves as the best alternative route to US 101 and I-280. However, there are several arterials in the County that serve as alternatives for stretches of the freeway. For example, Industrial Road parallels US 101 between Harbor Boulevard (San Carlos) and Whipple Avenue (Redwood City), Norfolk Street in the City of San Mateo parallels US 101 between Hillsdale Boulevard and 3rd Avenue, and Junipero Serra parallels I-280 between Westborough Boulevard (South San Francisco) and John Daly Boulevard (Daly City). Because the number of alternative routes is limited, these facilities can become congested if an incident occurs.

Local and regional agencies also need frequent review and updates to traffic signal timing plans, such as time-of-day traffic signal coordination plans, for traffic signals within their jurisdictions so that traffic can travel efficiently through the County.

The arterial management deficiencies and needs may be summarized as follows:

- Improve arterial congestion monitoring and incident detection capabilities along state routes, major and local arterials;
- Improve management of traffic during major events;
- Improve coordination of arterial operations between local jurisdictions, and between local jurisdictions and Caltrans;
- Improve coordination between arterial and freeway operations to enhance efficiency, especially during incidents and events; and
- Improve ability of local agencies to monitor traffic conditions and control traffic signals.

5.3   *Opportunities*

As with the Freeway Management System, a key focus for arterial management is collecting and sharing information essential for the real-time operation control and management of the different systems. Advanced transportation management systems are emerging as a key element in efforts to improve the efficiency, quality, and performance of transportation networks. Having added ITS elements along key arterials within the County, including CCTV cameras, message signs and weather sensing devices provides the necessary tools for proper management. This combined with providing the latest in proven technologies for traffic signal controllers and detection, makes way for effective and efficient arterial operations. The application of these ITS components in an integrated manner is often referred to as a "Smart Corridor". This concept may be appropriate within San Mateo County along major north-south arterials, as well as on the primary east/west arterials connecting to the freeways.

A critical factor to the overall effectiveness of arterial management within San Mateo County will be a link to Caltrans Arterial Management System, CTNet. Through this system, the local agencies can process in real-time the signal timings implemented along Caltrans-owned arterials and implement complementary signal timings, if feasible.

Many of the newer systems are leaning towards more "intelligent" traffic control systems that are more proactive utilizing adaptive control algorithms. These algorithms set signal timings based on predicted, real-time transportation conditions rather than executing preset time-of-day signal timing plans, or reacting to short-term changes in traffic demand. Building on the Menlo Park experience, there are huge opportunities to implement adaptive control systems.

The implementation of a countywide, or even sub-area transportation management centers would support the cross-jurisdictional cooperation and ITS initiatives aimed at establishing the capability to centrally monitor, modify and control traffic signal timings necessary to reduce delays and stops for all modes of travel on key arterials. It also provides a central facility or series of central facilities for monitoring of ITS devices and dissemination of information to other agencies.   Examples of dissemination mediums include but are not limited to Highway Advisory Radio, 511, Internet, CMS, and Center-to-Center Links.

For the San Mateo County ITS Program, as traditional transportation projects are designed and implemented, appropriate ITS devices and infrastructure should be integrated into the design package. This way, the installation of ITS elements – advanced traffic signal controllers, changeable message signs, CCTV cameras, and communications infrastructure, would be "mainstreamed" into the overall improvement packages as a minor incremental increase in the total cost of the project.

In evaluating the identified needs from the Arterial Management System perspective, the following lists the ITS Opportunities identified to address these needs:

1. Upgrade existing traffic signal systems (e.g. replace antiquated equipment, expand coordinated systems, update timing plans, etc.) throughout the County to enhance operating efficiency and reduce maintenance requirements.

2. Update time-of-day signal timing plans to improve traffic operations coordination between agencies.

3. Install CCTV cameras at key congested locations throughout the County for congestion monitoring and incident verification.

4. Install additional detection stations along major arterials to monitor traffic flows and detect potential incidents. Utilize transit vehicles with AVL systems as probe vehicles for real-time monitoring of traffic conditions including travel times and congestion detection.

5. Install changeable message signs on major arterials to inform motorists of traffic congestion and roadway conditions.

6. Design and implement Smart Corridor(s) in selected areas within San Mateo County to improve operations and coordination between systems.

7. Use predictive traffic control systems adjacent to at-grade railroad crossings to maximize vehicular throughput on the arterial network (requires ability to detect trains and their speed, and predict when gates will close, and how long they will be closed)

8. Provide link between traffic signal systems operated by local agencies, and by Caltrans (CTNet) to improve coordination.

9. Establish Countywide Transportation Management System (through a single TMC or series of sub-area TMCs) to enhance arterial management activities within the County.

10. Implement a center-to-center link between TMC(s) in San Mateo County and other regional systems including Caltrans TMC, SFgo, Silicon Valley ITS, and the San Francisco International Airport, to enhance inter-regional coordination.

11. Evaluate and implement advanced control strategies (e.g. adaptive) systems along key congested corridors within San Mateo County, building on the Menlo Park experience, to improve traffic operations.

5.4   Goals and Priorities

While the County's arterial roadways typically carry much lower traffic volumes than the freeways, these roadways still play an important role in the movement of people and goods.   At the same time, the limited resources available within many local agencies to deploy and operate ITS applications must be recognized.

The Arterial Management strategy for San Mateo County focuses on two key components: supporting freeway operations through coordination near interchanges and ability to serve in a reliever function, and providing cross-coordination between the local streets and El Camino Real. As part of the near-term strategy, the approach is to emphasize providing links between signal systems in the field (i.e. provide communication links directly between the signals) rather than through centralized systems of TMCs.

The short-term focus is to get all of Caltrans' District 4 traffic signals in San Mateo County communicating with their arterial management system, CTNet. The mid-term focus is to potentially expand CTNet to include selected local signals where coordination with Caltrans-operated signals is critical. The long-term vision sees the gradual development of local TMCs, leading to the possible development of a countywide TMC to manage and operate the traffic signal systems in the County.

Of the eleven arterial management ITS opportunities identified, three were ranked by the Working Group as Medium/High or above. These priorities recognize the need to upgrade existing signal systems as a first step toward improving coordination and being able to implement more advanced control strategies in the future. They also reflect the critical relationship between signals operated by Caltrans and the impact to local roads and signal operations.   The arterial management ITS opportunities and the priority ranking assigned by the Working Group are summarized in **Table 5-1**.

Table 5-1 - ARTERIAL MANAGEMENT OPPORTUNITY PRIORITIES

#	OPPORTUNITIES	Improve monitoring and incident detection capabilities along key arterials	Improve management of traffic during major events	Improve traffic signal coordination along key corridors	Improve coordination between arterial and freeway operations	Improve ability of local agencies to centrally monitor conditions and control signals	RATING
AM1	**Upgrade existing traffic signal systems (e.g. replace antiquated equipment, expand coordinated systems, update timing plans, etc.)**	●	●	●	●	●	**H**
	Update time-of-day signal timing plans to improve traffic operations coordination			●			**Incorporate into AM#1**
AM2	**Install CCTV cameras at key congested locations throughout the County**	●	●				**M/H**
AM3	Install additional detection stations along major arterials	●	●				L/M
AM4	Install changeable message signs on major arterials		●		●		L
AM5	Design and implement Smart Corridor(s) in selected areas within San Mateo County	●	●	●	●		L/M
AM6	Use predictive traffic control systems adjacent to at-grade railroad crossings			●			L/M
AM7	**Provide link between traffic signal systems operated by local agencies, and by Caltrans (CTNet)**			●		●	**H/M**
AM8	Establish Countywide Transportation Management System (through a single TMC or series of sub-area TMCs)				●	●	L
AM9	Implement a center-to-center link between San Mateo TMC(s) and other regional systems			●	●		L
AM10	Evaluate and implement other advanced control strategies (e.g adaptive) along key congested corridors	●	●	●			M

5.5   High Priority Arterial Management Project Concepts

Below are brief descriptions of the high priority arterial management project concepts. The numbers shown next to the project concept descriptions below correspond to the numbers presented in **Table 5-1**. Expanded descriptions of the arterial management opportunities ranked by the San Mateo County Working Group from High to Medium/High are provided in Technical Memorandum #4: Project Concept Descriptions and in Appendix E: Project Fact Sheets.

AM#1: Upgrade existing traffic signal systems (e.g. replace antiquated equipment, expand coordinated systems, update timing plans, etc.) and allocate funding and resources for the O&M (High priority).

There is a mixture of traffic signal controller currently used by the local agencies, including Type 170, Traconex TMP-390, Econolite ASC-8000, and Multisonics 820. Some of the traffic signal controllers have been in operation for more than 15 years and lack the sophistication or processing power to run advanced traffic control programs. Most of the cities do not have the resources to regularly monitor traffic conditions and update signal timing plans.

This project would entail:

- Identifying areas where enhanced operation is warranted;
- Replacing antiquated equipment:
    - Controllers, cabinets, detectors, software;
- Expanding or upgrading signal systems:
    - Expand coverage of central systems
    - Provide coordination across signals
    - May require additional infrastructure, hardware and software;
- Evaluating and updating outdated traffic signal timings only;
- Providing the funding and resources for on-going operations and maintenance.
- Provide grant funding opportunities for local agencies to install traffic signal interconnect on key corridors between traffic signals that are within their jurisdiction as well as between jurisdictions as part of a Countywide Program,.

AM #7: Provide a link between traffic signal systems operated by local agencies and by Caltrans (CTNet), and allocate funding and resources for the O&M (high/medium priority).

The signal progression of traffic in local cities on roadways that include Caltrans-owned signals may not be coordinated efficiently with adjacent local agency-owned signals if there is not a link between them. The flow of traffic from one signal affects the operation of the adjacent signal. Allowing the signals owned by Caltrans and the local agency to communicate with each other will improve the flow of traffic along the roadways within the County.

Elements that would be involved in this project include:

- Identifying coordination requirements;
- Providing communication link between affected signals (e.g. signal interconnect cable, center-to-center link);
- Developing necessary interface between controllers/signal systems;

- Establishing communication link between CTNet at Caltrans TMC and local systems; and
- Providing the funding and resources for on-going operations and maintenance.

AM #2: Install CCTV cameras at key congested locations throughout the County and allocate funding and resources for the O&M (medium/high priority).

Currently, there are no CCTV cameras installed along arterials in the County. Installing CCTV cameras at key congested locations throughout the County would improve monitoring and incident detection capabilities, primarily by providing real-time visual conditions.

This project would involve the following:

- Working with stakeholders to determine the camera locations and central monitoring requirements including staffing requirements;
- Designing and installing CCTV system(s);
- Implementing central monitoring facilities (e.g. workstations, monitors, software);
- Providing communication hardware, software and infrastructure for transmission of camera feed to monitoring location(s); and
- Providing the funding and resources for on-going operations and maintenance.

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6 TRANSIT MANAGEMENT

Transit management systems monitor the performance and location of the vehicles. Transit vehicles that are equipped with Automatic Vehicle Location (AVL) technology are tracked. Real-time position of a vehicle may be used to monitor schedule adherence and provide travelers with information regarding the location of transit vehicles. Transit vehicles equipped with Automatic Vehicle Identification (AVI) can request signal priority to improve transit route running time or serve as probe vehicles to provide real-time data about the performance of the roadway system. The transit management system category is more a local one since the local transit providers for San Mateo County SamTrans and Caltrain have strong control on what happens relating to their service.

6.1 Existing Initiatives

There are several Transit Management ITS initiatives being undertaken that impact San Mateo County. These include a regional electronic fare payment program and several local initiatives being undertaken by Samtrans. A brief description of these initiatives is provided below. Additional information about these initiatives is provided in Technical Memorandum #1: Inventory of Existing and Planned Systems.

6.1.1 TransLink

TransLink is a regional transit fare collection program initiated by MTC. It is intended to provide transit riders with a single point of transaction for their travels. The transit riders use a single TransLink smart card instead of paying fares using cash, passes or tickets. A Pilot Program was initiated in 2002 on select routes and at select station operated by six agencies including AC Transit, BART, Caltrain, Golden Gate Transit, Muni and VTA. The program is now moving to regional deployment of the smart cards. It is envisioned that the smart card will ultimately be used for non-transit opportunities such as parking, retail and building security.

6.1.2 Local Transit ITS Initiatives

As the primary bus transit service provider in the County, it is critical that SamTrams be able to provide safe and reliable service. To this end, SamTrans has implemented or is planning on implementing a number of technologies as part of their transit management system, including vehicle location, passenger counting, transit traveler information, collision warning, and transit signal priority (TSP) systems.

- **Automatic vehicle location (AVL) system** – SamTrans currently has AVL systems installed and operating on 317 fixed route and 76 paratransit buses. The AVL system provides real-time vehicle location information for real time fleet control, fleet performance tracking, fleet security, and Passenger Information Systems (arrival and departure information) purposes.

- **Automatic passenger counting (APC) system** – An APC system uses various technology to track passengers as they board or exit vehicles. Samtrans currently has APC devices on 30 percent of their fleet.

- **Transit traveler information** – SamTrans is in the process of testing a predictive arrival/departure system that uses input from the Advanced Communications System (ACS). ACS consists of interrelated radio and computer components that include a district-wide radio system, computer aided dispatching, automatic vehicle locators using GPS, and a

"Next Stop" announcement system. As part of this effort, Samtrans has installed three kiosks and dual panel LCD displays within each bus bay at the Millbrae BART Station. These devices provide real-time arrival times for SamTrans buses.

- **Collision Avoidance system** – SamTrans has been working with the Federal Transit Administration (FTA) on a frontal collision warning system. The system is radar-based and is able to screen out false-positives (e.g. shelters). It has been installed on two buses for testing.

- **Transit signal priority** – SamTrans is working with FTA, Caltrans, and PATH on an adaptive signal priority system on El Camino Real. The system works with the master controller over several signals.

6.2   Needs

San Mateo County is served by several major providers, including SamTrans, BART, and Caltrain. Coordination between providers is therefore critical to ensuring the attractiveness of transit as a mode of travel. Key areas for coordination include scheduling, transit information, and fare collection.

Better coordination among the different transit providers to provide real-time transit information (i.e., arrival and departure times of transit vehicles) at key transfer centers and transit stops can help travelers make informed travel decisions and improve their experience on transit. By displaying real-time next bus arrival information, riders can determine if there is sufficient time to initiate other activities before the vehicle arrives.

Another area of coordination that may be addressed through ITS is fare payment. It is intended to provide transit riders with a single point of transaction for their travels. TransLink was initiated in 2002, is now moving towards regional deployment. TransLink will enhance the transit rider's experience with transfers between BART, Caltrain, bus service and shuttles.

Amenities at the transit stop and on the transit vehicles that would facilitate the ability to work or accomplish other personal tasks could also improve the rider's experience. This may include providing wider seats, tray tables, reading lights, and power sources for laptops. If the rider has a positive experience on the transit system, he or she will more likely consider transit as a viable alternative to driving.

The transit management-related needs may be summarized as:

- Enhance coordination among the different transit providers;
- Improve the safety of the transit vehicles and patrons;
- Improve transit travel times (faster and more reliable); and
- Enhance transit riders' experience and convenience.

6.3   Opportunities

An ideal transit system is one where all transit vehicles are tracked in real-time, and those vehicles typically traveling on congested corridors are given priority over other travel modes to maintain the schedule. The traffic management system would also have a link to the transit management system to track transit vehicles utilizing this information as an indication of traffic conditions (i.e., the transit vehicle is used as a probe vehicle). Furthermore, transfers between services would be relatively seamless to riders.

Advanced Public Transportation Systems are technologies intended to improve the efficiency, quality, and performance of transit services. With respect to the San Mateo County ITS Program, the relevant trend and direction in the transit industry is towards more detailed real-time information about transit. This information can include real-time passenger counts, on-time schedule performance, vehicle location, route updates based on incidents, accidents, special events, and next vehicle arrival time predictions. SamTrans is already engaged in some of these features such as next vehicle departure time. Access to the real-time data allows for the dissemination of transit information to travelers so they may make more informed mode, route, and departure time decisions; the development of more attainable, realistic transit schedules; and better traffic control strategies that target transit performance.

Providing real-time transit information at key transit stops and transfer centers can help travelers make informed travel decisions and improve their experience on transit. If the rider has a positive experience on the transit system, he or she will more likely consider transit as a viable alternative to driving, especially for the medium and long distances.

One of the key transfer centers in the County is the Millbrae BART station. It provides a direct, cross-platform transfer between BART and Caltrain, allowing Caltrain passengers with airport destinations to transfer at the Millbrae Intermodal Station onto BART's dedicated airport train. Other key locations may include other intermodal stations, downtown areas, regional shopping centers, San Francisco International Airport, and event centers.

Another ITS application that will enhance the transit rider's experience with transfers between BART, Caltrain, and bus service is the use of TransLink. The transit rider uses a single TransLink smart card instead of paying fares using cash, passes, or tickets.

Having real-time information from transit vehicles would be valuable for traffic management systems in that the transit vehicles could be utilized as probe vehicles. This could give a realistic indication of the travel times between segments on the County's arterials. Having this information on other public agency vehicles could also serve the same purpose.

Caltrain and SamTrans usage is expected to grow significantly over the next decade. With no expansion plans for Highway 101, Caltrain and SamTrans, with its ability to expand capacity, is part of the congestion relief strategy for the US 101 corridor. SamTrans is planning to move more buses along El Camino Real through the use of bus rapid transit service and implementation of transit signal priority at the signalized intersections on El Camino Real.

The use of traditional transit signal priority and adaptive transit signal priority could potentially be utilized as a cost savings measure. By having more efficient and effective schedules with transit signal priority, an agency may discover they could provide enough service to accommodate the demand on a particular corridor with fewer buses.

In evaluating the identified needs from the Transit Management perspective, the following are the ITS Opportunities identified to address these needs:

1. Implement Automated Vehicle Location (AVL) systems within all transit vehicles to provide real-time vehicle location information for fleet management, schedule tracking and traveler information uses.

2. Implement transit vehicle collision warning systems to improve vehicle safety.

3. Implement transit signal priority and adaptive transit signal priority along key transit corridors within the County to improve transit travel time reliability.

4. Install electronic information signs at transit transfer and major activity centers including Caltrain stations, BART stations, SFO, other intermodal facilities, regional shopping centers and event centers to provide real-time transit arrival, departure and transfer information.

5. Install electronic information signs at all transit stops to provide real-time transit arrival and departure information.

6. Install in-vehicle electronic signs on transit vehicles to provide real-time transit arrival and departure information.

7. Expand deployment of the Regional Fare Collection System, TransLink, within San Mateo County to provide patrons with improved convenience, especially when transferring between systems.

8. Implement center-to-center link between SamTrans and local TMCs for exchange of real-time information related to traffic conditions, transit vehicle probes, and signal priority requests.

9. Implement center-to-center link for the exchange of real-time information between all transit agencies operating in San Mateo County, including SamTrans, BART, CalTrain, AC Transit, SCVTA, and Muni to support coordination and traveler information uses.

10. Provide amenities such as access to the Internet on rail transit vehicles to enhance patron convenience.

6.4   *Goals and Priorities*

Consistent with the CTP, a primary goal of this Strategic Plan is to promote transit as a viable alternative to maintain or enhance mobility and help manage/reduce congestion. This Strategic Plan includes a number of ITS applications make transit as attractive, efficient and convenient as possible. In the short-term, the objective is to expand deployment of current ITS initiatives including those related to automated vehicle location systems, transit information, and electronic fare payment.

Of the ten ITS opportunities identified in this category, six were ranked as Medium/high or above by SamTrans. The high number of highly ranked opportunities reflects the fact that a number of these opportunities relate to initiatives that are already underway, or serve as critical building blocks to future applications.   The transit management ITS opportunities and the ranking assigned by SamTrans and the Working Group are summarized in **Table 6-1**.

Table 6-1 - TRANSIT MANAGEMENT OPPORTUNITY PRIORITIES

Table 3 - TRANSIT MANAGEMENT		NEEDS				RATING
#	OPPORTUNITIES	Enhance coordination among the different transit providers	Improve the safety of the transit vehicles and patrons	Improve transit travel times (faster and more reliable)	Enhance transit riders' experience and convenience	
TM1	Implement AVL systems on Caltrain rail vehicles	●				H
TM2	Implement transit vehicle collision warning systems		●			L
TM3	Explore applications for Transit Signal Priority (TSP) along key transit corridors			●		H
TM4	Install electronic information signs at transit transfer and major activity centers				●	H
TM5	Install electronic information signs at all transit stops				●	M/L
TM6	Install in-vehicle electronic signs on transit vehicles				●	H
TM7	Expand deployment of TransLink electronic fare system	●			●	H/M
TM8	Implement center-to-center link between SamTrans and local TMCs	●		●		L
TM9	Implement center-to-center link between all transit agencies operating in San Mateo County	●				M
TM10	Provide amenities such as access to the Internet on rail transit vehicles				●	H

6.5   High Priority Transit Management Project Concepts

Below are brief descriptions of the high priority transit management project concepts. The numbers shown next to the project concept descriptions below correspond to the numbers presented in **Table 6-1**. Expanded descriptions of the transit management opportunities ranked by the San Mateo County Working Group from High to Medium/High are provided in Technical Memorandum #4: Project Concept Descriptions and in Appendix E: Project Fact Sheets.

TM#1: Implement Automated Vehicle Location (AVL) systems on Caltrain rail vehicles, and allocate funding and resources for the O&M (high priority)

SamTrans has already equipped its bus fleet with AVL devices. However, CalTrain is only able to monitor the schedule status of trains at the endpoints. An AVL system would help in the monitoring of train status throughout the corridor, and support real-time fleet control and fleet schedule performance tracking such as on-time performance between stations.

The AVL system would also serve as the foundation for the various other transit management components system, including an automated passenger counting system (load factor, line segment utilization and ridership information), computer aided dispatch, fleet security, passenger information (arrival and departure information on the rail vehicle as well as at the station), and a radio network for communicating to each of these systems.

Elements of this project concept would include:

- Furnishing and installing radios and GPS receivers on all Caltrain rail vehicles;
- Installing AVL hardware and software in the SamTrans TMC as necessary; and
- Providing the funding and resources for on-going operations and maintenance.

TM #3: Explore applications for transit signal priority (TSP), design and implement along key transit corridors within the County, and allocate funding and resources for the O&M (high/medium priority).

The El Camino Real corridor yields the highest bus usage in the SamTrans system and is expected to grow over the next decade. SamTrans is planning express bus service along El Camino Real and a transit signal priority system for El Camino is critical for the delivery of the express service.

Possible hardware elements of this project include purchasing additional GPS receivers, mobile radios for buses, TSP emitters for buses, and TSP detectors at the traffic signal locations. There would also be the need for new computer and communications hardware and software to enable the adaptive signal priority along the key transit corridors within the County.

Elements that would be involved include:

- Working with stakeholders to define TSP requirements;
- Installing necessary hardware and software within the TMCs, the bus fleet and the traffic signal controllers;
- Developing and implementing new traffic signal timings for effective TSP operations; and
- Providing the funding and resources for on-going operations and maintenance.

TM #4: Install electronic information signs at transit transfer and major activity centers, and allocate funding and resources for the O&M (high priority)

A common concern for transit riders or potential riders is the uncertainty of the buses keeping on-schedule, or when the buses would be arriving if they are delayed. This is especially important if a rider is transferring to another bus route. This project concept would seek to address this concern by providing real-time transit information at key locations.

Possible elements of this project include:

- Developing appropriate interagency and public/private partnership agreements;
- Installing electronic information signs at transit transfer and major activity centers, such as Caltrain stations, BART stations, SFO, other intermodal facilities, regional shopping centers and event centers;
- Providing the necessary communications hardware, software and infrastructure to enable remote communications for predicted arrival time information to be sent from SamTrans TMC to the electronic information signs; and
- Providing the funding and resources for on-going operations and maintenance.

TM #6: Install in-vehicle electronic signs on transit vehicles and allocate funding and resources for the O&M (high priority)

The American Disability Act (ADA) requires voice announcements and visual display of the announcement on all transit vehicles for the hearing and visually impaired riders. According to SamTrans, electronic signs were installed on 317 fixed-route buses in 2002. There is a need for additional in-vehicle electronic signs to be installed on approximately 30 Caltrain rail vehicles. The electronic signs would display the same information as what is displayed on the buses, as well as interface with the advanced communication system to provide real-time information on the arrival time of the train at the next station.

Possible elements of this project include:

- Procurement and installation of the in-vehicle electronic signs on the full fleet of rail vehicles;
- Communications hardware and software installed on the rail vehicles to enable remote communications for traveler information to be sent from SamTrans TMC to the transit vehicle and displayed on the sign; and
- Providing the funding and resources for on-going operations and maintenance.

TM #7: Expand deployment of TransLink electronic fare system and allocate funding and resources for the O&M (high/medium priority)

According to MTC staff, funds for TransLink equipment and installation by the contractor onto SamTrans vehicles and at Caltrain stations are already included in the TransLink budget. However, budget is not available for additional staff for each transit agency to administer the TransLink system. This project would provide funding to transit agencies for additional staff resources for administering the TransLink system. In addition, funding is not available for installation of new buses and future stations.

Possible elements of this project include:

- Providing the funding to transit agencies within San Mateo County for additional staff resources to administer the TransLink system;
- Installing TransLink equipment on new buses and at future stations; and
- Providing the funding and resources for on-going operations and maintenance.

TM #10: Provide amenities such as access to the Internet on rail transit vehicles, and allocate funding and resources for the O&M of the ITS elements and communication network (high priority)

Mobile Wi-Fi has been identified as a high importance item by Caltrain staff for implementation on rail vehicles. Besides providing increased passenger convenience, the technology will support other systems including AVL for rail vehicles, real-time passenger counts, ticket validation, etc.

Possible elements of this project include:

- Developing appropriate business model; and
- Providing necessary communications hardware and software installed on the rail vehicles and at the major transit stops to allow Wi-Fi internet access.

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7   TRAVELER INFORMATION

Traveler information is a major component of ITS. Traveler information systems provide the user with information regarding one or more modes of transportation as well as weather conditions. Pre-trip (prior to departure) information may be used to plan the mode of travel and/or the best route. En-route (during the trip) information provided to the user include schedule information and real-time status of the transit system. This category is more of a regional one since MTC has control over the 511 system and disseminates traveler information relating to traffic in San Mateo County.

7.1   Existing Initiatives

There are a variety of ITS strategies and elements for disseminating traveler information either en-route or pre-trip. Methods used to disseminate information en-route include electronic message signs along roadways, commercial radio broadcasts, and HAR. Pre-trip information can be delivered by way of Internet, kiosk, radio, news media, or telephone based information systems. The ITS-based traveler information systems covering San Mateo County are summarized below. More detailed description of these systems is presented in Technical Memorandum #1: Inventory of Existing and Planned Systems.

7.1.1   En-Route Traveler Information Systems

As part of its Freeway TOS program, Caltrans has deployed a number of CMSs, EMSs, and HAR transmitters within San Mateo County. These devices provide information directly to motorists in their autos.

According to the TOS inventory map received from Caltrans, there are CMS located along US 101, mainly in the southern portion of the County, on SR 92 between US 101 and I-280, and one on SR 84 in the City of Menlo Park. According to Caltrans staff, 6 CMS's, have been proposed for the I-380/I-280 corridor in the north area of the County.

En-route information is also provided via a HAR system on channel 540AM. Within the County, there are several HAR transmitters in operation along US 101. There is also one near the interchange of I-280 and SR 92. To alert motorists to tune into the HAR system, a number of Extinguishable Message Signs (EMS's) have been installed in the County. According to the TOS map, there are several operational EMS's in the County along US 101 in the northern portion of the County, some at the I-280/SR 92 interchange, and one along SR 84 in the City of Menlo Park.

A map showing the location of these devices within the County is provided in Chapter 4 of this report.

7.1.2   511 (TravInfo)

511 is a toll-free phone and web service that provides information on traffic conditions, public transportation routes and fares, carpool and vanpool referrals, bicycling information and more. The 511 website features a map showing the travel speeds as well webcams to view live images of the traffic in the Bay Area.

At this time, roadway information is focused on the region's freeways, and includes construction notices, incident reports, and travel time estimates. For this information, 511 uses data derived from Caltrans TOS detectors and accident information from CHP's Computer Aided Dispatch (CAD) center. As a way to supplement Caltrans' data, traffic flow data is being collected from the FasTrak transponders. Toll tag readers have been installed along I-280 from the Golden Gate Bridge to Highway

84. Based on the data, travel speeds and driving times for specific route-based traffic information is available to the public.

Travelers within the entire nine-county Bay Area are able to access 511 from most landline and cellular phones. 511 is managed by a partnership of public agencies led by MTC, CHP, and Caltrans.

7.2   Needs

One of the key requirements for traveler information is that the information be accurate and timely. It is critical that travelers believe that the information provided to them is both accurate and timely. If travelers are not confident in the quality of the information provided, the trust needed to obtain the desired travel choice modifications (i.e. route, mode, etc.) will be difficult to achieve. Obtaining accurate and comprehensive traffic and transit information requires systems to monitor real-time conditions. Thus, regardless of the method used to disseminate traveler information, it is important to recognize that data gathering systems support traveler information systems. Systems such as traffic monitoring and CCTV cameras, as well as systems that synthesize the data into a form meaningful to the traveling public are required.

It is also important that the information be available at the location and time when travelers are making decisions about their route, mode, and time of departure. This may include pre-trip information available at home, at work or at major activity centers; and en-route information along major roadways in advance of decision points such as junctions and interchanges. En-route devices may also be valuable around major event centers and shopping centers to provide route guidance assistance by directing travelers to alternative routes as appropriate. Route guidance signs may also be installed within San Mateo County for popular destinations that are outside of the County (e.g. Stanford University, Monster Park).

While the foundation for a comprehensive traveler information, including en-route, phone and internet systems, is in place, further improvements are warranted. For example, the existing en-route devices are focused on US 101, with only limited coverage on I-280 and other highways. Additionally, a number of the existing devices are currently non-operational. Similar comments can be made regarding the data collection systems that feed into traveler information. In both cases, the coverage on non-freeway facilities is lacking.

In summary, the traveler information deficiencies and needs include:

- Enhance traffic and transit monitoring capabilities;
- Enhance pre-trip traveler information system to include additional roadways and services, and information regarding adverse roadway conditions and roadway closures;
- Enhance en-route traveler information along freeways and major roads, and around major activity centers;
- Enhance inter-agency sharing of both freeway and arterial information such as video images, congestion levels, travel speeds, delays and travel times; and
- Enhance the effectiveness and public awareness of existing and future traveler information systems.

7.3   Opportunities

Traveler Information is a key component of the San Mateo County ITS Program. It is the primary method from which general public receives direct benefit from the effort (as well as being the most visible element). This component provides a clear benefit to the traveling public by keeping them

informed on transportation conditions and enabling them to make more informed decisions on mode of travel.

An ideal Traveler Information System is one where all of the transportation agencies, local, regional and state, exchange information in real-time with each other, the media, and the public. Incident information would be gathered from the emergency service providers and disseminated through a variety of channels including via telephone systems, the Internet, and electronic message signs. Transit agencies would be able to provide predicted arrival and departure times for all routes at every stop, and transit patrons would be able to get the information they want when and where they need it.

A key requirement for a traveler information systems is that the information be accurate and in real, or near real-time. If travelers are not confident in the quality and timeliness of the information provided, they will not trust the information. Another key factor to the success of a traveler information system is that the information be easily accessible, available at convenient locations, and provided at effective decision points. For example, if a CMS is placed far enough in advance of a decision point before an incident, motorists can divert to other routes thus reducing congestion and driver frustration. Another example is having traffic congestion information easily accessible using personal digital assistants (PDA) or via a phone call (e.g., 511).

The Internet has created an environment for distribution of customized information from a single distribution point to multiple users with customizable interfaces and access to different "pages" of information. Such delivery was not possible with pieces of transportation information such as a traffic report on the radio or a color-coded system map on cable television. As the Internet has become more integrated with daily life, the role of accurate real-time transportation information will be more important.

The increased availability of real-time, anywhere traveler information is predicated by the growth of wireless communication devices that are connected to the Internet. This trend and direction towards more powerful handheld devices with larger bandwidth connections to the communications system (Internet) is not likely to cease any time soon and will facilitate more sophisticated traveler information applications such as travel times and route planning. Eventually, the concept of wireless access to the Internet from anywhere within a transportation or transit hub will become a reality.

A relatively simple way of providing traveler information may simply be to publish, via a website, traffic congestion information at intersections and links throughout the County. This would serve to support decisions on departure time and route planning for travelers.

Providing accurate, real-time traveler information helps all modes of travel. It keeps drivers informed thus reducing driver frustration, reducing excess congestion/circulation of vehicles near major facilities, and reducing the impact of freeway incidents on local roadways. By engaging the different traffic and transit agencies within an overall traveler information system, it facilitates and supports cooperation between these agencies that traditionally has been non-existent.

In evaluating the identified needs from the Traveler Information perspective, the following are the ITS Opportunities identified to address these needs:

1. Implement CMS's at key locations along the I-280, I-380 and US 101 freeways to inform motorists of congestion and viable alternative routes.

2. Implement CMS's at key locations along Highways 92, 84, 35 and 1 to inform motorists of congestion and viable alternative routes.

3. Implement CMS's at key locations along major arterials throughout the County to inform motorists of congestion and viable alternative routes. Specific areas identified include Bayshore Boulevard in Brisbane, Hillsdale Boulevard in Colma and South San Francisco, Geneva Avenue in Daly City and El Camino Real throughout the County.

4. Expand the Highway Advisory Radio system within San Mateo County.

5. Implement traveler Information kiosks within the SFO baggage claim area.

6. Install electronic information signs at major centers including, but not limited to, Caltrain stations, BART stations, SFO, other intermodal facilities, regional shopping centers and event centers to provide real-time transit arrival, departure and transfer information.

7. Install electronic information signs at railroad at-grade crossing to provide information regarding the railroad preemption events

8. Provide traveler information to the media for real-time dissemination.

9. Publish traveler information on local agency websites including, but not limited to, traffic congestion, parking, video images, and links to other transportation agency websites.

10. Implement a link between local traffic monitoring systems and the 511 System.

11. Provide a link between local TMCs and the CHP CAD system for real-time incident information.

12. Publicize and provide education to the public regarding traveler information systems, including 511, websites, CMSs, etc.

The relationship between the traveler information needs and ITS opportunities is provided in **Table 7-1**.

Table 7-1 - TRAVELER INFORMATION OPPORTUNITY PRIORITIES

#	OPPORTUNITIES	Enhance traffic and transit monitoring capabilities*	Enhance pre-trip traveler information services	Enhance en-route traveler information	Enhance inter-agency sharing of both freeway and arterial information	Enhance the effectiveness and public awareness of traveler information systems	RATING
TI1	**Implement CMS's at key locations along the I-280, I-380 and US 101 freeways**			●			**H**
TI2	**Implement CMS's at key locations along Highways 92, 84, 35 and 1**			●			**H/M**
TI3	Implement CMS's at key locations along major arterials throughout the County			●			L
TI4	Expand the Highway Advisory Radio system within San Mateo County			●			L
TI5	Implement traveler Information kiosks within the SFO baggage claim area		●				L
TI6	Install electronic information signs at major activity centers		●	●			M
TI7	Install electronic information signs at railroad at-grade crossings			●			L
TI8	**Provide traveler information to the media for real-time dissemination**	●		●			**H**
TI9	Publish traveler information on local agency websites		●				L/M
TI19	Implement a link between local traffic monitoring systems and the 511 System		●	●	●		M/L
TI11	Provide a link between local TMCs and the CHP CAD system for real-time incident information				●		L
TI12	Publicize and provide education to the public regarding traveler information systems					●	L

Note: * - Opportunities for addressing this need are included in other categories including Freeway/Highway Management, Arterial Management, and Transit Management.

7.4   Goals and Priorities

One way to help increase the efficient use of the County's transportation system is to ensure that travelers have the information they need about travel options to make informed decisions. Within this Strategic Plan, great emphasis is placed on systems that collect and disseminate traveler information. In the short-term, this Plan focuses on the deployment of en-route traveler information devices (CMSs, HAR) along key routes, and the enhancement of existing regional systems such as 511. At the same time, the development of separate local information systems is de-emphasized.

Of the twelve ITS opportunities related to traveler information, three were identified by the Working Group as high/medium or high priority. In reviewing these opportunities, the Working Group felt that the regional "511" system operated through MTC should be the focal point for phone- and internet-based traveler information service, and that this should not be duplicated within San Mateo County. Furthermore, it was recognized that through 511 and the regional TMC, procedures have been developed to support the dissemination to the media of travel information related to major events and conditions on regional roadways. Thus, the Working Group felt that within San Mateo County priority should be placed on enhancing en-route information dissemination along major roadways through the deployment of additional CMSs, and greater effort may be needed to ensure that information about conditions on local roadways is conveyed to the media for further dissemination to the traveling public.

The traveler information ITS opportunities identified for San Mateo County and the ranking assigned by the Working Group are summarized in **Table 7-1**.

7.5   High Priority Traveler Information Project Concepts

Project concept descriptions for the high priority traveler information opportunities are presented below. These descriptions build on the brief opportunity statements listed in Table 7-1. The numbers shown next to the project concept descriptions below correspond to the numbers presented in Table 7-1. Expanded descriptions of these project concepts are provided in Technical Memorandum #4: Project Concept Descriptions and in Appendix E: Project Fact Sheets.

TI #1: Implement CMS's at key locations along I-280, I-380 and US 101 freeways, and allocate funding and resources for the O&M (high priority).

Caltrans currently has 11 CMS's in operation within the County. Most of these CMS's are installed along US 101 and I-380. At this writing, additional CMS's were not planned for the County. Additional CMS's may be installed along I-280 near the I-380 interchange, Serramonte Shopping Center, and at Sand Hill Road. Along US 101, additional CMS's may be installed near the San Francisco International Airport, Highway 92, and Highway 84. These CMSs would be designed to be controlled from Caltrans' TMC through a communications link between the CMS and the TMC.

Elements that would be involved include:

- Working with stakeholders to determine the key locations along the freeways within the County;
- Designing and installing CMS's at selected locations;
- Providing necessary communications hardware, software and infrastructure to enable Caltrans TMC control of CMS's;
- Upgrading TMC facilities as required; and
- Providing the funding and resources for on-going operations and maintenance.

TI #8: Provide traveler information to the media for real-time dissemination (high priority).

Traveler information in the Bay Area is available through the regional traveler information system, 511 (www.511.org). The 511 system attempts to provide up-to-the-minute information on traffic conditions, incidents and travel time information; however, the information reported primarily covers the freeways.

This project would provide roadway incident and transit information to the media that is focused on local conditions within the County. It will utilize existing systems such as 511 to disseminate traveler information. In the future, MTC is also interested in exploring the feasibility of providing information from real-time AVL and vehicle arrival systems onto the 511 website.

Some of the elements that would be involved include:

- Defining how local agencies will be able to transmit real-time travel conditions (e.g. Via 511, directly to the media, both); and
- Establishing necessary communications systems or protocols, data formats, maintenance considerations.

TI #2: Implement CMS's at key locations along Highways 92, 84, 82, 35 and 1, and allocate funding and resources for the O&M (high/medium priority).

Caltrans has four CMS's installed along Highway 92 and two CMS's installed along Highway 82. The additional CMS's would need to be placed at strategic locations in advance of decision points to allow drivers enough warning time to potentially modify their routes, if possible. Candidate locations for CMS installation include:

- Westbound Highway 92 approaching Highway 1;
- Eastbound Highway 82 approaching US 101;
- Northbound and southbound Highway 82 approaching Hillsdale Shopping Center, and;
- Southbound Highway 35 approaching Highway 1.

Some of the elements that would be involved include:

- Working with stakeholders to determine the key locations along the freeways within the County;
- Designing and installing CMS's at selected locations;
- Providing necessary communications hardware, software and infrastructure to enable Caltrans TMC control of CMS's;
- Upgrading TMC facilities as required; and
- Providing the funding and resources for on-going operations and maintenance.

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8 PARKING MANAGEMENT

Parking management includes a variety of strategies that encourage more efficient use of existing parking facilities. It may include a parking guidance system to help inform and guide motorists to available parking facilities which helps reduce excess circulation of vehicles looking for available parking. It may also include electronic payment systems at parking facilities.

8.1 Existing Initiatives

At present, there are no ITS parking management systems within San Mateo County.

8.2 Needs

A parking guidance system can inform and guide motorists unfamiliar with the street system to available parking facilities which helps reduce excess circulation of vehicles looking for available parking. Parking guidance systems are especially helpful to visitors during special events and during the holiday season, e.g. shopping. Parking management also includes parking payment without the use of cash at parking facilities.

Parking management is most appropriate for major activity and event centers. For example, the City of Redwood City is redeveloping their downtown area, which includes a new theater. The theater will be built next to City Hall and will attract people from neighboring cities. The City would like to provide information to motorists to guide them to the garages in the area.

Visitors attending events at major attraction centers such as the County Expo Center, Bay Meadow, and the Cow Palace often look for on-street parking in the surrounding residential areas. A parking guidance system at these event centers would reduce the number of visitors circulating among the neighborhoods and competing against the residents for parking spaces. Furthermore, at shopping centers such as Tanforan Mall, Serramonte and Hillsdale, a parking guidance system would direct motorists to areas of the parking lot with available parking spaces, rather than having the shopper circulate up and down the parking isles looking for a parking space. The parking guidance system is especially effective during the holiday season when the demand for parking often exceeds the parking supply.

In summary, parking management deficiencies and needs include:

- Improve parking management in larger downtown areas of the County, around special event centers, and at major shopping centers.

8.3 Opportunities

An ideal Parking Management System is where all lots and garages within an area are linked together sharing accurate space availability in real-time and displaying this information on changeable message signs. The message signs would have route guidance information telling motorists seeking parking which lots or garages are full and which have available spaces and how many. The garages and lots would have sensors for every stall to monitor the presence of parked vehicles and the ticket gates would provide estimates on those vehicles that are circulating within a lot or garage looking for a space to park. This information could also be sent to information service providers to facilitate route planning for people intending to park in an area before they enter that area.   Furthermore, a common electronic payment system would be in place to help reduce delays and inconvenience associated with the payment of parking fees.

The implementation and operation of a parking management system is mainly applicable to localized areas throughout the County. It is not envisioned that a Countywide Parking Management System would be considered for implementation, since there are few areas that have the specific need for such a system. Therefore, the study and evaluation of such a system is considered more of a local city process. The specific information that is generated by such a system can be exchanged with other systems for real-time information exchange.   Because it is considered more of a localized implementation, each local agency must first evaluate the feasibility of providing such services, prior to considering it a viable implementation.

ITS opportunities that may address the identified Parking Management needs include:

- Prepare a Parking Management System Study for various locations throughout the County such as downtown areas and major activity centers.

- Implement a real-time Parking Information and Guidance System at various locations throughout the County.

- Implement an electronic fee payment system utilizing FasTrak technology.

8.4 Goals and Priorities

Through this strategic planning process the view was taken that parking management was largely a local issue rather than countywide, and that individual local agencies would control what action is taken within their city relating to this effort. As such parking management was de-emphasized within this Countywide Strategic Plan. However, it is recognized that local ITS initiatives related to this element may be appropriate and should be supported.

Reflective of this view, the parking management ITS opportunities were assigned a low priority ranking. The parking management ITS opportunities and associated priority rankings are presented in **Table 8-1**.

Table 8-1 - PARKING MANAGEMENT OPPORTUNITY PRIORITIES

PM#	OPPORTUNITIES	NEEDS Improve parking management in larger downtown areas, around special event centers, and at major shopping centers	RATING
1	Prepare a Parking Management System Study for various locations	●	L
2	Implement a real-time Parking Information and Guidance System	●	L
3	Implement an electronic fee payment system utilizing FasTrak technology.	●	L

9   INCIDENT MANAGEMENT

Incident management is a coordinated or planned approach for responding to incidents that occur on either the freeway or arterials. Incident Management Systems help system operators identify and react to emergencies or incidents. Data received from traffic monitoring and CCTV stations are used to detect the occurrence of incidents.

This category may be broken into regional and local components. From a regional perspective, MTC oversees several emergency/incident management systems in the Bay Area. The Bay Area Call Box Program is a joint project of Caltrans, CHP, and MTC SAFE and the Freeway Service Patrol Program complements the Call Box Program.   From a local standpoint, incident management systems involve coordination between local police, fire, and emergency medical dispatch services. Because several freeway Incident Management systems are already in place, the focus of this category within this Strategic Plan is on the local emergency and incident management systems.

9.1   Existing Initiatives

There are several existing Incident Management ITS initiatives occurring in San Mateo County. These include the Freeway Service Patrol/Call Box system and the Freeway Concept of Operations as well as several local initiatives such as installation of emergency vehicle preemption, and operation of emergency management centers. Additional information about these initiatives is provided in Technical Memorandum #1: Inventory of Existing and Planned Systems.

9.1.1   Freeway Service Patrol/Call Box System

MTC oversees several incident management systems in the Bay Area. The Bay Area Call Box Program, a joint project of Caltrans, CHP, and MTC SAFE, provides motorists the ability to report a road hazard, a flat tire, or a mechanical breakdown. Approximately 3,400 call boxes are installed on over 1,100 miles of urban, suburban, and rural highways in the nine counties. Solar panels are used to recharge the wireless cellular telephone in each call box.

The Freeway Service Patrol (FSP) program complements the call box program by helping disabled vehicles and clearing freeway lanes. Each of the 74-truck fleet is equipped with AVL components. The AVL system provides information on the truck's exact location, direction, and speed. Knowing the location of the trucks ensures that the nearest available truck is dispatched.

9.1.2   Freeway Concept of Operations

MTC is leading the efforts for the Freeway of Concept of Operations. The purpose of the project is to help improve the Freeway Operations policies, procedures and practices, and build consensus on the roles, responsibilities and resource needs for Freeway Operations. The Concept of Operations focuses on the activities that support the operations and management components of the Freeway Management Program.   The objectives are aimed at establishing policies and improving procedures across jurisdictions, developing strategies and specific action items to support continued operations and best practices for freeway operations. The overall Concept was grouped into the following four categories:

- Planning
- Freeway Operations Infrastructure
- Operational Policies and Procedures
- Organization, Staffing and Funding

Several key initiatives were developed as part of the Concept of Operations, and one in particular was most relevant to San Mateo County, namely to Develop a Common Radio Frequency for Emergency Operators. San Mateo County was selected as a demonstration test bed for this initiative primarily due to the close interaction between the CHP and local authorities when dealing with incidents and emergencies.

9.1.3 Local initiatives

Local agencies within San Mateo County have undertaken or are pursuing a number of ITS-related activities, including emergency vehicle pre-emption systems and an emergency management center. These local initiatives are briefly described below.

- **Emergency vehicle pre-emption** – Several jurisdictions have deployed emergency vehicle pre-emption systems. These systems include a transmitter on the emergency vehicles, a receiver at the traffic signal controller, and an operating program that processes the pre-emption request and adjusts the traffic signal operation accordingly. Most of the cities that have installed emergency vehicle preemption systems are using the Opticom™ system manufactured by 3M. An emergency vehicle preemption (EVP) system allows a traffic signal to respond to emergency vehicles approaching the signalized intersection. By providing the emergency vehicle with a green signal, the system increases safety and reduces emergency response times.

- **Emergency Management Center** – The San Mateo County Public Safety Communications Center provides dispatching services for fire, Emergency Medical Dispatch (EMS), and law enforcement in the County. The dispatch center is located in Redwood City. The dispatch center has a state-of-the art CAD System and operates on 900MHz. The County has also created an Office of Emergency Services (OES) within the County Sheriffs Department. While the OES has not directly constructed any physical infrastructure, it does serve as a focal point for inter-agency coordination during major emergencies.

9.2   Needs

In addition to transportation agencies, incident management involves a variety of other entities including law enforcement, fire, and emergency medical services.   Incident management requires close coordination between these entities, both between dispatch centers and in the field.   Incident management is of special importance in the Bay Area given the significant risk of earthquakes and heightened attention towards terrorist attacks and energy availability.

Currently, none of the agencies within the County have the ability to automatically share information with each other, or with Caltrans. Improved inter-agency communications between the local agencies, Caltrans and the CHP will help facilitate a timely response plan for freeway incidents. However, in order to efficiently respond to arterial incidents, local agencies will need the ability to detect and verify incidents from a remote location. If dispatch centers had the ability to access CCTV cameras, they would be able to verify the incident and dispatch the appropriate response more efficiently.

Information sharing is also critical for disaster preparedness, and can assist Emergency Operation Centers (EOC's) during a catastrophic event. According to interviews with the County Office of Emergency Services (OES) staff, there is a need for their department to receive traffic information such as CCTV camera video feeds from the cities in the County and Caltrans' TMC, especially when their EOC is in operation. Expanding the transportation information sharing to EOC's assists operators to make more informed decisions during major emergencies that may affect the transportation network of the region.

It should be noted that establishing protocols for information sharing and responding to incidents will also be critical.   Local agencies will need to work together to develop incident management plans/programs to implement when incidents occur.

A challenge of incident management is the ability to quickly identify and verify incidents. Incident management can also be enhanced through the rapid detection and verification of incidents. Data received from traffic monitoring and CCTV cameras can help system operators detect the occurrence of incidents. Information collected from an agency can be shared with all affected agencies and providers and an appropriate response can be deployed. Better coordination between the agencies can help improve incident response and reduce the impacts of incidents on the freeways and roadways.

Another element of incident management is the ability of response vehicles to quickly arrive at the scene of the incident. An emergency vehicle preemption (EVP) system would allow a traffic signal to respond to emergency vehicles approaching the signalized intersection. By providing the emergency vehicle with a green signal, the system increases safety and reduces emergency response times. There are several agencies within the County that have EVP at key locations within their jurisdiction. Future EVP systems installed in other agencies within the County need to be consistent and compatible with the existing EVP system so that the traffic signals are pre-empted for the various emergency providers as they travel through each jurisdiction.

Incident management can also be extended to include special events that create unique and irregular travel patterns and traffic conditions. While not always recurring, this problem differs from non-recurring congestion in that the impacts are foreseeable and advance planning can occur. An example of special event traffic in San Mateo County include shopping at Hillsdale Shopping Center and Serramonte Shopping Center during the holiday season, shows at Cow Palace, and bike races in Redwood City. When there are shows at the Cow Palace, police officers are out at the intersections

manually controlling the signals. As a result, there is not any traffic signal coordination between the signals.

Some of the deficiencies and needs for incident management include:

- Improve inter-agency communications at incident scenes between local agencies, Caltrans, CHP, and other emergency service providers;
- Enhance the ability of transportation agencies and emergency service agencies to exchange information;
- Enhance ability to detect, verify and manage incidents along freeways, highways and major arterials;
- Improve emergency vehicle response time; and
- Establish well defined alternative routes to minimize the impact of incidents on the roadway.

9.3 Opportunities

Having a coordinated approach to responding to incidents and emergencies that impact the transportation network of the County will be critical to ensure the effective and efficient movement of people and goods. It involves all different types of agencies exchanging information and performing specific roles to properly respond to, and clear incidents and emergencies and reduce congestion and driver frustration.

An ideal Incident Management System consists of all representative agencies and emergency service providers exchanging valuable information on traffic congestion, incidents and emergencies in real-time. Proper procedures have been developed for notifying agencies of detected incidents, responding to incidents and clearing of incidents. All involved agencies are in constant communications with each other utilizing equipment that is interoperable. Traffic engineers are able to manipulate traffic signal timings and changeable message signs, and transit agencies able to re-route transit vehicles in response to an incident. Emergency service vehicles are provided with vehicle preemption at traffic signals, or are able to use alternate route to get to an incident in the event the primary route to the scene is severely congested.

Once an incident has been detected and verified, a set of procedures and protocols are necessary to be in place to carry out the appropriate response to the incident. The collection and dissemination of real-time information between agencies is very critical for this system to be effective, and improved coordination between the agencies will improve incident response and reduce the impacts of incidents on the freeways and roadways.

The primary element that drives improvement of incident management and response is the availability of real-time information about the location and characteristics of the incident (e.g. injury accident, public disturbance, fire, stalled vehicle, etc.). This real-time information may be obtained from monitoring cameras, on-street detection systems, motorists, and field personnel. CCTV cameras are a primary tool for the management of incident scenes.

The traffic signal systems within a jurisdiction may also be a valuable resource during emergency situations. As such, the traffic signal systems should be incorporated into the existing hierarchy for incident management, including leveraging any existing and future communications infrastructure for the San Mateo County ITS Program for emergency services use (e.g. possibly providing emergency services access to ITS network resources in the field). Another possibility is a link with the County's

wireless communications network for links between systems. Improving the capability of the local agencies to identify, respond, and manage on-street incidents is a central element that drives continued development (i.e. attraction of continued funding) of transportation management systems.

Transportation management software is becoming more capable to collect, process, and integrate this real-time incident information with the transportation management functionalities. This is important for the development of new "on-the-fly" transportation management and incident plans, as well as publishing the incident location and conditions to other local agencies, intranets, and the Internet. As more and more real-time information becomes available through increased implementation of detection and communications systems, incident, event, and emergency management systems will increase the sharing of this information for coordinated response.

A major opportunity that is being pursued more aggressively since September 11, 2001 is that different agencies are coordinating more in the areas of regional emergency management. The trend and direction for emergency response plans is to coordinate with all of the involved departments within an agency, e.g., Police, Fire, Highway Patrol, Public Works, and ambulance services. It is typical that these departments have access to the real-time information provided by an ITS network which enables the different departments to establish a coordinated plan based on this information. Such trends and directions should continue to the point where partner agencies with the appropriate security clearance can coordinate transportation activities from anywhere at anytime using equipment such as laptops or handheld devices.

Another element of incident management is the ability of response vehicles to quickly arrive at the scene of the incident. An emergency vehicle preemption (EVP) system would allow a traffic signal to respond to emergency vehicles approaching the signalized intersection. By providing the emergency vehicle with a green signal, the system increases safety and reduces emergency response times.

The dissemination of incident information to travelers can also aid incident management activities. If travelers are informed about incidents they can alter their travel plans thereby potentially reducing congestion and delay impacts. Awareness of incidents can also improve safety by reducing the potential for secondary accidents. For pre-trip situations, 511 (TravInfo) attempts to provide up-to-the-minute information on traffic conditions and incidents. En-route incident information can be provided through CMSs, EMSs, and HAR. These systems, however, require accurate and timely data regarding in-field conditions. For en-route information, a key is also providing devices at locations where drivers can safely and efficiently alter their route.

In evaluating the identified needs from the Incident Management System perspective, the following are the ITS Opportunities identified to address these needs:

1. Develop and implement incident management plans, procedures and protocols between emergency service providers and local traffic engineering personnel and systems to facilitate for information sharing and response.

2. Install CCTV cameras at key locations throughout the County for incident verification.

3. Implement Incident Management Support software to support efficient incident response.

4. Implement center-to-center links between transportation agencies and emergency service agencies, including the Countywide 911 dispatch center and the Office of Emergency Services to support information sharing and communication.

5. Implement Automated Vehicle Location (AVL) systems for all maintenance and emergency vehicles to support fleet management and dispatching activities.

6. Develop countywide standard for deployment of emergency vehicle pre-emption within county to ensure compatibility between systems. Implement emergency vehicle pre-emption on major routes to improve emergency vehicle response times.

7. Coordinate Incident Management Plans with adjacent counties for seamless implementation across County boundaries.

9.4 Goals and Priorities

For this element, the primary focus within this context of the Strategic Plan effort is how technology can be used to enhance incident management through procedures and inter-agency coordination and cooperation. In turn, these applications can help support freeway and transit management activities by improving traveler safety and reducing congestion related to incidents. The near-term emphasis within Incident Management is on developing and implementing incident management plans, procedures and protocols, and on standardizing emergency vehicle pre-emption equipment and implementing on major routes.

Out of the seven opportunities carried forward, four of these were assigned a medium/high priority or above. These higher priority opportunities included two related to the development of the necessary inter-agency plans, procedures and protocols for responding to major incidents within the transportation system. While these opportunities focus primarily on institutional issues, they may also set the foundation for potential technology applications. The other two higher ranked opportunities do involve technology applications related to emergency vehicle signal pre-emption and CCTV camera deployment. The incident management ITS opportunities and associated priority rankings are summarized in **Table 9-1**.

Table 9-1 - INCIDENT MANAGEMENT OPPORTUNITY PRIORITIES

#	OPPORTUNITIES	NEEDS				RATING
		Improve inter-agency communications at incident scenes	Enhance the ability of transportation agencies and emergency service agencies to exchange information	Enhance ability to detect, verify and manage incidents along major roads	Improve emergency vehicle response time	
EM1	Develop and implement Countywide Incident Management Plans	●	●			H
EM2	Install CCTV cameras at key locations throughout the County			●		M/H
EM3	Implement Incident Management Support software to support efficient incident response				●	M
EM4	Implement center-to-center links between transportation agencies and emergency service agencies		●			M
EM5	Implement Automated Vehicle Location (AVL) systems on all maintenance and emergency vehicles				●	M
EM6	Standardize Emergency Vehicle Pre-emption (EVP) equipment countywide and implement on major routes				●	H
EM7	Coordinate Incident Management Plans with adjacent counties	●	●			H

9.5 High Priority Incident Management Project Concepts

Below are brief descriptions of the high priority Incident Management project concepts. The numbers shown next to the project concept descriptions below correspond to the numbers presented in Table 9-1. Expanded descriptions of the incident management opportunities ranked by the San Mateo County Working Group from High to Medium/High are provided in Technical Memorandum #4: Project Concept Descriptions and in Appendix E: Project Fact Sheets.

IM #1: Develop and implement Countywide incident management plans (high priority).

The project would involve the development of an overall plan for the detection, notification, verification, communication/dispatch, response and clearance of incidents within the County. The Plan would identify the proper lines of communication and chain of command for all first responders and support personnel when an incident or emergency situation is detected. Because considerable work has already been done to develop and implement freeway Incident Management plans, the focus of this project would be on local incident management systems and coordination with freeway incident management.

Elements that would be involved include:

- Identifying key agencies;
- Reviewing current plans, procedures and protocols;
- Developing and documenting recommended plans, procedures and protocols;
- Providing necessary interagency agreements;
- Providing necessary equipment to implement plan responses;
- Providing a reliable communications system during an emergency, including a backup system; and
- Establish and coordinate well defined alternative routes to minimize the impact of incidents on the roadway.

IM #6: Standardize emergency vehicle pre-emption equipment countywide, implement on major routes, and allocate funding and resources for the O&M (high priority).

Since the County's 911 dispatch service coordinates the various fire, law enforcement and emergency medical services, the fire departments or districts within the County essentially function as one department. Consequently, it is important that the emergency vehicle preemption equipment installed throughout the County is compatible and interoperable. Preemption equipment from different manufacturers would not be compatible, especially if an encoding scheme is utilized. Most of the cities that have installed emergency vehicle preemption systems are using the Opticom™ system manufactured by 3M. However, the County does not have any existing standards or specifications for the installation and operation of preemption equipment.

Some of the elements that would be involved include:

- Reviewing existing systems and deployment coverage;
- Identifying incompatibilities and gaps;
- Establishing standards for future procurements and deployments;
- Installing necessary equipment on vehicles and at intersections; and
- Developing necessary interagency agreements

IM #7: Coordinate Incident Management plans with adjacent counties (high priority).

As part of IM #1, an incident management plan for the County will be developed. This project would expand the Incident Plan to include the coordination with the adjacent counties (e.g., San Francisco and Santa Clara County).

Some of the elements that would be involved include:

- Identifying stakeholders;
- Reviewing plans and systems
    - Identify incompatibilities
    - Develop recommended plans
    - Establish protocols;
- Developing necessary interagency agreements; and
- Providing necessary equipment to implement plan responses.

IM #2: Install CCTV cameras at key locations throughout the County and allocate funding and resources for the O&M (medium/high priority).

Recognizing that Caltrans has existing programs for the deployment of CCTV cameras on the region's freeways, this project concept focuses on deployment of these devices at key arterial locations throughout the County. The project would entail working with the stakeholders to determine the key locations for installing the CCTV cameras. The locations chosen for the CCTV cameras would augment the locations chosen from AM#2. The communications infrastructure and central monitoring facility requirements would also be identified and included as part of the design of the CCTV system.

Some of the elements that would be involved include:

- Determining camera locations and central monitoring requirements (e.g. major intersections and high accident locations;
- Designing and installing CCTV system(s);
- Implementing central monitoring facilities (e.g. workstations, monitors, software);
- Providing communications infrastructure; and
- Providing funding and resources for on-going operations and maintenance

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10 SUPPORTING ELEMENTS

This category, although not officially included in the National ITS Architecture, is included here to emphasize the elements that are needed to support the ITS technologies but may not fall into any of the systems identified above.   Supporting elements include the communications network, ITS standards, operating procedures and protocols, and data archiving.   This category is mainly a local one since the local agencies have a strong voice on what initiative impacts their jurisdiction.

10.1   Existing Initiatives

There are a number of existing Supporting Element ITS activities being undertaken on a regional basis such as communication networks, the Regional ITS Architecture, the Interim Center-to-Center System and data archiving systems. More detail of each initiative is discussed in previous chapters and also provided in Appendix A: Technical Memorandum #1: Inventory of Existing and Planned Systems.

10.1.1 Communication Networks

A primary component of many ITS applications is the ability to control and communicate with field devices from a central location. A variety of communications media can be used to provide these links. Landline options include traditional twisted pair copper wiring, telephone lines, and fiber optic cable.   Wireless options include radio, cellular phone, and satellite systems.   Caltrans communications network consists of a mixture of the media.

As noted in the Arterial Management System section, the various local agencies use different communications media. The most common media is the twisted-pair copper. The transportation-related wireline networks deployed by the various jurisdictions within San Mateo County are illustrated in **Figure 5-1 (a-d)**.   As shown in this figure, no comprehensive interjurisdictional network has been deployed.

However, a number of the jurisdictions within the County have entered into franchise agreements for local cable providers to lease fibers within the networks installed by the companies. There are two cable television companies servicing cities in the County (RCN and Comcast). RCN built out a majority of the County a couple of years ago, including unincorporated areas of the County, the cities of Daly City, Burlingame, San Mateo, Belmont, San Carlos, Redwood City, and some parts of South San Francisco. At that time, RCN had franchise agreements with these cities. Subsequently the company filed for bankruptcy, but renegotiated the agreements with the jurisdictions. The cities and San Mateo County negotiated an agreement with RCN to lease 4 dark fiber strands for $1 per year for 25 years. The fiber optic cable trunkline runs along El Camino between Redwood City and Daly City.

In the south end of the County, the Palo Alto JPA , which also included Atherton, Menlo Park, East Palo Alto and unincorporated areas of San Mateo County, have a franchise agreement with Comcast to build INET, which interconnects various government facilities via fiber in these jurisdictions. SAMCAT, the Peninsula JPA, has also been negotiating with Comcast and other wireless companies wanting franchise agreements with the cities.

The County has also deployed a microwave system that is shared with SamTrans. There are four transmitter sites within San Mateo County. The County has a microwave ring network (self-healing) they use to get to the transmitters. Between the towers and Redwood City, they use a T-1 line (483-

486 MHz t-based). There is a microwave link between the north base and San Carlos. Although the microwave network is reliable, the land line is used for redundancy.

Caltrans has proposed extensive improvements to the TOS equipment systems in San Mateo County. In addition to additional equipment proposed for the I-380/I-280 corridor in the north county, 18 miles of fiber optic communication cable have been proposed for the corridor.

10.1.2 Regional ITS Architecture

The San Francisco Bay Area Regional ITS Architecture & Strategic Plan was recently completed under the sponsorship of MTC. It is a roadmap for transportation systems integration in the Bay Area over the next 10 years. The Plan provides methods to make the most out of technological advances by defining a strategy for deployment and a framework, or architecture, for linking the region's transportation systems. The development of the Regional ITS Architecture ensures that the Bay Area meets the FHWA Final Rule on National ITS Architecture conformity[1].

The architecture was developed through a cooperative effort by the region's transportation agencies, and focuses on the regional transportation system within the San Francisco Bay Area. It represents a shared vision of how the transportation systems will work together in the future, sharing information and resources to provide a safer, more efficient, and more effective transportation system for travelers in the region.

The regional architecture is an important tool to be used by:

- MTC to better reflect integration opportunities and operational needs into the transportation planning process;
- Operating Agencies to recognize and plan for transportation integration opportunities in the region; and
- Other organizations and individuals that use the transportation system in the San Francisco Bay Area.

The architecture provides an overarching framework that spans all of these organizations and individual transportation projects. Using the architecture, each transportation project can be viewed as an element of the overall transportation system, providing visibility into the relationship between individual transportation projects and ways to cost-effectively build an integrated transportation system over time.

The Regional ITS Architecture has a time horizon with a particular focus on those systems and interfaces that are likely to be implemented in the next ten years. The architecture covers the broad spectrum of ITS, including Traffic Management, Transit Management, Traveler Information, Commercial Vehicle Operations, and Emergency Management over this time horizon.

The Regional ITS architecture project was conducted in two phases. In Phase I, an extensive ITS inventory was conducted during the period from October 2001 through June 2002. Phase 2 focused on identifying a strategy for integrating existing ITS projects and deploying new ITS projects and developing an architecture that will describe the technical details of systems integration. Phase 2 was completed in June 2004.

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[1] USDOT ITS Architecture, Final Rule (Federal Register, 23 CFR Part 940, January 8, 2001) requires ITS projects funded through the Highway Trust Fund to conform to the National ITS Architecture and applicable standards.

For San Mateo County, the Regional ITS Architecture defines how regional systems may be integrated with one another, and provides guidance on how local systems may also be linked to the regional network. In turn, the San Mateo County ITS Strategic Plan will help further define the relationship between regional and local systems, and help ensure the necessary integration of local systems within the county.

10.1.3 Interim Center-to-Center System

This project will enable the Regional Smart Corridors, 511 and Caltrans to exchange valuable data and share video feeds. It entails the development of a common communications protocol that will link the Smart Corridors with the Regional TMC (Caltrans). The communications link will provide the bandwidth for the exchange of real-time data and video over a fiber optic backbone network. **Figure 10-1** illustrates the proposed fiber optic backbone network as part of the overall Center-to-Center System. Within San Mateo County, the proposed conduit and fiber network runs along US 101 with connections to existing Caltrans conduit and fiber at Highway 92 and Highway 84.

Figure 10-1: Proposed Bay Area Fiber Optic Backbone Network

10.1.4 Data Archiving Systems

A potential function of ITS is the archiving of transportation-related data for later use as part of operational and planning analyses. Data archiving refers to the recording, processing and storage of the transportation-related data collected through ITS components. While many ITS applications are oriented towards real-time operation, many of these systems include various transportation data monitoring components. However, much of this information is used only to support the real-time operation, and is often immediately discarded or not recorded. While it is not appropriate to store all types of data, traffic volumes and transit ridership represent the two primary data types typically used in operational analysis and planning functions.

The primary data archiving activity underway in San Mateo County at this time is the compilation of freeway loop detector data as part of the Freeway Performance Measurement System (PeMS). The PeMS is a system to collect, filter, process, aggregate and examine information collected via Caltrans loop detectors from traffic management centers (TMCs) throughout the state. It is a joint effort by Caltrans, the University of California, Berkeley, and PATH, the Partnership for Advanced Technology on the Highways.

PeMS obtains 30-second loop detector data in real-time from each Caltrans District TMC. The data are transferred through the Caltrans wide area network (WAN) to which all districts are connected. Users can access PeMS over the Internet through a Web browser. The 30-second data received by PeMS consist of counts (number of vehicles crossing the loop), and occupancy (the average fraction of time a vehicle is present over the loop).

Although not linked to specific ITS field devices, another useful transportation data resource is MTC's database of existing traffic signals and interconnect for the Bay Area, including cities in San Mateo County. This database is maintained within a geographic information system (GIS) thus allowing information to be tied to a spatial location. However, in order for this database to be useful, information in the database needs to be kept current.

10.2   Needs

A communications network allows the system operator to have the ability to communicate with and control field devices from a central location. Most of the cities have some traffic signal interconnect, but many do not have the ability to communicate with field devices from a central location. The communications network is limited outside of Caltrans facilities and there is a lack of communications links between freeway and arterial systems. The implementation of various ITS field components can serve as an opportunity to establish or expand the communications network.

Having the physical communications network (i.e., fiber network) is just as important as having interagency communication to the effective management of the transportation system. An effective communications system allows all interested agencies to share important data in a timely manner. The need for improved communication is a region-wide issue, affecting all transportation and emergency service agencies. Expansion of the fiber network and franchise agreements with Comcast, which also operates in the County, for leasing dark fiber strands will provide the agencies with a fiber network that can be used for transmitting transportation data between agencies.

Due to the size of some of the cities and limited resources, a staff member dedicated to transportation issues is not always available. Some of the smaller cities do not have the staff to maintain their signals and therefore, contract this service to a third party. These cities are less likely to want to take on anything new and "experiment."

A key to a successful communication network is to continually operate and maintain the communication system. Operations and maintenance resources for the communication network needs to be budgeted for by all the agencies so that the system can operate effectively.

While many ITS applications are oriented towards real-time operation, many of these systems include various transportation data monitoring components. However, much of this information is used only to support the real-time operation, and is often immediately discarded or not recorded. One exception is the Freeway Performance Measurement System (PeMS). The enhancement of other existing and planned ITS applications to include data archiving capability can provide the County's transportation agencies with the information and data needed to effectively and efficiently conduct many operational analysis and planning functions.

Some of the deficiencies and needs that support the ITS technologies, but are not included in the previous chapters include:

- Fill gaps in the existing communications network;

- Upgrade any existing faulty or outdated communications systems;

- Enhance coordination, information sharing and cooperation between transportation and emergency agencies;

- Ensure continued operations and maintenance of all ITS elements and the communications network; and

- Improve availability of transportation data for planning and analysis purposes.

10.3   Opportunities

Most of the cities have some traffic signal interconnect, but many do not have the ability to communicate with or collect data from a central location. The communications network is limited outside of Caltrans facilities and there is a lack of communications links between freeway and arterial systems. The implementation of various ITS field components can serve as an opportunity to establish or expand the communications network.

Several of the cities and the County of San Mateo have a joint powers agreement with the cable company RCN. Expansion of the fiber network and franchise agreements with Comcast, which also operates in the County, for leasing dark fiber strands will provide the agencies with a fiber network that can be used for transmitting transportation data between agencies.

It will be critical to prepare an overall Communications Network Plan for a Countywide system. This Plan should explore all opportunities to utilize private infrastructure to minimize implementation costs. It should also consider ways of linking with Caltrans, including the proposed fiber optic backbone. For arterial management, providing links with CTNet masters installed throughout the County, primarily along El Camino Real will need to be built into the Plan. Given that the County already has a comprehensive wireless network, there are huge potentials to utilize this network to establish the physical links between traffic signal systems throughout the County.

The current direction in the transportation industry is the reduction of proprietary technologies and migration towards standards, allowing more seamless interoperability between communications hardware from different vendors. This will be an issue for the San Mateo County ITS Program since the overall implementation will most likely involve multiple vendors of each component of each system. As ITS elements are deployed within the County, compatibility between systems will be an important consideration. Striving to use recognized standards will help ensure system inter-operability and integration. The National ITS standards do not prescribe specific equipment to use, but try to make sure that all of the different systems can be compatible and able to work together.

Likewise within San Mateo County, it needs to be recognized that it may be difficult to achieve standards in the technology employed, but try to ensure that all of the systems and components are able to work together.

Another factor to build into the communications network is automated failure recovery, where a network can automatically recover and reconfigure itself when multiple failures occur. This is because a significant problem within a transportation communication's infrastructure is the vulnerability of the system to link cuts, which can disable communications to many field devices for a significant period of time before the link cut is repaired.

An often overlooked element of ITS is the on-going operations and maintenance. The initial implementations of these advanced transportation system tends to focus primarily on the design and installation of system components. However, once installed, the system must be operated and managed effectively to realize its full benefits. Operations and maintenance has been recognized as a very important issue for the ITS Program and has been built into most of the ITS Opportunities. This component provides the basis for continuous operations of the system. The current focus for agencies is the mainstreaming of ITS. This enables the operations and maintenance to become part of the routine maintenance similar to the traditional transportation elements including traffic signals and traffic poles. Agencies are then able to build in the added costs of the ITS elements as part of traditional capital and on-going operations and maintenance costs.

While many ITS applications are oriented towards real-time operation, many of these systems include various transportation data monitoring components. It may be possible to design or enhance these applications to process and store data for later retrieval and use. Alternatively, detection stations may be established at key locations specifically to record data for planning and anlaysis uses.

In evaluating the identified needs from the Supporting Elements perspective, the following are the ITS Opportunities identified to address these needs:

1. Prepare an overall Communications Network Plan for the San Mateo County ITS Program.

2. Design and upgrade the existing communications infrastructure to support communication with the various ITS field devices, integration of signal systems, and center-to-center links throughout the County.

3. Expand the existing RCN fiber network and expand franchise agreements with Comcast to connect to the RCN network.

4. Connect into Caltrans' proposed fiber optic backbone on US101.

5. Evaluate the feasibility of utilizing private infrastructure to form part of the overall communications network.

6. Utilize the County's microwave system to provide communications between agency systems throughout the County.

7. Develop a standard set of communications protocols and communication channels for all agencies.

8. Designate staff dedicated to transportation management.

9. Establish cooperation between the agencies to work together under the San Mateo County ITS Program.

10. Allocate funding and resources for the operations and maintenance of ITS elements and communication network including appropriate system upgrades and system integration.

11. Deploy monitoring devices at select locations for the purpose of collecting historical data.

12. Incorporate data processing and archiving features into all transportation monitoring systems.

10.4 Goals and Priorities

By nature, the focus of the element is to the technical infrastructure and procedures needed to support the initiatives and priorities identified within the other elements. In the short-term, the emphasis is placed on the communication network needed to support the operation of various ITS applications, and on securing the necessary funding to operate and maintain these ITS systems.

Out of the twelve opportunities carried forward, three of these were assigned a medium/high priority or above. Two of these opportunities focused on the communication network needed to support the operation of various ITS applications. The third high ranked opportunity relates to the provision of the funding and resources needed to operate and maintain these ITS systems. The supporting element ITS opportunities and associated rankings for San Mateo County are listed in Table 10-1.

10.5 Supporting Elements High Priority Project Concepts

Below are brief descriptions of the high priority Supporting Elements project concepts. The numbers shown next to the project concept descriptions below correspond to the numbers presented in Table 10-1. Expanded descriptions of the Supporting Elements opportunities ranked by the San Mateo County Working Group from High to Medium/High are provided in Technical Memorandum #4: Project Concept Descriptions and in Appendix E: Project Fact Sheets.

Table 10-1 – SUPPORTING ELEMENTS OPPORTUNITY PRIORITIES

#	OPPORTUNITIES	NEEDS					RATING
		Fill gaps in the existing communications network	Upgrade any existing faulty or outdated communications systems	Enhance coordination, information sharing and cooperation between agencies	Ensure continued O&M of all ITS elements and the communications network	Improve availability of transportation data	
SE1	**Prepare an overall Communications Network Plan for the County ITS Program**	●					**H**
SE2	**Design and upgrade the existing communications infrastructure**		●	●			**H**
SE3	Expand the existing RCN fiber network and expand franchise agreements with Comcast	●					M
SE4	Connect into Caltrans' proposed fiber optic backbone on US101	●					M
SE5	Evaluate the feasibility of utilizing private infrastructure to form part of the overall comm network	●					M
SE6	Utilize the County's microwave system to provide communications between agency systems	●					M
SE7	Develop a standard set of communications protocols and communication channels			●	●		M
SE8	Designate staff dedicated to transportation management			●			L
SE9	Establish cooperation between the agencies to work together under the San Mateo County ITS Program			●			M
SE10	Allocate funding and resources for the O&M of ITS elements and communication network				●		H
SE11	Deploy monitoring devices at select locations for the purpose of collecting historical data					●	M
SE12	Incorporate data processing and archiving features into all monitoring systems					●	M

SE #1: Prepare an overall Communications Network Plan for the San Mateo County ITS Program (high priority).

The communications network plan for the San Mateo County ITS Program will identify which gaps in the communication network will need to be filled in order to support the project concepts and communicate with the ITS equipment effectively. The communications network plan will be a blueprint for the County to use to expand their network for the future and make sure segments that are installed in the County are consistent with the overall communications network plan.

The elements that would be involved include:

- Defining specific needs/gaps to support other ITS projects;
- Developing communication network concept:
  - Identify and evaluate options
  - Develop recommendations;
- Defining an implementation plan, including the level of coordination and integration with the other projects; and
- Estimating the construction cost for each option.

SE #2: Design and upgrade the existing communications infrastructure to support ITS deployment throughout the County, and allocate funding and resources for the O&M (high priority).

Once the Communications Network Plan has recommended which gaps in the communications network need to be filled, the next step in the project would be to design and construct the upgrades.

The upgrade of the existing communications infrastructure would replace any existing faulty or outdated communications systems and improve the cooperation and coordination between agencies and the sharing of information within the region. Furthermore, adjacent agencies traffic signal systems will be able to communicate between each other for sharing of traffic data and improve the regional mobility of the transportation network.

The elements that would be involved include:

- Designing the necessary upgrades;
- Constructing the upgrades; and
- Entering into the necessary agreements where leasing or sharing of communications infrastructure is recommended.

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11 PROJECT IMPLEMENTATION

This Strategic Plan presents a vision for the deployment of ITS within San Mateo County. The realization of this vision will come with the implementation or deployment of the ITS opportunities and project concepts described in this Plan. The following section of this chapter presents an overall framework for the deployment of these opportunities in terms of agency roles and implementation timeframe. The final section identifies a number of issues that implementing agencies should take into consideration as they design and deploy ITS projects.

11.1 Implementation Plan

The implementation of the ITS opportunities and project concepts identified in this Strategic Plan will be carried out by a broad spectrum of agencies, and to some degree private entities, over many years. An initial Implementation Plan for these ITS opportunities is presented in **Exhibit 11-1**. This exhibit identifies the priority rating, agency roles and estimated implementation timeframe for each of the proposed ITS opportunities and project concepts. Where appropriate, additional comments are provided related to items such as the current status of a project, the specific relationship between participating agencies, the relationship between projects, and the potential phasing of deployment.

The purpose is to provide a coordinated Implementation Plan that will address overall issues of agency responsibilities, project phasing and interagency requirements. This will serve as the road map assisting San Mateo County in implementing ITS to achieve the mission established in this Strategic Planning process. Projects that are already underway are included and generally identified as near-term projects. The inclusion of these projects is aimed at providing a more complete picture of the planned activities and an understanding of the integration needs.

11.1.1 Agency Participation

Exhibit 11-1 identifies which agencies are expected to be involved with the implementation of the various ITS opportunities and project concepts identified in this Plan. C/CAG and SMCTA should take the lead to advance the planning and implementation of ITS in San Mateo County. For the purposes of brevity and because the exact locations or boundaries of most projects are not yet defined, local agencies are grouped in generic categories, not by individual jurisdiction. For example, "Local PW" refers generically to the Public Works departments of the individual cities and the County. The County's various police, fire and medical response services are grouped under "Local ESP" (emergency service providers). Most other countywide, regional and state agencies are identified by name. These include C/CAG, SMCTA, the Metropolitan Transportation Commission (MTC), Caltrans, SamTrans, and other transit providers.

Insert Exhibit 11-1

Please refer after page 11-6.

To help stakeholders get a clearer understanding of their potential roles, agency participation has been broken down into the project planning and project deployment phases, and the expected lead agency or agencies for each phase is identified. In general terms, the planning phase may include activities such as master planning, preparing functional requirements, identifying and securing funding, and defining priorities. The deployment phase may include detailed design, construction or installation, and operations and maintenance (O&M).

While a potential lead agency or agencies are identified, coordination with other agencies and stakeholders will be necessary as part of most projects. All of the agencies are potential participants and partners in many of the projects. Furthermore, participating agencies typically have roles in both phases, but the lead may change.

C/CAG and SMCTA are identified as the lead agencies for the planning phase of many projects to help establish countywide requirements and priorities, and ensure coordination with other activities, but then the individual jurisdictions or operators would be responsible for deployment. In general, agencies should be responsible for deployment for the facilities that they own or for which they already have responsibility. For example, Caltrans would be expected to have lead responsibility for the deployment of ITS Projects on state highways, local public works departments would be expected to have the lead responsibility for ITS Project deployment on local roadways, and transit agencies would be expected to have responsibility for transit projects. It is critical that the SMCTA incorporate appropriate ITS components and strategies in all the Measure A funded projects.

It must be recognized however, that an increasing level of integration of ITS components will require agencies to examine whether there should be exceptions to this general owner-operator rule. A good example would be where a local or multi-agency transportation management center is envisioned, which could include the capability for freeway/arterial diversion. Likewise, coordination of signals across jurisdictional boundaries may require one jurisdiction assuming some degree of responsibility for deployment or operation across these boundaries.

In many cases, and especially where agencies will contribute resources cooperatively on individual projects, formal agreements or memoranda of understandings will need to be put in place. In addition to clarifying roles in such a situation, formal agreements will help to keep all stakeholders informed.

11.1.2 Implementation Timeframe

Exhibit 11.1 also identifies the estimated implementation timeframe for each project concept. This timeframe is based on several factors including:

- Relative priority;

- Availability and maturity of necessary technology; and

- Significance of institutional issues to be overcome.

Dependence on other deployments is also a contributing factor in the estimated timeframe for implementation. This dependence can is of two primary forms:

- Project B builds upon the technology or infrastructure deployed as part of Project A.

- Project B is most useful or effective when inputs from Project A are available.

Many of the ITS project concepts identified in this Strategic Plan may be deployed independently of the other projects. However, it is important to recognize where dependencies occur and how this may impact the sequencing of project deployment.

In addition to the factors described above, variables such as changing needs and priorities, the availability of funding and emergence of new technology can also have a significant influence the implementation timeframe of the ITS projects identified in this Strategic Plan. Because of these uncertainties, the implementation timeframes are presented in five-year increments, and represent a best-guess estimate of the potential timeframe.

While many of the project concepts are shown with a specific five-year implementation window, many others are shown as being implemented over a much more extended period. This extended timeframe can reflect the fact that particular project may be implemented in phases as needs dictate and/or the concept represents an on-going activity.

Projects that are already underway are included and generally identified as being implemented in the near-term. The inclusion of these projects is aimed at providing a more complete picture of the planned activities and an understanding of the integration needs.

11.2   *Deployment Considerations*

To ensure that ITS strategies are appropriately considered in addressing the County's transportation needs and deficiencies, it is critical that ITS be "mainstreamed" into the traditional transportation planning process. At the same time, however, it must also be recognized that ITS projects may be different than traditional transportation projects. To facilitate the efficient and effective implementation of ITS projects in San Mateo County, several factors must be considered during the planning, design and deployment of these projects. These factors are discussed in detail within Appendix F of this Strategic Plan and may be summarized as follows:

- **Project Conformance.** Federal funding of ITS Projects is contingent on projects being in conformance with the Regional ITS Architecture and, by extension, the National ITS Architecture.[1] As part of this, a systems engineering approach must be used in developing and defining individual projects. This systems engineering approach is further described in the Final Rule. ITS projects within the County should also be consistent with applicable local plans such as the CTP and local General Plans.

- **Standards.** Another element of the federal requirements is that applicable ITS standards be used for all federally-funded ITS projects. More importantly, use of these standards can help support the design and specification process, and ensure interoperability between systems. It needs to be recognized that standards are important and the goals for this regulation are vital for achieving interoperability for ITS applications. However, achieving 100% standardization is very difficult since standards are being updated or changed continuously. Agencies need to recognize this and work within this environment to achieve interoperability.

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[1] USDOT ITS Architecture, Final Rule (Federal Register, 23 CFR Part 940, January 8, 2001).

- **Interoperability.** To take full advantage of their potential, most individual ITS applications will need to accommodate linkages to other systems. This ability for the different ITS projects and systems to communicate and work with one another is referred to as "interoperability". The regional architecture and ITS standards provide a framework for this interoperability.

- **Inter-Agency Agreements.** Most of the ITS deployments in this Plan call for cooperative deployment and operations efforts between multiple jurisdictions. This will require a greater degree of coordination with other agencies than might normally be the case. Formal agreements or memoranda of understandings will need to be put in place to help clearly define agency roles and responsibilities.

- **Funding.** Opportunities for funding and implementation for ITS Projects are not as obvious as for traditional types of transportation improvements. In some cases, ITS applications may be best implemented as "add-ons" to conventional improvements and incorporated into the overall project design. In other cases, targeted funding needs to be sought for stand-alone ITS applications. Additionally, the staging of projects in the strategic plan must be flexible enough to make adjustments to respond to funding opportunities and changing circumstances. C/CAG will develop a policy on funding ITS projects as identified in this ITS Strategic Plan using Federal and State transportation funds allocated to San Mateo County.

- **Procurement.** The traditional procurement and contract procedures used by agencies vary and may not always be well suited to the unique characteristics of ITS projects. Selection of appropriate procurement procedures for designing, developing and installing the elements of ITS projects will help ensure that long delays don't occur during implementation.

- **Operations and Maintenance.** Successful ITS applications depend to a great extent on the approach taken to provide day-to-day operation of the systems. Project sponsors must have a plan for and devote resources to operations. They cannot take a "set it and forget it" approach. They must think through not only how they will get a system running, but how they will keep it running, and how they will maximize its potential benefit.

In addition to these factors, it should be recognized that the ongoing coordination and communication between agencies implementing ITS is paramount. Many of the projects identified in this Plan will involve the deployment of the same technologies in more than one jurisdiction. As these projects are implemented, understanding the latest developments relative to the technology as well as the experiences of others is vital to successful deployment. Project development activities should include contact with other agencies that have pursued the technologies involved to both understand the latest advances and to coordinate where necessary the integration issues. Much of this coordination can be initiated and advanced by the stakeholder committee as it monitors implementation of projects.

This coordination also needs to extend to other areas where similar ITS activities are being undertaken and guided by oversight committees. This sort of interaction between ITS efforts in San Mateo County and other areas will help to maximize the benefits realized by all and ultimately provide advances toward greater systems integration.

To the extent possible, there should also be continuity in the personnel involved in guiding each ITS Project. Although an ITS Project may pass through more than one division of an agency, keeping the

project vision clearly in focus throughout the effort is essential. The most successful ITS projects have typically been those for which there has been continuity of staff over a long period of time. These staff have been able to maintain the vision to ensure that the original objectives of the project were actually achieved.

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Table 11-1: ITS Opportunity & Project Concept Implementation Plan

#	Description	Countywide Priority[1]	Planning	Deployment	0-5	5-10	10-15	15-20
	OPPORTUNITY/PROJECT CONCEPT		**Agency Participation[2,3]**		**Implementation Timeline[4]**			
Freeway/Highway Management								
FM1	**Bring already deployed ITS devices into full and stable operation**	H	**C/CAG, Caltrans**	**Caltrans**	█			
FM2	**Make Regional transportation management center (TMC) fully-operational with respect to San Mateo County**	H	**C/CAG, Caltrans**	**Caltrans**	█			
FM3	Deploy additional traffic monitoring and incident verification equipment where appropriate on the County's freeways and highways	M	Caltrans, C/CAG, MTC	Caltrans	█	█		
FM4	Install fog sensing equipment where appropriate on the County's highways	L/M	Caltrans, C/CAG	Caltrans		█	█	
FM5	Install additional changeable message signs (CMSs), including along I-280 and Highway 35 in Daly City and Pacifica	M	Caltrans, C/CAG	Caltrans	█			
FM6	Install additional changeable message signs (CMSs) on US 101 and I-280 for route guidance to major attractions	M/L	C/CAG, Caltrans	Caltrans		█	█	
FM7	**Bring ramp metering system, as approved, into operation and integrate with signal operations where appropriate**	M/H	**Caltrans, C/CAG, Local PW**	**Caltrans, Local PW**	█			
FM8	Implement a center-to-center link between Caltrans' Transportation Management Center (TMC) and existing or future TMCs within San Mateo County	M/L	C/CAG, Local PW, Caltrans	Caltrans, Local PW		█	█	█
Arterial Management								
AM1	**Upgrade existing traffic signal systems (e.g. replace antiquated equipment, expand coordinated systems, update signal timings, etc.)**	H	**Local PW, Caltrans, C/CAG**	**Local PW, Caltrans**	█	█	█	█
AM2	**Install CCTV cameras at key congested locations throughout the County**	M/H	**C/CAG, Local PW, Caltrans**	**Local PW, Caltrans**	█			
AM3	Install additional detection stations along major arterials	L/M	C/CAG, Local PW, Caltrans	Local PW, Caltrans		█	█	
AM4	Install changeable message signs (CMSs) on major arterials	L	C/CAG, Local PW, Caltrans	Local PW, Caltrans		█	█	
AM5	Design and implement Smart Corridor(s) in selected areas	L/M	C/CAG, Local PW, Caltrans	Local PW, Caltrans		█	█	
AM6	Use predictive traffic control systems adjacent to at-grade railroad crossings	L/M	Local PW, Caltrans, Caltrain	Local PW, Caltrans				█
AM7	**Provide link between traffic signal systems operated by local agencies and by Caltrans (CTNet)**	H/M	**C/CAG, Local PW, Caltrans**	**Local PW, Caltrans**	█	█		
AM8	Establish Countywide Transportation Management System (through a single TMC or series of sub-area TMCs)	L	C/CAG, Local PW	Local PW			█	█
AM9	Implement a center-to-center link between San Mateo TMC(s) and other regional systems	L	C/CAG, Local PW, Caltrans, adjacent counties	Local PW, Caltrans, adjacent counties			█	█
AM10	Evaluate and implement other advanced control strategies (e.g adaptive) along key congested corridors	M	Local PW, Caltrans, C/CAG	Local PW, Caltrans	█	█		
Transit Management								
TM1	**Implement AVL systems on Caltrain rail vehicles**	H	**Caltrain**	**Caltrain**	█			
TM2	Implement transit vehicle collision warning systems	L	SamTrans	SamTrans		█		
TM3	**Explore applications for transit signal priority (TSP) along key transit corridors**	H	**SamTrans, Local PW, C/CAG, Caltrans**	**SamTrans, Local PW, Caltrans**	█	█	█	█
TM4	**Install electronic information signs at transit transfer and major activity centers**	H	**SamTrans, Caltrain, BART, Muni, AC Transit, VTA, MTC**	**SamTrans, Caltrain, BART, Muni, AC Transit, VTA**	█			
TM5	Install electronic information signs at all transit stops	M/L	SamTrans	SamTrans			█	
TM6	**Install in-vehicle electronic signs on transit vehicles**	H	**Caltrain**	**Caltrain**		█		
TM7	**Expand deployment of TransLink electronic fare system**	H/M	**MTC, SamTrans, Caltrain, BART**	**SamTrans, Caltrain, BART**	█	█		
TM8	Implement center-to-center link between SamTrans and local TMCs	L	C/CAG, SamTrans, Local PW	SamTrans, Local PW			█	
TM9	Implement center-to-center link between all transit agencies operating in San Mateo County	M	SamTrans, Caltrain, BART, Muni, AC Transit, VTA, MTC	SamTrans, Caltrain, BART, AC Transit, VTA		█		
TM10	**Provide amenities such as access to the Internet on rail transit vehicles**	H	**Caltrain**	**Caltrain**		█		
Traveler Information								
TI1	**Implement CMS's at key locations along the I-280, I-380 and US 101 freeways**	H	**C/CAG, Caltrans**	**Caltrans**	█			
TI2	**Implement CMS's at key locations along Highways 92, 84, 35 and 1**	H/M	**C/CAG, Caltrans**	**Caltrans**	█			
TI3	Implement CMS's at key locations along major arterials throughout the County	L	C/CAG, Local PW, Caltrans	Local PW, Caltrans		█		
TI4	Expand the Highway Advisory Radio (HAR) system within San Mateo County	L	Caltrans	Caltrans			█	
TI5	Implement traveler Information kiosks within the SFO baggage claim area	L	MTC, SFO, C/CAG	SFO, MTC			█	
TI6	Install electronic travel information signs at major activity centers	M	C/CAG, Local PW, Caltrans, SamTrans, MTC, Private	Local PW, Caltrans, SamTrans, MTC, Private	█	█		
TI7	Install electronic information signs at railroad at-grade crossings	L	Local PW, Caltrans	Local PW, Caltrans				█
TI8	**Enhance distribution of traveler information to the media for real-time dissemination**	H	**CHP, Caltrans, MTC, Local PW, Local Police**	**CHP, Caltrans, MTC, Local PW, Local Police**	█	█		
TI9	Publish traveler information on local agency websites	L/M	Local PW, C/CAG, MTC	Local PW			█	█
TI10	Implement a link between local traffic monitoring systems and the regional 511 traveler information system	M/L	C/CAG, MTC, Local PW	Local PW, MTC		█	█	
TI11	Provide a link between local TMCs and the CHP CAD system for real-time incident information	L	C/CAG, CHP, Local PW	Local PW, CHP			█	
TI12	Publicize and provide education to the public regarding traveler information systems	L	MTC	MTC	█	█		
Parking Management								
PM1	Prepare a Parking Management System Study for various locations	L	Local PW	See PM #2	█			
PM2	Implement a real-time Parking Information and Guidance System , where appropriate	L	Local PW	Local PW		█	█	
PM3	Implement an electronic fee payment system utilizing FasTrak technology.	L	MTC, Caltrans, Local PW, Private	Local PW, Private, MTC, Caltrans		█		
Incident Management								
IM1	**Develop and implement Countywide incident management plans**	H	**C/CAG, Local PW, Caltrans, MTC, Local ESP, County OES, CHP**	**Local PW, Caltrans, Local ESP, County OES, CHP**	█	█		
IM2	**Install CCTV cameras at key locations throughout the County**	M/H	**C/CAG, Local PW, Caltrans, County OES**	**Local PW, Caltrans**		█		
IM3	Implement Incident Management software to support efficient incident response	M	C/CAG, County OES, Local PW, Local ESP	County OES, Local PW, Local ESP		█	█	
IM4	Implement center-to-center links between transportation agencies and emergency service agencies	M	C/CAG, Local PW, Caltrans, Local ESP, County OES, CHP	Local PW, Caltrans, Local ESP, County OES, CHP		█	█	
IM5	Implement Automated Vehicle Location (AVL) systems for all maintenance and emergency vehicles	M	Local PW, Local ESP, C/CAG	Local PW, Local ESP	█	█		
IM6	**Standardize emergency vehicle pre-emption (EVP) equipment countywide and implement on major routes**	H	**C/CAG, Local PW, Local ESP**	**Local PW, Local ESP**	█	█		
IM7	**Coordinate Incident Management Plans with adjacent counties**	H	**C/CAG, County OES**			█	█	
Supporting Elements								
SE1	**Prepare an overall Communications Network Plan for the County ITS Program.**	H	**C/CAG, Local PW, Caltrans, MTC, SamTrans**	**See SE #2**	█			
SE2	**Design and upgrade the existing communications infrastructure**	H	**See SE #1**	**Local PW, Caltrans, MTC**	█	█	█	█
SE3	Expand the existing RCN fiber network and expand franchise agreements with Comcast	M	See SE #1	See SE #2	█	█		
SE4	Connect into Caltrans' proposed fiber optic backbone on US101	M	See SE #1	See SE #2	█	█		
SE5	Evaluate the feasibility of utilizing private infrastructure to form part of the overall communication network	M	See SE #1	See SE #2	█	█		
SE6	Utilize the County's microwave system to provide communications between agency systems	M	See SE #1	See SE #2	█	█		
SE7	Develop a standard set of communications protocols and communication channels	M	C/CAG, Local PW, Caltrans, MTC, Local ESP, County OES, CHP	Local PW, Caltrans, MTC, Local ESP, County OES, CHP	█			
SE8	Designate staff dedicated to transportation management	L	Local PW	Local PW		█	█	█
SE9	Establish cooperation between the agencies to work together under the San Mateo County ITS Program	M	C/CAG, all others	C/CAG, Local PW, Caltrans	█	█		
SE10	**Allocate funding and resources for the O&M of ITS elements and communication network**	H	**C/CAG, Local PW, Caltrans, MTC, Local ESP, County OES, CHP**		█	█		
SE11	Deploy monitoring devices at select locations for the purpose of collecting historical planning data	M	C/CAG, Local PW, Caltrans	Local PW, Caltrans		█	█	█

OPPORTUNITY/PROJECT CONCEPT		Countywide	Agency Participation[2,3]		Implementation Timeline[4]			
#	Description	Priority[1]	Planning	Deployment	0-5	5-10	10-15	15-20
SE12	Incorporate data processing and archiving features into all monitoring systems	M	C/CAG, Local PW, Caltrans, MTC	Local PW, Caltrans		███	███	███
Notes:								
1	**Bold type** = high or high medium priorities							
2	Underlining denotes potential lead agency. for deployment, agencies will typically take lead for portion on facilities over which they have jurisdiction. Agencies - Local PW = City/County Public Work medical response, etc.; SFO = San Francisco International Airport; Private = private sector entities							
3	The San Mateo County Transportation Authority (SMCTA) will be a potential participant in the planning and deployment of all projects as funding partner.							
4	Estimated timing for implementation. Actual timing will depend on many factors including availability of funding.							

Comments

C/CAG to lead determination of specific requirements and priorities, and may provide funding support. Caltrans would be responsible for implementing improvements, and for on-going operations and maintenance.

Requires additional staff resources at regional TMC. C/CAG to define level of support needed, and may provide necessary funding.

Project will fill gaps in existing system. C/CAG and MTC may help identify priorities and funding. Deployment may occur in phases.

Caltrans to identify priorities with input from C/CAG.

Related to TI #1 and TI #2. C/CAG may assist in defining priorities and identifying funding.

Related to TI #1 and TI #2. C/CAG to take lead in defining priorities.

C/CAG to ccordinate with Caltrans on operating parameters and integration requirements. Some ramp metering equipment has been deployed. Further deployment and operation may occur in phases.

Access to freeway information (data, camera images) by local agencies is a priority, but development of local TMCs is a long-term strategy. C/CAG to lead coordination between agencies.

Each jurisdiction may establish own upgrade needs, but C/CAG to coordinate improvements of county or inter-jurisdicitonal significance. Upgrade type and priority will vary by location. Should be an on-going program.

C/CAG to lead identification of locations and priorities. Deployment should only occur once networks and resources are in place to monitor and utilize information received.

Data may be used to support monitoring activities and advanced control strategies. C/CAG to lead identification of locations and priorities. Deployment will vary by location.

C/CAG to lead identification of locations and priorities. Deployment should only occur once networks and resources are in place to operate signs.

Involves coordinated deployment and operation of various elements included in AM #1, AM #2, AM #3 and AM #4. C/CAG to lead identification of locations and priorities. Deployment should only occur once networks and resources are in place to operate signs.

To be deployed on a case-by-case (location-specific) basis. Countywide ccordination not required.

Sharing of data and information will facilitate coordinated operation. C/CAG to coordinate definition of requirements and priorities.

Countywide or subarea TMCs are viewed as a long-term strategy. However, individual jurisdictions may establish limited TMC operations in near-term. C/CAG to coordinate definition of requirements and priorities.

C/CAG to coordinate definition of requirements and priorities. To be pursued as San Mateo TMCs come on-line.

Advanced control strategies have been deployed in some locations. Further deployment will occur on a case-by-case basis. C/CAG to coordinate improvements of county or inter-jurisdicitonal significance.

AVL already installed on buses. Equipping all vehicles with AVL is a prerequisite function to allow for most Transit Management initiatives

Collision warning systems are being developed as part of an R+D project with FTA. Full implementation will depend on test results and funding availability.

Testing of adaptive program is underway. Application to specific locations needs to be evaluated before deployment. Timing will vary by location.

Looking for public/private partnerships to sponsor equipment purchase and placement.

Evaluation of benefits at less frequently used stops is necessary. Signage at major stops are still desired (TM4)

Project is complete for transit buses. Expansion to Caltrain being studied. Funding is issue.

Translink is an MTC-sponsored program. SamTrans to lead deployment in San Mateo.

Benefits need to be explored before moving forward. Studies on information to be transferred also necessary. C/CAG to coordinate definition of requirements and priorities.

This system already exists for SamTrans operated systems including paratransit. Outside systems need to be identified and benefits explored.

The usefulness of internet capability at stops without similar capability on vehicles needs to be explored further. Deployment may be phased in over longer period.

Related to FM #5 and FM #6. C/CAG to coordinate identification of locations and priorities; may also provide funding.

Related to FM #5 and FM #6. C/CAG to coordinate identification of locations and priorities; may also provide funding.

C/CAG to coordinate identification of locations and priorities; may also provide funding.

Secondary form of information dissemination. Need may be re-evaluated.

Viewed as regional intitiative; part of 511 system.

C/CAG to coordinate identification of locations and priorities; may be involved in securing funds for deployment. Should be linked to regional 511 system.

To be deployed on a case-by-case (location-specific) basis. Countywide ccordination not required.

Objective is to maximize effectiveness of commercial traveler information services. Already being done, especially for freeways. Need to enhance reporting of local conditions.

As additional moninitoring systems come on-line (e.g. AM #2, AM #3, etc.), may make information available to public. C/CAG to help facilitate coordination between local information systems and regional 511 system.

As local systems come on-line, provide data link to 511 systems. C/CAG to facilitate coordination.

Local TMCs within San Mateo is viewed as a long-term strategy. C/CAG to facilitate coordination.

Viewed as a regional (511/MTC) responsibility. Will be an on-going program.

Local initiative; timing will vary by location.

Local initiative; timing will vary by location but will follow initial study (PM #1)

Requires coordination with FasTrak managers. More include application at private facilities.

Requires significant inter-agency coordination and cooperation. Initial steps are to focus on transportation agency coordination and identification of incident reliever routes.

Related to AM #2. Important as local TMCs come on-line.

More important as local TMCs come on-line and linkages are made between TMCs and emergency service operation centers. C/CAG to coordinate definition of requirements and priorities.

More important as local TMCs come on-line. C/CAG to coordinate definition of requirements and priorities.

AVL systems have been implemented by some agencies. Further deployment will vary by agency. C/CAG may play role in coordinating between agencies.

EVP has been deployed in several jurisdictions. Standaridzation of technology will facilitate cooperative emergency response. C/CAG to coordinate definition of requirements and priorities.

To follow development of San Mateo Countywide plan (IM #1).

Initial steps are to examine near-term communication needs and opportunities. Long-term strategy should also be defined.

Exact needs to be determined as part of Communicaiton System Master Plan (SE #1).

Exact needs to be determined as part of Communication System Master Plan (SE #1). Deployment to occur as part of SE #2.

Exact needs to be determined as part of Communication System Master Plan (SE #1). Deployment to occur as part of SE #2.

Exact needs to be determined as part of Communication System Master Plan (SE #1). Deployment to occur as part of SE #2.

Exact needs to be determined as part of Communication System Master Plan (SE #1). Deployment to occur as part of SE #2.

Supports inter-operability of ITS elements. Most important as linkages between TMCs and other operations centers are implemented.

Need and timing varies by jursidiction. More important as local TMCs come on-line.

ITS Program Manager responsibility.

C/CAG to coordainte requirements and priorities. Deployment may be phased in over time.

Comments
Implementing agencies responsible for incorporating element into design. C/CAG should provide oversight and ensure this element is considered.
s; County OES = County Office of Emergency Services; Local ESP = City/County police, fire

12 NEXT STEPS

Through the San Mateo County ITS Strategic Plan effort, momentum has been gained for the deployment of ITS in the County of San Mateo. It is important that this energy and momentum be maintained. As part of this, individual agencies or entities will need to step forward to lead or "champion" individual ITS projects based on their level of interest and need. However, the successful implementation of ITS also requires top level leadership that focuses on the overall program.

This chapter describes what is needed as part of an on-going Countywide ITS Program, identifies those projects to be actively pursued in the near-term, and lists the key activities to be undertaken in the next 6 to 12 months for these projects.

12.1 ITS Program Funding

One critical component of the San Mateo County ITS program is funding. Deployment will only occur if funding is available. C/CAG will develop a policy on funding ITS projects identified in this ITS Strategic Plan using Federal and State transportation funds allocated to San Mateo County. It is important that all participating agencies involved in the deployment of ITS applications including C/CAG, SMCTA, local agencies, transit agencies, emergency response agencies, and other appropriate agencies work together to seek available funds to support the San Mateo ITS program. Some potential funding sources include:

- State Transportation Improvement Program (STIP)
- Surface Transportation Program (STP)
- Congestion Management and Air Quality Program (CMAQ)
- San Mateo County Sales Tax (Measure A)
- Regional Freeway Operations Program
- State Highway Operation and Protection Program (SHOPP)
- Federal and State transit funds
- Homeland security funds
- Private partnership funds
- Relevant Federal, State, and regional grant funds

12.2 ITS Program Management

The San Mateo County ITS Strategic Plan resulted from a joint effort by governmental agencies in the region. The participant agencies will need to be committed to a cooperative method of program management in order to realize the full benefits of systems integration inherent in ITS deployment. This approach will need to provide oversight and guidance to ITS implementation throughout the county using this Plan as a starting point to move ITS projects forward and into the mainstream of transportation planning, development, and operations.

This program leadership should involve both a coordinating group to provide oversight of ITS activities in the region, and an ITS coordinator responsible for specific activities related to the region's ITS program.

An ITS Coordinating Group should be established to help guide further planning and implementation of ITS projects within San Mateo County. This group should meet on a periodic basis as determined necessary to provide input to issues pertaining to the design and

implementation of the projects in the San Mateo County ITS Strategic Plan. It should be a forum for assessing the status of strategic plan implementation, facilitating coordination among the various agencies within the region as well as with the adjacent regions, and for working out inter-agency agreements. For projects involving a lead agency and participating agencies, it is essential that this guiding body takes an active roll in plan implementation in order to ensure the coordination among these agencies and that an integrated approach to deployment of field elements is taken. It is imperative that guidance come from a committee that represents the full spectrum of agencies in the region and also has the background regarding the ITS planning process as well as the technology options available through ITS deployment.

At a minimum, the ITS Coordinating Group should include C/CAG, SMCTA, Caltrans, MTC, representatives from a number of local jurisdictions, and SamTrans. Other local implementing entities could become more involved as major projects are advanced to implementation. A logical starting point for this group is the Working Group that participated in the San Mateo County ITS strategic planning effort. Through their involvement in this process, members of the Strategic Plan Working Group have developed the knowledge base to enable continued successful guidance of the ITS program. The committee also provides good representation from an appropriate cross section of the transportation community in the region.

In addition to the top-level guidance of a multi-agency group, more detail-oriented project level coordination will be needed for the county as a whole. This is the role for the region's ITS coordinator. This individual would be responsible for guiding the coordinating group, identifying potential funding for ITS Projects, monitor progress on project implementation, provide information to those within and outside the agency on ITS applications, and serve as a primary point of contact for regional coordination on ITS issues.

The key areas of program leadership and responsibility for the coordinating group and ITS coordinator include:

1   Tracking project deployment and conformance;
2   Updating the Strategic Plan;
3   Maintaining intra- and inter-county coordination;
4   Providing technical support and assistance;
5   Identifying funding opportunities;
6   Evaluating the ITS program and individual projects;
7   Ensuring compliance with the Bay Area Regional ITS Architecture; and
8   Mainstreaming and promoting ITS.

These areas are discussed in more detail in Appendix G. In general, C/CAG and SMCTA should take the lead role in managing the County's ITS program, with a designated ITS coordinator who will be responsible for the completion of specific activities.

12.3   Early Winner Project Development

In the previous chapter, the approximate implementation timeline was identified for each of the ITS project concepts listed in this Strategic Plan. A number of these were shown as being implemented in the near-term (within the next five years). Thus, the next step is to move toward implementing these near-term strategies and projects. In some cases, the projects are fairly well-defined and the focus may be placed on capital investment and deployment. In other cases, significant planning is still necessary and will require the commitment of staff resources from participating agencies.

Those projects identified as candidates for immediate action ("early winners") include:

1   FM #1: Bring already deployed freeway ITS devices into full and stable operation (high priority)
2   AM#1 Upgrade existing traffic signal systems – fill critical gaps in signal inter-connect network (high priority)
3   AM #7: Provide a link between traffic signal systems operated by local agencies and by Caltrans (CTNet) (high/medium priority)
4   TM#1: Implement Automated Vehicle Location (AVL) systems on Caltrain rail vehicles (high priority)
5   TM #3: Explore applications for transit signal priority (TSP) along key transit corridors within the County (high/medium priority).
6   TM #4: Install electronic information signs at transit transfer and major activity centers (high priority)
7   TM #7: Expand deployment of TransLink electronic fare system (high/medium priority)
8   IM #1: Develop Countywide incident management plans (high priority)
9   SE #1: Prepare an overall Communications Network Plan for the San Mateo County ITS Program (high priority)

This list includes a number of projects that are already underway. The inclusion of these projects is aimed at providing a more complete picture of the planned activities and an understanding of the integration needs.

This section describes each of these "early winner" projects in terms of near-term goals and objectives, and identifies actions expected to be undertaken in the next six to twelve months. **Table 12-1** at the end of this chapter summarizes the action items for each of these early winner projects.

FM #1: Bring already deployed freeway ITS devices into full and stable operation (high priority)

A number of ITS devices (e.g. traffic monitoring stations, CCTV cameras, CMSs) have already been installed on the freeways and highways in San Mateo County. However, a number of these devices are not fully operations, and have been classified by Caltrans as functional, incomplete, or out of order. The overall goal of this project is to upgrade to operational status all of these devices. The near-term goal for this project is to determine what exactly is needed to bring each device to operational status, and to establish a program for implementing the necessary improvements or upgrades.

Actions to be undertaken in the next six to twelve months:

1   Confirm status of existing freeway and highway ITS devices
2   Identify specific requirements to bring each device to operational status
3   Estimate order of magnitude cost to upgrade each location
4   Define implementation priorities
5   Identify and secure funding
6   Develop interagency agreement between C/CAG and Caltrans for funding of repairs

This will lead to a list of specific repairs. Once the list has been finalized and funding secured, some improvements may proceed directly to implementation, while others may require some

additional design work.

AM#1 Upgrade existing traffic signal systems (high priority)

The overall goal of this project is to maximize the efficiency of signals operations through the updating of equipment and signals timings, coordinating operation along key corridors both within and across jurisdictions, and providing for centralized management. In the near-term, the primary objective to enhance intra-jurisdictional coordination by filling gaps in the signal interconnect network. The interconnect network supports the coordinated operation of signal groups.

Actions to be undertaken in the next six to twelve months:

1. Identify the key arterial corridors and segments
2. Identify gaps in the interconnect network for these key corridors and segments
3. Define interconnect requirements (e.g. boundaries, type of communication link) for each location
4. Develop order-of-magnitude cost estimates
5. Establish priorities for implementation
6. Define projects and responsible agencies
7. Define potential funding program

Once these actions have been completed, it will be the responsibility of local agencies and Caltrans to undertake the proposed improvements. Typically, more detailed design will be required. These improvements may be phased over time and will be undertaken by local agencies, but C/CAG and SMCTA may help provide funding.

In the longer-term, this project concept will include a variety of signal upgrade strategies including replacing antiquated equipment, expanding or upgrading signal systems, expanding the coverage of central systems, coordinating signals across jurisdictional boundaries, and updating traffic signal timings. Some of these upgrades will be initiated and undertaken by individual agencies while others will require coordination between multiple jurisdictions.

AM #7: Provide a link between traffic signal systems operated by local agencies and by Caltrans (CTNet) (high/medium priority)

The overall goal of this project is to coordinate efficiently the traffic signals owned by local agencies with Caltrans-owned signals by providing a link between signal systems. The near-term goal is to identify the requirements that would enable the communication between the local agency signal systems and Caltrans CTNet traffic signal system. This project also needs to be coordinated with SamTrans as part of Transit Management #3 project.

Actions to be undertaken in the next six to twelve months:

1. Define data-sharing requirements (i.e. what agencies would be involved, what data to share)
2. Identify system access strategy and data-sharing protocols
3. Identify interface requirements (hardware, software)
4. Develop order-of-magnitude cost estimates
5. Develop implementation work plan

Long-term actions will include securing the necessary funding and implementing the recommended improvements. In some cases, detailed design will be required prior to implementation.

TM #1: Implement Automated Vehicle Location (AVL) systems on Caltrain rail vehicles (high priority)

The overall goal of this project is to assist Caltrain in monitoring of train status throughout the corridor, and support real-time fleet control and fleet schedule performance tracking. The AVL system would also serve as the foundation for the various other transit management components system, including an automated passenger counting system (load factor, line segment utilization and ridership information), computer aided dispatch, fleet security, passenger information (arrival and departure information on the rail vehicle as well as at the station), and a radio network for communicating to each of these systems. Caltrain would like to install AVL hardware on all of their transit engine and cab cars.

Actions to be undertaken in the next six to twelve months:

1 Identify and secure necessary Regional Measure 2 funding
2 Procure and install AVL equipment on all Caltrain vehicles
3 Upgrade, as necessary, AVL hardware and software in the SamTrans TMC

In the long-term, once the AVL system is in place, funding and resources for installing radios and GPS receivers on future Caltrain rail vehicles, integrating each of the other transit management components to this system and on-going operations and maintenance will need to be provided.

TM #3: Explore applications for transit signal priority (TSP) along key transit corridors within the County (high/medium priority).

The overall goal of this project is to facilitate express bus service along El Camino Real and other key transit corridors using transit signal priority. The El Camino Real corridor yields the highest bus usage in the SamTrans system and is expected to grow over the next decade. SamTrans is planning express bus service along El Camino Real and a transit signal priority system for El Camino is critical for the delivery of the express service. Near–term objectives include defining transit signal priority requirements, and exploring adaptive transit signal priority. This project will also need to coordinate with the AM#7 project since both projects involve communication to Caltrans traffic signals. C/CAG will need to work with SamTrans to identify funding sources so that SamTrans can seek funding through potential grants and capital improvement projects.

Actions to be undertaken in the next six to twelve months:

1 Work with stakeholders to define TSP requirements
2 Develop memorandums of understanding between Caltrans, SamTrans, and the affected local agencies
3 Continue working with PATH on an adaptive transit signal priority system.
4 Coordinate with stakeholders on the AM#7 project
5 C/CAG to identify funding sources for SamTrans to seek funding through potential grants and capital improvement projects

In the long-term, once the institutional issues have been taken care of, the conceptual design phase will proceed. This will involve the identifying the necessary hardware and software needed

to implement the recommended form of TSP for each location. Following the design will begin implementation of the identified components.

Developing and implementing new traffic signal timings for effective TSP operations will be required after the TSP system is in place. Also, providing the funding and resources for on-going operations and maintenance will be required.

TM #4: Install electronic information signs at transit transfer and major activity centers (high priority)

The overall goal of this project is to provide transit riders with real-time transit information at key locations through the installation of electronic information signs.

A common concern for transit riders or potential riders is the uncertainty of the buses keeping on-schedule, or when the buses would be arriving if they are delayed. This is especially important if a rider is transferring to another bus route. This project concept would seek to address this concern by providing real-time transit information at key locations, such as Hillsdale Caltrain station, Serramonte Shopping Center and Hillsdale Shopping Center.

A near-term goal is to develop the appropriate interagency and public/private partnership agreements so when funding is available, the design and implementation of the signs will be ready to commence without institutional issues restricting the construction schedule. Also, a prioritized list of locations for the signs would be developed.

Actions to be undertaken in the next six to twelve months:

1 Develop appropriate interagency and public/private partnership agreements
2 Identify and prioritize the locations for installing the signs

In the long-term, SamTrans and Caltrain will seek funding for installing electronic information signs at transit transfer and major activity centers, such as Caltrain stations, Daly City and Colma BART stations, SFO, other intermodal facilities, regional shopping centers and event centers. Also, identification of the necessary communications hardware, software and infrastructure to enable remote communications for predicted arrival time information to be sent from SamTrans TMC to the electronic information signs, and funding and resources for on-going operations and maintenance will be required.

TM #7: Expand deployment of TransLink electronic fare system (high/medium priority)

The overall goal of this project is to have TransLink deployed on all the major transit operators in the Bay Area, such as Golden Gate Transit, AC Transit, Muni, BART, Caltrain, VTA, and SamTrans. For San Mateo County, this means deploying the TransLink system within SamTrans, Caltrain and BART. According to MTC staff, funds for procuring TransLink equipment and installation onto SamTrans vehicles and at Caltrain stations are already included in the TransLink budget. However, budget is not available for additional staff for each transit agency to administer the TransLink system. According to SamTrans staff, deployment of TransLink onto Caltrain and SamTrans transit vehicles will not be complete until December, 2006 at the earliest.

The near-term goal of this project is to continue installation of the infrastructure (such as pull boxes, conduit, electrical service, etc.) at the transit stations and continue installation of the infrastructure on the transit vehicles (such as the mounting for the TransLink readers) so that the

computer equipment and TransLink readers will be ready to be deployed and tested prior to December, 2006. SamTrans will also need to develop operating costs associated with administering the TransLink system and seek funding from MTC for additional staff resources to administer the TransLink system prior to the revenue ready date of December, 2006.

Actions to be undertaken in the next six to twelve months:

1 Continue installation of the infrastructure at the transit stations and on the transit vehicles; and
2 Develop operating cost budget for fiscal year 2007 and request MTC budget for administration of the TransLink system

Long-term activities include continued administration of system and equipping new buses and transit stations with the necessary TransLink equipment. Interagency revenue transfer agreements will need to be developed between MTC and SamTrans, Caltrain, and BART prior to the revenue ready date of December, 2006.

IM #1: Develop Countywide incident management plans (high priority)

The overall goal of this project is to develop plans for responding to incidents on the County's transportation system. This may include the procedures and protocols for the detection, notification, verification, communication/dispatch, response and clearance of incidents. The Plan would also identify the proper lines of communication and chain of command for all first responders and support personnel when an incident situation is detected.

The near-term objective is to define traffic management incident response plans. These traffic management plans would focus on where traffic would be diverted and how this traffic would be managed in case of an incident on a major roadway.

Actions to be undertaken in the next six to twelve months:

1 Establish traffic incident management working group
2 Define guiding principles, roles and responsibilities
3 Develop Concept of Operations
4 Identify diversion routes and facilities
5 Define management strategies and requirements
6 Identify short-term action plan
7 Develop order-of-magnitude cost estimates

Subsequent phases of this project include developing the necessary interagency agreements and deploying the recommended field equipment. There will also be a need to engage a broader spectrum of stakeholders in order to develop more comprehensive incident management plans.

SE #1: Prepare an overall Communications Network Plan for the San Mateo County ITS Program (high priority)

The overall goal of this project is to identify the communication network infrastructure that will be needed to support the San Mateo County ITS Program. Specifically, the network plan will

identify gaps in the existing communication network and identify the appropriate strategies for filling these gaps. The communications network plan will be a blueprint for the County's agencies to use to expand their networks for the future and make sure segments that are installed are consistent with the overall communications network plan.

As the communication network forms the backbone for most ITS applications, it is critical that this plan be in place as early as possible. Thus, preparation of the countywide communications network plan will be undertaken as an early-winner project. Because this plan will be based on assumptions regarding what ITS applications will be deployed in the future, greater emphasis will be placed on defining near-term communication network requirements and strategies.

Actions to be undertaken in the next six to twelve months:

1. Inventory existing systems and networks building from that already conducted for the Strategic Plan
2. Identify current, near-term and long-term needs or gaps based on assumed deployment of ITS applications
3. Identify and evaluate potential solutions looking at capabilities and constraints
4. Define specific recommendations for addressing current and near-term solutions
5. Develop order-of-magnitude cost estimates

Following completion of the communications network plan, various agencies will be tasked with the responsibility to implement the plan's recommendations. In most cases, detailed design will be required before deployment.

Table 12-1 Early Winner Projects - Next Steps

Lead Agency[1]	Participating Agency(ies)[1]	Near-Term Action Items
FM #1: Bring already deployed freeway ITS devices into full and stable operation		
C/CAG	Caltrans	•7 Confirm status of existing freeway and highway ITS devices •8 Identify specific requirements to bring each device to operational status •9 Estimate order of magnitude cost to upgrade each location •10 Define implementation priorities •11 Identify and secure funding •12 Develop interagency agreement between C/CAG and Caltrans for funding of repairs
AM#1 Upgrade existing traffic signal systems – fill critical gaps in signal inter-connect network		
C/CAG	Local PW, Caltrans, SamTrans	•8 Identify the key arterial corridors and segments •9 Identify gaps in the interconnect network for these key corridors and segments •10 Define interconnect requirements (e.g. boundaries, type of communication link) for each location •11 Develop order-of-magnitude cost estimates •12 Establish priorities for implementation •13 Define projects and responsible agencies •14 Define potential funding program
AM #7: Provide a link between traffic signal systems operated by local agencies and by Caltrans		
C/CAG	Local PW, Caltrans	•1 Define data-sharing requirements (i.e. what agencies would be involved, what data to share) •2 Identify system access strategy and data-sharing protocols •3 Identify interface requirements (hardware, software) •4 Develop order-of-magnitude cost estimates •5 Develop implementation work plans
TM #1: Implement Automated Vehicle Location (AVL) systems on Caltrain rail vehicles		
Caltrain	Caltrain	•6 Identify and secure necessary Regional Measure 2 funding •7 Procure and install AVL equipment on Caltrain rail vehicles •8 Upgrade, as necessary, AVL hardware and software in the SamTrans TMC
TM #3: Explore applications for transit signal priority (TSP) along key transit corridors		
SamTrans	Local PW, Caltrans, C/CAG	•9 Work with stakeholders to define TSP requirements •10 Develop memorandums of understanding between Caltrans, SamTrans, and the affected local agencies •11 Continue working with PATH on an adaptive transit signal priority system. •12 Coordinate with stakeholders on the AM#7 project •13 C/CAG to identify funding sources for SamTrans to seek funding through potential grants and capital improvement projects
TM #4: Install electronic information signs at transit transfer and major activity centers		
SamTrans	Caltrain, BART, Muni, AC Transit, VTA, MTC	•1 Develop appropriate interagency and public/private partnership agreements •2 Identify and prioritize locations for installing the signs
TM #7: Expand deployment of TransLink electronic fare system		
MTC	SamTrans,	•1 Continue installation of the infrastructure at transit stations and on the

	Caltrain, BART	transit vehicles
		•2 Develop operating cost budget for fiscal year 2007 and request MTC budget for administration of the TransLink system
IM #1: Develop Countywide incident management plans		
C/CAG	Local PW, Caltrans, MTC, Local ESP, County OES, CHP	•8 Define guiding principles, roles and responsibilities •9 Develop Concept of Operations •10 Identify diversion routes and facilities •11 Define management strategies and requirements •12 Identify short-term action plan •13 Develop order-of-magnitude cost estimates
SE #1: Prepare an overall Communications Network Plan for the San Mateo County ITS Program		
C/CAG	Local PW, Caltrans, MTC, SamTrans	•6 Inventory existing systems and networks building from that already conducted for the Strategic Plan •7 Identify current, near-term and long-term needs or gaps based on assumed deployment of ITS applications •8 Identify and evaluate potential solutions looking at capabilities and constraints •9 Define specific recommendations for addressing current and near-term solutions •10 Develop order-of-magnitude cost estimates
Establish On-going County ITS Program		
C/CAG		•13 Identify ITS Coordinator •14 Define coordinating committee structure •15 Conduct initial committee meeting
1. The San Mateo County Transportation Authority (SMCTA) will be a potential participant in the planning and deployment of all projects as funding partner.		
Source: DKS Associates, 2005		

Appendix A
Technical Memorandum #1
Inventory of Existing and Planned ITS Elements

DKS *Associates*
TRANSPORTATION SOLUTIONS

Appendix B
Technical Memorandum #2
Transportation Deficiencies and Needs

DKS *Associates*
TRANSPORTATION SOLUTIONS

Appendix C
Technical Memorandum #3
ITS Opportunities

DKS *Associates*
TRANSPORTATION SOLUTIONS

**Appendix D
Technical Memorandum #4
Project Concept Descriptions**

DKS *Associates*
TRANSPORTATION SOLUTIONS

Appendix E
High Priority Project Concept Fact Sheets

DKS *Associates*
TRANSPORTATION SOLUTIONS

Appendix F
ITS Project Deployment Consideration

Appendix G
San Mateo ITS Program Management

Appendix E

High Priority Project Concept Fact Sheets

Project Fact Sheet	
Category & Project number	**Freeway Management #1**
Project Concept	**Bring already deployed ITS devices into full and stable operation, and allocate funding and resources for the O&M**
Rating	High
Timeframe	0-5 years
Agency Participation	Planning	Deployment
	C/CAG, Caltrans	Caltrans

Project Detailed Description:

Currently, Caltrans has installed a number of ITS field devices within San Mateo County. Most of these devices have been installed along US 101, although some are installed along I-280 (north of I-380), I-380, SR 92 (east of I-280), and SR 84 (East of US 101). According to a Traffic Operations System (TOS) Inventory provided by Caltrans in June of 2004, the ITS field devices deployed within San Mateo County include 61 CCTV cameras, 11 CMS's, 14 extinguishable message signs (EMS), 9 HAR's, 50 ramp metering locations, 161 detectors, and 9 ETC readers. However, a number of these devices are not fully operational, for a variety of reasons. Table 8 summarizes the status of these devices.

Table 8: Freeway System ITS Field Devices (San Mateo County only)

Device	Status					Total
	Operational	Functional	Incomplete	Out of Order	Under Construction	
CCTV	22	5	9	17	8	61
CMS	8		1		2	11
EMS	3		5	2	4	14
HAR	3		2	1	3	9
Ramp Meters	1	17	20		12	50
Detector	139		3		19	161
ETC Reader	6				3	9
TOTALS	**176**	**22**	**40**	**20**	**48**	**315**

Source: Caltrans Traffic Operations System (TOS) Inventory (January, 2005)

This project would upgrade to operational status the ITS equipment that is classified as functional, incomplete, or out of order. In order to upgrade the ITS field devices to operational status, existing hardware that is outdated or broken would be replaced, locations needing communications links to the TMC would be identified and new hardware would be installed to enable communication to the TMC, and locations that require power or telephone service connection would be identified and the necessary work implemented.

- Also, the process would involve looking into possible sharing of resources and infrastructure, primarily for remote communications to the field devices, e.g., using the County's wireless communications system as a

means to bridge any communications gaps.

- Repairing and making the ITS equipment operational in the County will improve the traffic monitoring and incident verification capabilities within the region as well as maximize and optimize the use of the current ITS infrastructure.

Elements that would be involved in this project include:

- Investigating with Caltrans each specific location that is not fully operational
- Identifying what is needed to bring each device to operational status
    - Replacing or repairing "out of order" devices
    - Determining what infrastructure already exists and what is remaining to be installed for devices labeled "incomplete" and
    - Identifying options for providing remote communications with devices labeled as "functional"
- Implementing corrective measures
- Providing funding for on-going operations and maintenance

Project Fact Sheet	
Category & Project number	**Freeway Management #2**
Project Concept	- Make Caltrans Traffic Management Center (TMC) - fully-operational with respect to San Mateo County
Rating	High
Timeframe	0-5 years

Agency Participation	Planning	Deployment
	C/CAG, Caltrans	Caltrans

Potential Participants	Caltrans, C/CAG, TA

Project Detailed Description:

- The field devices described in Freeway Management Project #1 communicate with the TMC operated by Caltrans. From there, information on traffic conditions
- is monitored and traffic management devices such as CMSs and ramp meters are controlled. However, effective management of the entire Bay Area freeway system requires significant resources.

- Caltrans operates the freeway system for the Bay Area from the District 4 TMC. However, Caltrans does not have enough resources to manage the entire Bay Area effectively. Additional Caltrans staff resources housed inside the Caltrans TMC would focus on managing freeway operations in San Mateo County, monitoring traffic and verifying incidents occurring within the County.

Elements that would be involved include:

- Providing financial support for additional TMC staff to manage the freeway, highway, and arterial system in San Mateo.
- Installing additional hardware at the TMC as necessary, such as workstations and monitors for viewing the video from the freeway cameras.

Project Fact Sheet		
Category & Project number	**Freeway Management #7**	
Project Concept	Bring ramp metering system, as approved, into operation to help manage traffic flow on the freeways, integrate traffic signal operations with future ramp meters, and allocate funding and resources for the O&M	
Rating	• (medium/high priority).	
Timeframe	0-10 years	
Agency Participation	Planning	Deployment
	Caltrans, C/CAG, Caltrans, Local PW	Caltrans, Local PW
Project Detailed Description:		

Project Detailed Description:

The Peninsula Corridor Ramp Metering Study is analyzing potential benefits and impacts of ramp metering along US 101 and the northern segment of I-280 between I-380 and the County line. The study is expected to be finalized in early 2005 and lead to recommendations on whether to pursue ramp metering within San Mateo County.

According to Caltrans, there are additional projects pending future funding. One of them is CCTV surveillance of the ramp meters to be monitored and operated from the TMC. There are also plans to install new cameras and/or relocate existing cameras at five metering locations.

- If ramp metering is implemented, the integration of the future ramp meters with the local traffic signal operations will improve agency coordination between the freeway operations and the local arterial street traffic operations, increase the efficiency of the roadway network adjacent to the ramp metering locations and improve the flow of traffic along the arterials that are adjacent to the on and off-ramp signals.

If ramp metering is approved for use in San Mateo County, elements that would be involved include:
- Installing ramp metering field equipment where needed
- Providing necessary communication hardware, software and infrastructure to:
  - Establish communications to the Caltrans TMC
  - Integrate ramp meters with traffic signals
- Developing MOU's between Caltrans and the local agencies affected by ramp metering
- Providing funding for on-going operations and maintenance

Project Fact Sheet		
Category & Project number	**Arterial Management #1**	
Project Concept	**Upgrade existing traffic signal systems and allocate funding and resources for the O&M**	
Rating	**high/medium priority**	
Timeframe	0-20 years	
Agency Participation	Planning	Deployment
	C/CAG, Caltrans, Local PW	Caltrans, Local PW

Project Detailed Description:

There is a mixture of traffic signal controllers currently used by the local agencies, including Type 170, Traconex TMP-390, Econolite ASC-8000, and Multisonics 820. Some of the traffic signal controllers have been in operation for more than 15 years and lack the sophistication or processing power to run advanced traffic control programs. Most of the cities do not have the resources to regularly monitor traffic conditions and update signal timing plans.

This project would enable local agencies to collect volume data and thus implement updated traffic signal coordination plans and other advanced control strategies such as adaptive signal control along key congested or unpredictable arterials. The implementation of advanced control strategies would improve traffic signal coordination and the management of traffic, without the need for additional staff. Any updates to communications equipment would be included under Supporting Elements.

This project would entail:

- Identifying areas where enhanced operation is warranted
- Replacing antiquated equipment
  - Controllers, cabinets, detectors, software
- Expanding or upgrading signal systems
  - Expand coverage of central systems
  - Provide coordination across signals
  - May require additional infrastructure, hardware and software
- Evaluating and updating outdated traffic signal timings only.

Project Fact Sheet	
Category & Project number	**Arterial Management #7**
Project Concept	**Provide a link between traffic signal systems operated by local agencies and by Caltrans, and allocate funding and resources for the O&M**
Rating	**high/medium priority**
Timeframe	0-5 years

Agency Participation	Planning	Deployment
	C/CAG, Caltrans, Local PW	Caltrans, Local PW

Project Detailed Description:

Caltrans operates approximately 60 percent of the traffic signals in the County with intersections in almost every city within San Mateo County. Most Caltrans-owned traffic signals are connected to their signal system, CTNet.

The signal progression of traffic in local cities on roadways that include Caltrans-owned signals may not be coordinated efficiently with adjacent local agency-owned signals if there is not a link between them. The flow of traffic from one signal affects the operation of the adjacent signal. Allowing the signals owned by Caltrans and the local agency to communicate with each other will improve the flow of traffic along the roadways within the County.

Elements that would be involved in this project include:
- Identifying coordination requirements
- Providing communication link between affected signals (e.g. signal interconnect cable, center-to-center link)
- Developing necessary interface between controllers/signal systems
- Establishing communication link between CTNet at Caltrans TMC and local systems

Project Fact Sheet		
Category & Project number	**Arterial Management #2**	
Project Concept	**Install CCTV cameras at key congested locations throughout the County and allocate funding and resources for the O&M**	
Rating	**medium/high priority**	
Timeframe	0-5 years	
Agency Participation	Planning	Deployment
	C/CAG, Caltrans, Local PW	Caltrans, Local PW

Project Detailed Description:

Currently, there are no CCTV cameras installed along arterials in the County. Installing CCTV cameras at key congested locations throughout the County would improve monitoring and incident detection capabilities, primarily by providing real-time visual conditions.

The placement of CCTV cameras would focus on high-volume, high-incident areas and areas that are most critical to the operation of the transportation network, especially those on the Metropolitan Transportation System (MTS). Potential locations for the placement of CCTV cameras include entrances and exits to event centers, and near regional attractions such as the Cow Palace, Serramonte Shopping Center, Tanforan Shopping Center, and Hillsdale Shopping Center. CCTV cameras installed in these areas would help improve the management of traffic during major events or during the holiday shopping season. As an example, to help monitor the traffic to Hillsdale Shopping Center, the largest shopping center in the County, one potential project may be to install CCTV cameras on El Camino Real between Highway 92 and Hillsdale Boulevard and on Hillsdale Boulevard between the US 101 interchange and El Camino Real.

This project would involve the following:

- Working with stakeholders to determine the camera locations and central monitoring requirements including staffing requirements
- Designing and installing CCTV system(s)
- Implementing central monitoring facilities (e.g. workstations, monitors, software)
- Providing communication hardware, software and infrastructure for transmission of camera feed to monitoring location(s)

Typically, the video signals from the CCTV cameras are transmitted back to a central viewing location. The Communications Network Plan (prepared as part of Supporting Elements #1) will determine how and where the video signals will be transmitted. The CCTV cameras would be accessible by both local agencies and Caltrans staff. The project will include setting up workstations at local agencies for viewing the CCTV cameras.

Project Fact Sheet	
Category & Project number	**Transit Management #1**
Project Concept	**Implement Automated Vehicle Location (AVL) systems on Caltrain rail vehicles, and allocate funding and resources for the O&M**
Rating	**high priority**
Timeframe	0-5 years
Agency Participation	Planning
	Caltrain

(Agency Participation — Deployment: Caltrain)

Project Detailed Description:

- SamTrans currently has AVL systems installed and operating on 317 fixed route
- and 76 paratransit buses for providing real-time vehicle location information for real time fleet control, fleet performance tracking, fleet security, and Passenger Information Systems (arrival and departure information) purposes. Installation began in 2001 and final acceptance of the contract installing the equipment was completed in December, 2004. Software is currently in place for analyzing the
- AVL data at the TMC. SamTrans can track on time performance in near real-time and also historically track vehicle location, movement, etc. Currently, SamTrans has limited tools to "mine" data. They are in the process of developing other uses for the data.

- The AVL system is a foundation for the transit management system, which includes an automated passenger counting system, computer aided dispatch, a traveler information system, and a radio communications network for communicating to each of these systems.

- SamTrans/Joint Powers Board is interested in equipping approximately 60 Caltrain rail vehicles (30 engines and 30 cab cars) with an AVL system for the purposes of real-time fleet control, fleet schedule performance tracking such as on-time performance between stations, fleet security, and Passenger Information Systems (arrival and departure information on the rail vehicle as well as at the station), load factor, line segment utilization and ridership information, on-board audio and visual real-time displays.

- Currently, Caltrain can only monitor end points locations for the trains. An AVL system for the trains will assist staff in understanding what is happening in-between the end points.

Elements of this project concept would include:

- Furnishing and installing radios and GPS receivers on all Caltrain rail vehicles
- Installing AVL hardware and software in the SamTrans TMC as necessary
- Providing the funding and resources for on-going operations and maintenance

Project Fact Sheet		
Category & Project number	**Transit Management #3**	
Project Concept	**Explore applications for transit signal priority (TSP), design and implement along key transit corridors within the County, and allocate funding and resources for the O&M**	
Rating	**High/medium priority**	
Timeframe	5-10 years	
Agency Participation	Planning	Deployment
	SamTrans, Local PW, C/CAG, Caltrans	SamTrans, Local PW, Caltrans

Project Detailed Description:

The El Camino Real corridor yields the highest bus usage in the SamTrans system and is expected to grow over the next decade. SamTrans is planning express bus service along El Camino Real and a transit signal priority system for El Camino is critical for the delivery of the express service.

Other areas identified by SamTrans staff as potential candidates for TSP include Junipero Serra Boulevard in Daly City and at the signals adjacent to the Millbrae BART station.

SamTrans is also working with FTA, Caltrans, and UC Berkeley PATH on exploring the feasibility of an adaptive signal priority system for El Camino Real (in San Mateo County only). The system would work with the master controller over several signals. Using a Global Positioning System (GPS) and radios on the buses for mobile communications, the buses send a signal back to SamTrans AVL System, which in turn sends a signal to Caltrans District 4's signal system (center-to-center communications). The Caltrans signal system, CTNet, then sends a signal to the field traffic controllers. The traffic controllers will then perform transit signal priority (TSP) operations based on pre-set criteria, e.g., last TSP call, minimum phase durations. Disruption to side-street traffic is expected to be minimal since only a small group of intersections would be affected at a time. TSP operations are currently occurring on the San Pablo Avenue (Hwy 123) corridor in Alameda County.

Possible hardware elements of this project include purchasing additional GPS receivers, mobile radios for buses, TSP emitters for buses, and TSP detectors at the traffic signal locations. There would also be the need for new computer and communications hardware and software to enable the adaptive signal priority along the key transit corridors within the County.

Elements that would be involved include:

- Working with stakeholders to define TSP requirements
- Installing necessary hardware and software within the TMC's, the bus fleet and the traffic signal controllers
- Developing and implementing new traffic signal timings for effective TSP operations
- Providing the funding and resources for on-going operations and maintenance
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Project Fact Sheet		
Category & Project number	**Transit Management #4**	
Project Concept	**Install electronic information signs at transit transfer and major activity centers and allocate funding and resources for the O&M**	
Rating	**High priority**	
Timeframe	0-5 years	
Agency Participation	Planning	Deployment
	SamTrans, Caltrain, BART, Muni, AC Transit, VTA, MTC	SamTrans, Caltrain, BART, Muni, AC Transit, VTA
Project Detailed Description:		

Project Detailed Description:

- A common concern for transit riders or potential riders is the uncertainty of the buses keeping on-schedule, or when the buses would be arriving if they are delayed. This is especially important if a rider is transferring to another bus route. This project concept would seek to address this concern by providing real-time transit information at key locations.

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- According to SamTrans, the District has installed infrastructure to provide passenger information (predicted arrival time) at the Millbrae BART Station. There are currently three kiosks at the station along with dual panel LCD displays at each bus bay displaying real-time arrival times for SamTrans buses. The predicted arrival system at the SamTrans TMC transmits arrival information to a remote transmission site and then transmits the information to the main kiosk at the BART station. The main kiosk then transmits the information to the other two kiosks and the LCD display signs. Communication from the SamTrans TMC to the remote transmission site, kiosks and LCD displays are via SamTrans' existing radio communication network.

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- The passenger information system can be expanded to transit centers and major activity centers. There is also a potential for public/private partnerships for the procurement and installation of electronic information signs and kiosks at other transit centers and major activity centers such as Hillsdale Shopping Center or Serramonte Shopping Center.

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- Possible elements of this project include:
- Developing appropriate interagency and public/private partnership agreements
- Installing electronic information signs at transit transfer and major activity centers, such as Caltrain stations, BART stations, SFO, other intermodal facilities, regional shopping centers and event centers
- Providing the necessary communications hardware, software and infrastructure to enable remote communications for predicted arrival time information to be sent from SamTrans TMC to the electronic information signs
- Providing the funding and resources for on-going operations and maintenance
-

Project Fact Sheet	
Category & Project number	**Transit Management #6**
Project Concept	**Install in-vehicle electronic signs on transit vehicles and allocate funding and resources for the O&M**
Rating	**High priority**
Timeframe	5-10 years
Agency Participation	Planning
	Caltrain

Agency Participation	Deployment
	Caltrain

Project Detailed Description:

- American Disability Act (ADA) requires voice announcements and visual display of the announcement on all transit vehicles for the hearing and visually impaired riders. According to SamTrans, electronic signs were installed on 317 fixed-route buses in 2002. The signs visually display next-stop information, time, date, and courtesy information.

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- There is a need for additional in-vehicle electronic signs to be installed on approximately 30 Caltrain rail vehicles. The electronic signs would display the same information as what is displayed on the buses, as well as interface with the advanced communication system to provide real-time information on the arrival time of the train at the next station.

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- Possible elements of this project include:
- Procurement and installation of the in-vehicle electronic signs on the full fleet of rail vehicles.
- Communications hardware and software installed on the rail vehicles to enable remote communications for traveler information to be sent from SamTrans TMC to the transit vehicle and displayed on the sign.
- Providing the funding and resources for on-going operations and maintenance
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Project Fact Sheet		
Category & Project number	**Transit Management #7**	
Project Concept	**Expand deployment of TransLink electronic fare system and allocate funding and resources for the O&M**	
Rating	**high/medium priority**	
Timeframe	0-5 years	
Agency Participation	Planning	Deployment
	MTC, SamTrans, Caltrain, BART	SamTrans, Caltrain, BART
Project Detailed Description:		

- There are several transit agencies in the Bay Area providing service to riders of buses, trains, light rail vehicles, and ferries. However, each agency has a separate payment and ticket system so transfers can be inconvenient for the rider.

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- On February 1, 2002, the Metropolitan Transportation Commission (MTC) and six San Francisco Bay Area transit agencies introduced the TransLink® regional fare payment system. With TransLink®, customers use a single smart card, which is about the size of a credit card, to ride Bay Area buses, trains, light rail lines, and ferries. The nine-county Bay Area is the first region in the U.S. to have a single card that can be used on all forms of public transit.

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- According to MTC staff, funds for TransLink equipment and installation by the contractor onto SamTrans vehicles and Caltrain stations are already included in the TransLink budget. However, budget is not available for additional staff for each transit agency to administer the TransLink system. This project would provide funding to transit agencies for additional staff resources for administering the TransLink system. In addition, funding is not available for installation of new buses and future stations.

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- Possible elements of this project include:
- Providing the funding to transit agencies within San Mateo County for additional staff resources to administer the TransLink system
- Installing TransLink equipment on new buses and at future stations
- Providing the funding and resources for on-going operations and maintenance
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Project Fact Sheet	
Category & Project number	**Transit Management #10**
Project Concept	**Provide amenities such as access to the Internet on rail transit vehicles and allocate funding and resources for the O&M of the ITS elements and communication network**
Rating	**high priority**
Timeframe	5-15 years
Agency Participation	Planning	Deployment
	Caltrain	Caltrain

Project Detailed Description:

Mobile Wi-Fi has been identified as a high importance item by Caltrain staff for implementation on rail vehicles. Besides providing increased passenger convenience, the technology will support other systems including AVL for rail vehicles, real-time passenger counts, ticket validation, etc.

The specific technology to implement Wi-Fi on the trains has not been identified by Caltrain. Existing communications infrastructure would need to be evaluated to determine if it can be utilized for providing mobile Wi-Fi on the trains. The hardware components may include wireless hubs, switches, routers, servers, and firewalls. Caltrain would need to determine business model for providing this convenience to riders

Possible elements of this project include:
- Developing appropriate business model
- Providing necessary communications hardware and software installed on the rail vehicles and at the major transit stops to allow Wi-Fi internet access.

Project Fact Sheet	
Category & Project number	**Traveler Information #1**
Project Concept	**Implement CMS's at key locations along I-280, I-380 and US 101 freeways, and allocate funding and resources for the O&M**
Rating	**high priority**
Timeframe	0-5 years

Agency Participation	Planning	Deployment
	C/CAG, Caltrans	Caltrans

Project Detailed Description:

Caltrans currently has 11 CMS's in operation within the County. Most of these CMS's are installed along US 101 and I-380. At this writing, additional CMS's were not planned for the County. CMS's are often used to provide the traveling public real-time information regarding the road conditions ahead, for incident management, and to enhance the traveler's trip.

Additional CMS's may be installed along I-280 near the I-380 interchange, Serramonte Shopping Center, and at Sand Hill Road. Along US 101, additional CMS's may be installed near the San Francisco International Airport, Highway 92, and Highway 84. The CMS would be designed to be controlled from Caltrans' TMC through a communications link between the CMS and the TMC. This communications link would be included under Supporting Elements.

Elements that would be involved include:

- Working with stakeholders to determine the key locations along the freeways within the County
- Designing and installing CMS's at selected locations
- Providing necessary communications hardware, software and infrastructure to enable Caltrans TMC control of CMS's
- Upgrading TMC facilities as required
- Providing the funding and resources for on-going operations and maintenance

Project Fact Sheet		
Category & Project number	**Traveler Information #8**	
Project Concept	**Enhance distribution of traveler information to the media for real-time dissemination**	
Rating	**high priority**	
Timeframe	0-5 years	
Agency Participation	Planning	Deployment
	CHP, Caltrans, MTC, Local PW, Local Police	CHP, Caltrans, MTC, Local PW, Local Police
Project Detailed Description:		
Traveler information in the Bay Area is available through the regional traveler information system, 511 (www.511.org). The 511 system is a toll-free phone and web service that attempts to provide up-to-the-minute information on traffic conditions, incidents and travel time information. However, the information reported primarily covers the freeways. This project would provide roadway incident and transit information to the media that is focused on local conditions within the County. It will utilize existing systems such as 511 to disseminate traveler information. In the future, MTC is also interested in exploring the feasibility of providing information from real-time AVL and vehicle arrival systems onto the 511 website. Some of the elements that would be involved include: • Defining how local agencies will be able to transmit real-time travel conditions (e.g. Via 511, directly to the media, both) • Establishing necessary communications systems or protocols, data formats, maintenance considerations		

Project Fact Sheet	
Category & Project number	**Traveler Information #2**
Project Concept	**Implement CMS's at key locations along Highways 92, 84, 82, 35 and 1 and allocate funding and resources for the O&M**
Rating	**high/medium priority**
Timeframe	0-5 years

Agency Participation	Planning	Deployment
	C/CAG, Caltrans	Caltrans

Project Detailed Description:

Caltrans has four CMS's installed along Highway 92 and two CMS's installed along Highway 82. Similar to the CMS's installed along the freeways, these CMS's would be used to provide the public with real-time information on transportation conditions.

The additional CMS's would need to be placed at strategic locations in advance of decision points to allow drivers enough warning time to potentially modify their routes, if possible.

Candidate locations for CMS installation include:

- Westbound Highway 92 approaching Highway 1;
- Eastbound Highway 82 approaching US 101;
- Northbound and southbound Highway 82 approaching Hillsdale Shopping Center, and;
- Southbound Highway 35 approaching Highway 1.

The signs would be controlled from Caltrans' TMC via a communications link between each CMS and the TMC. The locations of the CMS would be coordinated with future CCTV camera installations since the cameras can be used to verify that the correct message is being displayed on a CMS, and also to verify the sign's correct operation. The communications link would be included under Supporting Elements.
Some of the elements that would be involved include:

- Working with stakeholders to determine the key locations along the freeways within the County
- Designing and installing CMS's at selected locations
- Providing necessary communications hardware, software and infrastructure to enable Caltrans TMC control of CMS's
- Upgrading TMC facilities as required
- Providing the funding and resources for on-going operations and maintenance

Project Fact Sheet		
Category & Project number	**Incident Management #1**	
Project Concept	**Develop and implement Countywide emergency/incident management plans**	
Rating	**high priority**	
Timeframe	0-10 years	
Agency Participation	Planning	Deployment
	C/CAG, Local PW, Caltrans, MTC, Local ESP, County OES, CHP	Local PW, Caltrans, Local ESP, County OES, CHP
Project Detailed Description:		

The project would involve the development of an overall plan for the detection, notification, verification, communication/dispatch, response and clearance of incidents and emergencies within the County. The Plan would identify the proper lines of communication and chain of command for all first responders and support personnel when an incident or emergency situation is detected.

In order to effectively develop the Plan, a series of meetings, interviews, and detailed input would be required of each agency involved. In addition, any existing Plans would need to be researched and incorporated, or built on as part of this new Incident/Emergency Management Plan.

A major consideration in the development of this incident/emergency management system is the ability of the different agencies to properly and effectively communicate with each other. This requires different communications systems to functionally interoperate with each other. San Mateo County is unique in that the emergency services agencies work very well and effectively with each other. This project would build upon the relationships and communications systems that already exist for these agencies. It may be that much of the coordination would be through the 911 Dispatch Center in Redwood City, which provides the backbone communications for the county's fire departments.

Elements that would be involved include:
- Identifying key agencies
- Reviewing current plans, procedures and protocols
- Developing and documenting recommended plans, procedures and protocols
- Providing necessary interagency agreements
- Providing necessary equipment to implement plan responses
- Providing a reliable communications system during an emergency, including a backup system

Project Fact Sheet		
Category & Project number	**Incident Management #6**	
Project Concept	**Standardize emergency vehicle pre-emption equipment countywide, implement on major routes, and allocate funding and resources for the O&M**	
Rating	**high priority**	
Timeframe	5-10 years	
Agency Participation	Planning	Deployment
	C/CAG, Local PW, Local ESP	Local PW, Local ESP
Project Detailed Description:		

Since the County's 911 dispatch service coordinates the various fire, law enforcement and emergency medical services, the fire departments or districts within the County essentially function as one department. Consequently, it is important that the emergency vehicle preemption equipment installed throughout the County is compatible and interoperable. Preemption equipment from different manufacturers would not be compatible, especially if an encoding scheme is utilized. Most of the cities that have installed emergency vehicle preemption systems are using the Opticom™ system manufactured by 3M. However, the County does not have any existing standards or specifications for the installation and operation of preemption equipment.

Agencies may have the option of programming the preemption system with encoding in order to prevent unauthorized use of preemption. With the potential widespread operation of preemption and the concept of mutual aid amongst agencies, the use of encoding will be very important, primarily to prevent unauthorized use which may serve to delay a responding vehicle.

Some of the elements that would be involved include:
- Reviewing existing systems and deployment coverage
- Identifying incompatibilities and gaps
- Establishing standards for future procurements and deployments
- Installing necessary equipment on vehicles and at intersections
- Developing necessary interagency agreements

Project Fact Sheet		
Category & Project number	**Incident Management #2**	
Project Concept	**Install CCTV cameras at key locations throughout the County and allocate funding and resources for the O&M**	
Rating	**medium/high priority**	
Timeframe	5-10 years	
Agency Participation	Planning	Deployment
	C/CAG, Local PW, Caltrans, County OES	Local PW, Caltrans
Project Detailed Description:		

As part of Emergency Management Project #1, an emergency/incident management plan for the County will be developed. This project would expand the Emergency/Incident Plan to include the coordination with the adjacent counties (e.g., San Francisco and Santa Clara County).

Some of the elements that would be involved include:
- Identifying stakeholders
- Reviewing plans and systems
    - Identify incompatibilities
    - Develop recommended plans
    - Establish protocols
- Developing necessary interagency agreements
- Providing necessary equipment to implement plan responses

Project Fact Sheet		
Category & Project number	**Supporting Elements #1**	
Project Concept	**Prepare an overall Communications Network Plan for the San Mateo County ITS Program**	
Rating	**high priority**	
Timeframe	0-5	
Agency Participation	Planning	Deployment
	C/CAG, Local PW, Caltrans, MTC, SamTrans	Local PW, Caltrans, MTC

Project Detailed Description:

The communications network plan for the San Mateo County ITS Program will identify which gaps in the communication network will need to be filled in order to support the project concepts and communicate with the ITS equipment effectively. The communications network plan will be a blueprint for the County to use to expand their network for the future and make sure segments that are installed in the County are consistent with the overall communications network plan.

Some options to consider in the communications master plan include expanding the existing RCN fiber network, expanding franchise agreements with Comcast, connecting into Caltrans' proposed fiber optic backbone on US 101, evaluating the feasibility of utilizing private infrastructure to form part of the overall communication network, and utilizing the County's microwave system to provide communications between agency systems and potentially field devices.

The elements that would be involved include:

- Defining specific needs/gaps to support other ITS projects
- Developing communication network concept:
  - Identify and evaluate options
  - Develop recommendations
- Defining an implementation plan, including the level of coordination and integration with the other projects
- Estimating the construction cost for each option

Project Fact Sheet		
Category & Project number	**Supporting Elements #2**	
Project Concept	**Design and upgrade the existing communications infrastructure to support the various ITS field devices and integration of signal systems throughout the County, and allocate funding and resources for the O&M**	
Rating	**high priority**	
Timeframe	2-20	
Agency Participation	Planning	Deployment
	C/CAG, Local PW, Caltrans, MTC, SamTrans	Local PW, Caltrans, MTC
Project Detailed Description:		

The communications network plan for the San Mateo County ITS Program will identify which gaps in the communication network will need to be filled in order to support the project concepts and communicate with the ITS equipment effectively. Once the plan has recommended which gaps in the communications network need to be filled, the next step in the project would be to design and construct the upgrades.

Designing and upgrading the communications system may be done in segments as part of the implementation of other projects (i.e. would upgrade the part of the communication network needed for that project, as opposed to looking at it from a full system perspective).

The upgrade of the existing communications infrastructure would replace any existing faulty or outdated communications systems and improve the cooperation and coordination between agencies and the sharing of information within the region. Furthermore, adjacent agencies traffic signal systems will be able to communicate between each other for sharing of traffic data and improve the regional mobility of the transportation network.

The elements that would be involved include:

- Designing the necessary upgrades
- Constructing the upgrades
- Entering into the necessary agreements where leasing or sharing of communications infrastructure is recommended

Appendix F

ITS Project Deployment Considerations

Appendix F - Deployment Considerations

The implementation of the projects identified in this Strategic Plan will be carried out by a broad spectrum of agencies and private interest groups within a very complex environment. To facilitate the efficient and effective implementation of ITS in the region, several factors must be considered during the planning, design and deployment of these projects. These factors may be summarized as follows:

- **Project Conformance.** Federal funding of ITS Projects will be contingent on projects being in conformance with the Regional ITS Architecture and, by extension, the National ITS Architecture.[1] As part of this, a systems engineering approach must be used in developing and defining individual projects. ITS projects within the County should also be consistent with applicable local plans such as the Countywide Transportation Plan and local General Plans.

- **Standards.** Another element of the federal requirements is that applicable ITS standards be used for all federally-funded ITS projects. More importantly, use of these standards can help support the design and specification process, and ensure interoperability between systems.

- **Interoperability.** To take full advantage of their potential, most individual ITS applications will need to accommodate linkages to other systems. This ability for the different ITS projects and systems to communicate and work with one another is referred to as "interoperability". The regional architecture and ITS standards provide a framework for this interoperability.

- **Inter-Agency Agreements.** Most of the ITS deployments in this Plan call for cooperative deployment and operations efforts between multiple jurisdictions. This will require a greater degree of coordination with other agencies than might normally be the case.

- **Funding.** Opportunities for funding and implementation for ITS Projects are not as obvious as for traditional types of transportation improvements. In some cases, ITS applications may be best implemented as "add-ons" to conventional improvements and incorporated into the overall project design. In other cases, targeted funding needs to be sought for stand-alone ITS applications. Additionally, the staging of projects in the strategic plan must be flexible enough to make adjustments to respond to funding opportunities and changing circumstances.

- **Procurement.** The traditional procurement and contract procedures used by agencies vary and may not always be well suited to the unique characteristics of ITS projects. Selection of appropriate procurement procedures for designing, developing and installing the elements of ITS projects will help ensure that long delays don't occur during implementation.

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[1] USDOT ITS Architecture, Final Rule (Federal Register, 23 CFR Part 940, January 8, 2001) requires ITS projects funded through the Highway Trust Fund to conform to the National ITS Architecture and applicable standards.

- **Operations and Maintenance.** Successful ITS applications depend to a great extent on the approach taken to provide day-to-day operation of the systems. Project sponsors must have a plan for and devote resources to operations. They cannot take a "set it and forget it" approach. They must think through not only how they will get a system running, but how they will keep it running, and how they will maximize its potential benefit.

A more detailed discussion of each of these factors is presented in the following sections.

F.1   Project Conformance

FHWA's ITS Architecture Final Rule (Federal Register, January 8, 2001) and FTA's National ITS Architecture Consistency Policy for Transit Projects (April 8, 2001) require that Federally-funded ITS Projects conform to the National ITS Architecture and approved standards. Conformance with the National ITS Architecture is interpreted to mean the use of the National ITS Architecture in developing a local implementation plan of the National ITS Architecture, referred to as a Regional ITS Architecture, and the subsequent adherence of all ITS Projects to that Regional ITS Architecture. The Regional ITS Architecture for the Bay Area, including San Mateo County, has been developed by MTC. The Regional ITS Architecture is intended to guide the development of specific projects and programs within the Bay Area.

The Final Rule (Section 940.11 a-c) also indicates that a systems engineering analysis must be used in the development of individual projects. This analysis is to be conducted on a scale commensurate with the project scope and should include:

- Identification of portions of the regional ITS architecture being implemented;
- Identification of participating agency roles and responsibilities;
- Requirements definitions;
- Analysis of alternative configurations and technology options;
- Procurement options;
- Identification of applicable standards; and
- Procedures and resources for operations and management.

During project implementation, the following results are expected from a project conformance analysis:

- The project specifications shall ensure that the project accommodates the interface requirements and information exchanges, and provides for the functionality and operations (both at the time of project implementation and in the future) between the agencies and jurisdictions as indicated in the Strategic Plan and Regional ITS Architecture. If a project is inconsistent with the regional architecture, the architecture itself should be updated accordingly.
- The project should use applicable ITS standards that have been published by the Standard Development Organizations.

F.2   Standards

Federal regulations (Section 940.11 f) state that all ITS projects using federal funds should use applicable ITS standards that have been officially adopted through rulemaking by the USDOT. The goal of this regulation is to ensure that ITS applications achieve the interoperability necessary to function consistently and effectively nationwide. ITS standards are specifications that define

how system components interconnect and interact within the overall framework of the regional ITS Architecture. They specify how different technologies, products and components interconnect and interoperate so that information can be shared automatically.

The U.S. DOT Standards Program is working towards fostering the widespread use of interoperable ITS elements by accelerating the development and deployment of ITS Standards. The U.S. DOT is using a five-track approach to develop ITS standards and to meet ITS deployment goals. Together with many partners and other stakeholders in the ITS community, the U.S. DOT is conducting a comprehensive, five-part program of activities in standards development, testing, outreach and education, technical assistance, and policy support.

Effective ITS deployment depends on the ability to integrate many advanced technologies; standards are essential in making this possible. With ITS standards, transportation agencies can implement systems to cost-effectively exchange pertinent data and accommodate equipment replacements, system upgrades, and system expansions. The traveling public can benefit from ITS standards through products that will function consistently and reliably anywhere in the country.

The current version of the tool (Turbo Architecture) used to create the Bay Area Regional ITS Architecture includes the capability to identify the relevant ITS standard activities associated with each architecture flow within the Regional ITS Architecture. This is a starting point for defining the specific standards that may be used for individual ITS projects and interfaces within the Bay Area and San Mateo County.

F.3 Interoperability

To take full advantage of their potential, most individual ITS applications will need to accommodate linkages to other systems and coordination between different agencies. This ability for the different ITS projects and systems to communicate and work with one another is referred to as "interoperability". Related to this, a goal of the federal ITS program is to ensure that mobile users can travel across the region and the nation and retain the same level of ITS services. There are three types (levels) of ITS interoperability that the San Mateo County ITS Program needs to be concerned with:

- Technical – the capability for equipment (hardware and software) to communicate effectively (i.e., send and receive information)
- Procedural – common procedures to exchange meaningful information
- Institutional – administrative and or/contractual agreements between operators and users of the information

The regional architecture and ITS standards provide a framework for achieving technical interoperability. Close coordination and cooperation between various agencies will be required to ensure procedural and institutional interoperability. This may be achieved, in part, through the development of inter-agency agreements.

F.4 Inter-Agency Agreements

Most of the ITS deployments in this Plan call for cooperative deployment and operations efforts between multiple jurisdictions. These types of deployments most often require some sort of inter-agency agreement such as a bi-lateral letter of agreement or a Memorandum of Understanding (MOU). Regardless of the specific institutional tool decided upon by agencies, the agreement should attempt to achieve the following:

- Establish roles and responsibilities for the smooth operation and maintenance of system components that affect management of regional traffic and traveler information on a day-to-day basis.

- Provide agencies with enough degree of freedom (as per agreement) so that motorist needs are met irrespective of the agency that has jurisdiction over the system components.

- Develop operational guidelines to regional agencies such that they follow consistent and common methods of operations, which benefit both motorists and the system operators.

- Set forth and mutually agree upon standard operating procedures and strategies for various components of the system.

- Serve as a standard reference document for partnering agencies for day to day operation and during staff turnovers.

- Establish contact personnel during and after hours of business to manage emergency situations.

- As part of the standard operating procedure identify:

  o Type of information to be shared (type and content) between agencies,
  o Resources to be shared between agencies and how, where, and to whom the information from the system can be distributed, and
  o How operating costs for the system will be distributed.

F.5 Funding Opportunities

The successful implementation of the San Mateo County ITS Strategic Plan will depend upon the availability of funding. Beyond the initial funding for development of this Strategic Plan, no local, state or federal funds are specifically set aside for project implementation, operations or maintenance of the projects recommended. Therefore, it is essential, from the inception of an ITS program or project, to seek every opportunity to secure funding from a variety of sources. This commitment of funding can be from private enterprise, public/private partnerships, or other arrangements such as special congressional ITS earmarks. However, it is more likely that funding for ITS projects will come from traditional transportation funding programs. As such, the ITS projects identified in the Strategic Plan will have to compete with other transportation projects for the same funding. This is part of the process of "mainstreaming" ITS.

There are numerous funding programs for which ITS projects are eligible. It is important to note that TEA-21 encourages ITS deployment through expanded eligibility of Federal-aid funding. As a result, all categories of Federal-aid funds are available for ITS implementation projects. Efforts at the national level indicate that it is not unreasonable to expect this emphasis to continue. In addition, other funding sources, such as FTA funds, can be used for certain types of ITS projects.

Obtaining adequate funding for the Strategic Plan elements in the San Mateo County will depend on the plan elements achieving a high enough priority in the regional planning and programming process. It will be the responsibility of the County's stakeholders to seek funding and make ITS implementation a priority in regional funding decisions.

It is also important to keep in mind that traffic management projects carry with them the obligation to operate and maintain the systems. Thus, it is critical to not only obtain capital outlay funding, but also to secure the commitment for covering on-going operating and maintenance costs.

F.6 Procurement

The traditional procurement and contract procedures used by agencies vary and may not always be well suited to the unique characteristics of ITS projects. ITS projects generally require extensive interagency cooperation, private sector personnel may need to be hired to support public facilities, public/private partnership agreements need to be determined, and privacy issues need to be resolved. ITS projects also involve the acquisition and placement of high-tech equipment that may require special procurement considerations. Therefore certain aspects of traditional procurement and contract procedures of the public agencies may have to be changed to accommodate ITS projects. Many ITS projects will have their own unique characteristics that will need to be addressed. This section identifies some of the options and issues relative to procurement and contracting procedures of ITS projects and services.

The implementation of ITS projects will require the system components of each project to be designed, developed/manufactured and installed. Unless the implementation phase is correctly planned and managed, long delays may occur in implementation.

Five basic procurement options have been identified.
- Engineer/Contractor

- Systems Manager

- Sole Source

- Design/Build (operate)

- Public/Private

The first two methods are traditionally used by public agencies. The latter three methods may require education of agencies for utilization of these techniques for implementing ITS projects. Each method is discussed in greater detail on the following pages.

Engineer (Consultant)/Contractor Approach. The Engineer Consultant)/Contractor method represents the traditional procedure used by public agencies. Based on project requirements and preliminary studies, the Engineer (Consultant) prepares the final study and/or design plans, specifications and estimates (PS&E) for the proposed project. An agency employee or a consultant can act as the Engineer. The completed PS&E are then presented to the Contractor community and receive bids in accordance with established procedures. The Contractor bids on the PS&E and agrees to provide a complete system consisting of hardware and software procured, installed and implemented by the Contractor.

Hardware may be manufactured by the Contractor's organization and/or subcontracted within the conditions imposed by the contract. The Contractor may also be responsible for system startup assistance. In the case of traffic control systems, the calibration of the system and the development and implementation of timing plans and other database elements may be required.

The Engineer (Consultant) is responsible for inspecting and acceptance of project components and the entire system.

Systems Manager. The Systems Manager option requires the pubic agency to select a single firm or consulting team as Systems Manager. The Systems Manager is responsible for system design, PS&E preparation, systems integration, documentation and training. The project is divided into several sub-projects and each sub-project is contracted by using the agency's normal bidding processes. The Systems Manager oversees all work by the various contractors. The sub-project contractors can be selected on the basis of specific sets of skills required for each sub-project. This permits the selection of experts for various steps of the system. The Systems Manager is responsible for integrating the sub-projects into an overall operating system. The contract between an agency and the Systems Manager is typically a negotiated contract that allows contract flexibility when projects are refined. This procurement method assigns responsibility of total system success to one entity and creates an environment to more easily meet project requirements.

Sole Source Approach. This form of procurement is used when there is documented existence of one technical or cost effective solution to the requirements of a certain project. Sole Source procurement is most often used when compatibility with existing equipment and/or systems is required. In the early stages of establishing components of an ITS system, Sole Source procurement should not be necessary. During the later stages of development, Sole Source procurement may need to be employed to ensure system-wide compatibility in certain circumstances.

Design/Build (Operate) Approach. The Design/Build approach requires the selection of a single responsible entity to perform all work associated with the deployment of the system and its components. The selected entity may also be responsible for ongoing operation of the system. The public agencies are responsible for monitoring the activity of the Design/Builder. The Design/Builder performs all design work, contracts and/or constructs the system elements and systems and turns over the operating system to the public agency. In some instances the Design/Builder will operate the system with oversight and monitoring maintained by the public agency.

For the public agency, the advantage of this option may be that it saves time and money, and reduces agency risk. However, a potential limitation of this approach is that the public agency may lose some control over the design of the project. The agency's sole role is reduced to oversight and monitoring of the Design/Builder and does not involve any of the design details that may impact the operational needs of the agency.

Private/Public Approach. The Private/Public approach is a newer procurement system that establishes a Public/Private partnership for financing and implementation of a project. Each project proposed as a Public/Private partnership would need to be investigated individually to determine that there are not issues such as conflict of interest, unfair advantage given to one competitor over another, etc. Many projects may appear to be good candidates for Public/Private partnership, but may be eliminated due to local, state and federal laws. Creativity and close study of regulations will be needed to insure Public/Private partnerships are viable projects that have benefits for all involved parties.

F.7 Operations and Maintenance

Successful ITS applications depend to a great extent on the approach taken to provide day-to-day operation of the systems. Operations can consist of activities ranging from deployment of portable devices to supervision of a traffic management center. These activities are often labor intensive raising staffing issues that will need to be addressed during implementation. Maintenance of ITS infrastructure typically entails systems calibration, software and hardware updates, reestablishing lost communications, and repair of damaged equipment.

Costs associated with these tasks can be as varied as the operations themselves and the technologies in question. In some cases, operations and maintenance costs associated with ITS can be high in comparison with more traditional transportation infrastructure, however, when viewed in light of the benefit provided, they can actually represent on going savings in other areas. Efforts are being made at the national level to account for this with the development of a new user service aimed specifically at operations and maintenance.

Project sponsors must have a plan for and devote resources to operations and maintenance. They cannot take a "set it and forget it" approach. They must think through not only how they will get a system running, but how they will keep it running, and how they will maximize its potential benefit. Key issues include the availability of staff, the need for special training, the development of operating procedures, and the budgeting of annual funding. However these issues are ultimately addressed, it is important to consider the impact of these requirements during both the planning and implementation phases.

It is absolutely essential that lead agencies think through the implications of operating and maintaining the systems for which they would be responsible. A commitment to maintenance must be present for the ITS Project to succeed. Electronics and communications systems always require attention, and credibility will be easily lost if systems are poorly maintained. In addition, some ITS Projects may require dual lead agencies to deal with various parts of the implementation process. For example, call boxes are generally an initiative at the County level, but the CHP is responsible for answering calls.

Implementing agencies should develop management procedures for operation of ITS applications before they are procured. This should be done along with preparation of design documents. This will ensure that agencies have thought through how they will use what they are about to acquire, reducing the chance of misapplication, misunderstanding, or procurement of inappropriate equipment. Training budgets should be included with many ITS procurements. For information-oriented projects, agencies must ensure that there is a commitment to delivery of accurate and timely information. Implementing agencies should also ensure that a continuing source of operations and maintenance funding is available prior to procuring ITS Projects.

Appendix G

San Mateo ITS Program Management

Appendix G – San Mateo ITS Program Management

G.1 Program Leadership

Through the San Mateo County ITS Strategic Plan effort, momentum has been gained for the deployment of ITS in the county. It is important that this energy and momentum be maintained. As part of this, individual agencies or entities will need to step forward to lead or "champion" individual ITS projects based on their level of interest and need. This implementation will be carried out by a broad cross-section of agencies: Caltrans, MTC, the CHP, local agencies and transit operators. The private sector will likely implement yet another portion of the eventual ITS system (e.g. devices in vehicles, information systems, etc.). All of these systems must work together. However, the successful implementation of ITS also requires top level leadership that focuses on the overall program.

The San Mateo County ITS Strategic Plan resulted from a joint effort by governmental agencies in the region. The participant agencies will need to be committed to a cooperative method of program management in order to realize the full benefits of systems integration inherent in ITS deployment. This approach will need to provide oversight and guidance to ITS implementation throughout the county using this Plan as a starting point to move ITS projects forward and into the mainstream of transportation planning, development, and operations.

The San Mateo County ITS Strategic Plan resulted from a joint effort by governmental agencies in the region. The participant agencies will need to be committed to a cooperative method of program management in order to realize the full benefits of systems integration inherent in ITS deployment. This approach will need to provide oversight and guidance to ITS implementation throughout the county using this Plan as a starting point to move ITS projects forward and into the mainstream of transportation planning, development, and operations.

This program leadership should involve both a coordinating group to provide oversight of ITS activities in the county, and an ITS coordinator responsible for specific activities related to the county's ITS program.

An ITS Coordinating Group should be established to help guide further planning and implementation of ITS projects within San Mateo County. This group should meet on a periodic basis as determined necessary to provide input to issues pertaining to the design and implementation of the projects in the San Mateo County ITS Strategic Plan. It should be a forum for assessing the status of strategic plan implementation, facilitating coordination among the various agencies within the region as well as with the adjacent regions, and for working out inter-agency agreements. For projects involving a lead agency and participating agencies, it is essential that this guiding body takes an active roll in plan implementation in order to ensure the coordination among these agencies and that an integrated approach to deployment of field elements is taken. It is imperative that guidance come from a committee that represents the full spectrum of agencies in the region and also has the background regarding the ITS planning process as well as the technology options available through ITS deployment.

At a minimum, the ITS Coordinating Group should include C/CAG, Caltrans, MTC, representatives from a number of local jurisdictions, and SamTrans. Other local implementing entities could become more involved as major projects are advanced to implementation. A logical starting point for this group is the Working Group that participated in the San Mateo

County ITS strategic planning effort. Through their involvement in this process, members of the Strategic Plan Working Group have developed the knowledge base to enable continued successful guidance of the ITS program. The committee also provides good representation from an appropriate cross section of the transportation community in the region.

In addition to the top-level guidance of a multi-agency group, more detail-oriented project level coordination will be needed for the county as a whole. This is the role for the region's ITS coordinator. This individual would be responsible for guiding the coordinating group, identifying potential funding for ITS Projects, monitor progress on project implementation, provide information to those within and outside the agency on ITS applications, and serve as a primary point of contact for regional coordination on ITS issues.

The key areas of program leadership and responsibility for the coordinating group and ITS coordinator include:
Tracking project deployment and conformance;
Updating the Strategic Plan;
Maintaining intra-county and regional coordination;
Providing technical support and assistance;
Identifying funding opportunities;
Evaluating the ITS program and individual projects; and
Mainstreaming and promoting ITS.

These areas are discussed in more detail in the following sections. In general, the coordinating group will provide oversight and overall guidance, while the coordinator will be responsible for the completion of specific activities.

G.2   Track Project Deployment

As individual projects proceed with deployment, it is critical that their status be actively tracked. During the design phase, this tracking will help facilitate coordination among projects. As projects evolve and are implemented, this information should be used to update program resources such as project descriptions and the countywide ITS inventory, and be reflected in updates to the Strategic Plan. This information may also be used to check conformance with and provide updates to the Regional Architecture.

The project tracking process should also involve checking for conformance with the Regional Architecture and applicable standards. As described in the Strategic Plan, MTC has developed a Regional ITS Architecture that provides the framework for linking or integrating the various systems and functions described in the Regional ITS Plan. Individual ITS projects must conform to the Regional Architecture in order to qualify for federal funds. It is also required that the Regional Architecture be maintained, therefore information regarding the status of individual projects should be submitted to MTC. The Regional ITS Plan and Architecture documents contain specific guidance checking the conformance of projects and updating the Regional Architecture. It should be the role of the ITS Coordinator, with guidance from the Coordinating Committee, that compliance with these requirements is maintained as individual projects are developed.

The coordinating committee should serve as a forum for sharing information regarding the status of individual projects. This may include information regarding design details, timing, funding

sources, and coordination requirements. The ITS Coordinator should maintain a log of ITS projects. Specific activities may include:

Maintain a centralized log of ITS Projects that appear in individual agency transportation programs (e.g., RTP, STIP, STP, etc.). This will foster coordination among projects and provide a type of "status report" on progress. The log may include projects in adjacent counties as well as regional projects that are relevant to San Mateo County.
Update the ITS Project descriptions contained in Appendix E. This could include revisions to currently listed projects or the addition of new project descriptions.

G.3 Update Strategic Plan

The San Mateo County ITS Strategic Plan should be a living document. This is particularly important in light of the rapid pace of change in technology. The technology opportunities and projects in this plan are aimed at meeting specific transportation needs while addressing the ITS goals identified early in the ITS Planning process. While it is imperative for a guiding document such as this to be in place, as changes in direction within the agencies or for the county as a whole are realized, the planning goals and therefore specific projects may need to be revisited and revised.

The Strategic Plan presents an overall framework, but decisions regarding the best timing and technical approaches for projects must be responsive to conditions that exist at the time when the decisions are being made. Agencies should be encouraged to implement additional or ancillary projects that are not necessarily included in the ITS Strategic Plan but that will benefit traffic management, emergency services, transit management, etc. The staging of projects and programs in the ITS Strategic Plan must be viewed as flexible enough to make adjustments to respond to funding opportunities and changing circumstances.

While the Strategic Plan cannot be constantly updated to keep pace with these changes, a process should be established to conduct a periodic review and update of information in the Strategic Plan. It is suggested that this be done on a cycle similar to updates of other transportation planning documents (i.e. three years). Particular attention needs to be given to the inclusion of new/revised ITS Projects and updates to the Regional ITS Architecture. In this respect, the updates will be similar to those conducted for other types of transportation strategies, such as short-range transit plans, highway plans, and bicycle plans, but the update cycle may be more frequent because of the pace of change.

The coordinating group should be responsible for overseeing updates to the County ITS plan. This could include revisions of top level issues such as program goals, or it could focus on specific issues such as project scoping and scheduling and detailed architecture refinements. C/CAG, the county's ITS coordinator, should be responsible for initiating this activity and producing the updated documents.

G.4   Maintain Intra-County and Regional Coordination

A significant component of the program leadership will consist of coordination among agencies as the ITS plan is implemented. The coordination of ITS activities by various agencies provides the key to maximizing the value of integration of systems. Intra-county coordination is necessary

on a project level basis. This may involve issues of compatible communication technologies, data formats, and physical connectivity, as well as the need for inter-agency agreements.

Beyond the boundaries of San Mateo County, coordination may be necessary at both program and project levels. At the program level, contact with regional agencies and those in other counties can facilitate congruent implementation approaches. A focal point for inter-county and regional coordination is the sharing of traveler information. The integration of information dissemination will allow travelers to make their trips and, consequently, the transportation facilities more efficient. Information sharing on this scale requires coordination at both the planning and implementation stages.

The coordinating committee will need to be involved in coordination of system linkages, integration and interoperability issues at both the intra-county and regional levels. Because several potential members of the San Mateo County coordinating group are also active at the regional level, the group should serve as one forum for addressing regional coordination issues. Participation in regional committees and those for adjacent counties provides another opportunity to address these issues. The ITS coordinator can help facilitate these activities by working with the program managers from these other agencies and participating in their committee discussions as appropriate.

G.5   *Provide Technical Support and Assistance*

The level of ITS knowledge and expertise among potential ITS project implementers in San Mateo County Basin can vary greatly. Therefore, it would be valuable to establish the means for sharing the available knowledge and supporting the activities of individual implementers. Technical resources should be identified to whom agencies can refer for assistance in ITS project design, procurement, maintenance, and operations. These could be individuals within other San Mateo County agencies, FHWA, FTA, Caltrans, or other agencies within California that are available to provide technical guidance on various facets of ITS implementation.

The Coordinating Committee should serve as forum for sharing information and an opportunity for members to ask questions of one another. The ITS coordinator should maintain a library of ITS-related information that may include:
A listing of technical resource contacts.
ITS design guidance materials.
Sample RFPs for ITS design, deployment and management projects.
Information on ITS-related and procurement contracting.
Updates of information on ITS Project conformance with the Regional ITS Architecture.
Information on funding sources and opportunities.
Sample inter-agency agreements and memorandums of understanding.

G.6 *Identify Funding Opportunities*

The successful implementation of the ITS opportunities and project concepts presented in this Strategic Plan will largely depend upon the availability of funds. A wide range of funding opportunities should be examined to build the county's ITS system over time. This could include consideration of opportunities in non-ITS construction projects to build portions of the ITS infrastructure. Agencies need to take a long-term view and

anticipate opportunities for cost savings. Each implementing agency should examine potential projects in their capital programs to determine if ITS applications are appropriate.

Beyond the initial funding for deployment, a critical factor to the success of ITS will be the continued availability of funding for operations and maintenance. The implementation of ITS elements for the detection, surveillance, and management of transportation will necessarily increase the operations and maintenance demands of those agencies responsible for transportation.

There are several possible strategies for pursuing ITS funding. Because of the diverse multi-modal, multi-jurisdictional nature of ITS, it is usually found that funding must be pursued along multiple tracks simultaneously. An individual project may require multiple sources of funding. Elements of this multi-dimensional strategy could include this following:

Explore the full range of potential sources including Surface Transportation Program (STP), National Highway System (NHS), Statewide Transportation Improvement Plan (STIP), State Highway Operational Protection Program (SHOPP), Regional Transportation Plan (RTP), Office of Traffic Safety (OTS), and local (i.e., sales tax) funds.

Work cooperatively with Caltrans and MTC to secure other state or regional funds, especially for the deployment of regional project elements within San Mateo County..

Seek cooperative funding with the private sector. The most significant opportunities are in the provision of traveler information. Examples could include private installation or leasing of information kiosks, privately initiated information services through pager technology or FM-subcarrier, or private financing of CCTV cameras at key locations of interest to the media. Private financing of motorist aid service patrols is also possible.

The actual pursuit of the various funding sources will be the responsibility of each lead agency, however the ITS Coordinating Group can serve as a forum for sharing information about funding sources and can provide multi-jurisdictional support for project applications. Working with MTC, Caltrans and FHWA, the County ITS Coordinator should maintain a listing of potential funding sources.

G.7 Evaluate ITS Program and Projects

As the ITS program moves forward in San Mateo County and new deployments are implemented, a need to evaluate the effectiveness of these implementations will be required. This need will stem from the desire to ensure that future expenditures on ITS implementations will continue to be worthwhile and cost effective. This requires the development of criteria that may be used to evaluate the county's ITS program and individual projects.

There are several purposes of the evaluation criteria:
- To identify specific data types to be used for ITS deployment goals;
- To assess system performance;
- To demonstrate ITS effectiveness;
- To document project accomplishments;

The primary purpose is to identify specific types of data that can be used to set quantitative and qualitative goals for ITS deployment. In San Mateo County, the goals and objectives for ITS can

be defined in terms such as a decrease in accidents at a specific location or travelers' perception of improved traveler information. The evaluation criteria will provide parameters for measuring improvements in the transportation network that result from ITS deployment.

Evaluation criteria can also be used to assess the performance of a system and to detect and correct problems. These criteria also establish sets of data to be collected for system management and to help determine which future activities to undertake. Finally, these criteria provide the statistical evidence that can be used to demonstrate ITS effectiveness and document project accomplishments.

The ITS Coordinating Committee, with guidance and support from FHWA, should take the lead in defining appropriate evaluation criteria. The county's ITS Coordinator would then be responsible for leading evaluation efforts with the support of the individual implementing agencies.

G.8 Mainstream and Promote ITS

ITS projects have often been planned, funded, and implemented using a different process than more traditional transportation projects. This has been in part due to the separate funding mechanisms provided by the FHWA in the past. While this approach has generated many innovative applications of technology, it has lead to a separation between ITS planning and the more traditional transportation planning process. The technology solutions encompassed by ITS can be more efficiently implemented through their incorporation into the mainstream process of managing the transportation infrastructure. ITS should not be thought of as something independent of other transportation improvements, but rather as part of a comprehensive set of initiatives that may involve traditional improvements as well as technological ones.

"Mainstreaming" ITS involves incorporating ITS into the established transportation planning and programming process and is a key to initiating the ITS plan. This means considering ITS projects alongside more traditional transportation solutions during the process of updating local and state transportation programs, or integrating ITS elements into larger, more traditional transportation projects that share location or objective. As part of the mainstreaming effort, elements of this ITS Strategic Plan should be incorporated into other transportation planning and programming activities including the Countywide Transportation Plan, local planning documents, the Regional Transportation Plan, Project Study Reports (PSRs), Short-Range Transit Plans, Long-Range Transit Plans, Route Circulation Reports, etc.

There are several benefits of mainstreaming ITS. The first of these is that it will help increase awareness of ITS strategies by putting them before the broader transportation planning audience. Second, mainstreaming can help initiate deployment of ITS technologies as part of larger projects. Finally, mainstreaming will help open up additional funding opportunities beyond the separate funding mechanisms provided in the past. ITS projects will compete with other transportation improvements as part of traditional funding programs.

This mainstreaming activity should be undertaken by all agencies that prepare transportation improvement programs and planning documents that impact San Mateo County. This includes C/CAG, SMCTA, local jurisdictions and Samtrans, as well as agencies such as MTC, Caltrans, Caltrain and BART. Furthermore, all ITS stakeholders should undertake efforts to promote ITS as part of outreach efforts to policymakers, agency management, and the general public. These

efforts are needed to gain the support to obtain funding and overcome institutional obstacles. While this should be a collective effort involving the Coordinating Committee, the sponsors or "champions" of individual projects should also seek to promote their ITS project and ITS in general. Some champions will be required to promote the project internally within their own agencies and organizations in addition to their external promotion efforts. Most projects could benefit from some general promotion to the public that will inform them as to the purposes and benefits of the project. Potential use of web pages, flyers, and news articles/reports should be considered. If possible, the champion may seek the support of additional champions with good connections within communities that the project will benefit. Chambers of Commerce, economic development groups, and professional organizations are good sources of support.

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Table E-1: Freeway/Highway Management

OPPORTUNITY/PROJECT CONCEPT		Countywide Priority[1]	Agency Participation[2, 3]		Benefits
#	Description		Planning	Deployment	
FM1	**Bring already deployed ITS devices into full and stable operation**	**H**	<u>C/CAG</u>, **Caltrans**	<u>**Caltrans**</u>	**Improve traffic monitoring and incident verification capabilities. Maximize and optimize the use of existing ITS elements.**
FM2	**Make Regional transportation management center (TMC) fully-operational with respect to San Mateo County**	**H**	<u>C/CAG</u>, **Caltrans**	<u>**Caltrans**</u>	**Improve traffic monitoring and incident verification capabilities. Maximize and optimize the use of existing ITS elements.**
FM3	Deploy additional traffic monitoring and incident verification equipment where appropriate on the County's freeways and highways	M	<u>Caltrans</u>, C/CAG, MTC	<u>Caltrans</u>	Improve traffic monitoring and incident verification capabilities.
FM4	Install fog sensing equipment where appropriate on the County's highways	L/M	<u>Caltrans</u>, C/CAG	<u>Caltrans</u>	Improve traffic monitoring and incident verification capabilities.
FM5	Install additional changeable message signs (CMSs), including along I-280 and Highway 35 in Daly City and Pacifica	M	<u>Caltrans</u>, C/CAG	<u>Caltrans</u>	Enhance dissemination of real-time traveler information.
FM6	Install additional changeable message signs (CMSs) on US 101 and I-280 for route guidance to major attractions	M/L	<u>C/CAG</u>, Caltrans	<u>Caltrans</u>	Enhance dissemination of real-time traveler information.
FM7	**Bring ramp metering system, as approved, into operation and integrate with signal operations where appropriate**	**M/H**	<u>**Caltrans**</u>, **C/CAG, Local PW**	<u>**Caltrans**</u>, **Local PW**	**Improve coordination between freeway operations and local arterial street traffic operations. Improve management of traffic flow and congestion on the freeway system.**
FM8	Implement a center-to-center link between Caltrans' Transportation Management Center (TMC) and existing or future TMCs within San Mateo County	M/L	<u>C/CAG</u>, Local PW, Caltrans	<u>Caltrans</u>, Local PW	Improve coordination between freeway operations and local arterial street traffic operations. Provide local agency access to Caltrans' cameras and other freeway monitoring information.

Notes:

1 **Bold type** = high or high medium priorities.

2 <u>Underlining</u> denotes potential lead agency. for deployment, agencies will typically take lead for portion on facilities over which they have jurisdiction. Agencies - Local PW = City/County Public Works; County OES = County Office of Emergency Services; Local ESP = City/County police, fire, medical response, etc.; SFO = San Francisco International Airport; Private = private sector entities.

3 The San Mateo County Transportation Authority (SMCTA) will be a potential participant in the planning and deployment of all projects as funding partner.

Table E-2: Arterial Management				
OPPORTUNITY/PROJECT CONCEPT	**Countywide Priority[1]**	**Agency Participation[2,3]**		**Benefits**
# **Description**		**Planning**	**Deployment**	
AM1 Upgrade existing traffic signal systems (e.g. replace antiquated equipment, expand coordinated systems, update signal timings, etc.)	**H**	<u>Local PW, Caltrans</u>, C/CAG	<u>Local PW, Caltrans</u>	**Improve monitoring and incident detection capabilities. Improve management of traffic during major events. Improve traffic signal coordination. Improve coordination between arterial and freeway operations. Improve ability of local agencies to centrally monitor conditions and control signals.**
AM2 **Install CCTV cameras at key congested locations throughout the County**	**M/H**	<u>C/CAG</u>, Local PW, Caltrans	<u>Local PW, Caltrans</u>	**Improve monitoring and incident detection capabilities. Improve management of traffic during major events.**
AM3 Install additional detection stations along major arterials	L/M	<u>C/CAG</u>, Local PW, Caltrans	<u>Local PW, Caltrans</u>	Improve monitoring and incident detection capabilities. Improve management of traffic during major events.
AM4 Install changeable message signs (CMSs) on major arterials	L	<u>C/CAG</u>, Local PW, Caltrans	<u>Local PW, Caltrans</u>	Improve management of traffic during major events. Improve coordination between arterial and freeway operations.
AM5 Design and implement Smart Corridor(s) in selected areas	L/M	<u>C/CAG</u>, Local PW, Caltrans	<u>Local PW, Caltrans</u>	Improve monitoring and incident detection capabilities. Improve management of traffic during major events. Improve traffic signal coordination. Improve coordination between arterial and freeway operations.
AM6 Use predictive traffic control systems adjacent to at-grade railroad crossings	L/M	<u>Local PW, Caltrans</u>, Caltrain	<u>Local PW, Caltrans</u>	Improve traffic signal coordination.
AM7 **Provide link between traffic signal systems operated by local agencies and by Caltrans (CTNet)**	**H/M**	<u>C/CAG</u>, Local PW, Caltrans	<u>Local PW, Caltrans</u>	**Improve traffic signal coordination. Improve ability of local agencies to centrally monitor conditions and control signals.**
AM8 Establish Countywide Transportation Management System (through a single TMC or series of sub-area TMCs)	L	<u>C/CAG</u>, Local PW	<u>Local PW</u>	Improve coordination between arterial and freeway operations. Improve ability of local agencies to centrally monitor conditions and control signals.
AM9 Implement a center-to-center link between San Mateo TMC(s) and other regional systems	L	<u>C/CAG</u>, Local PW, Caltrans, adjacent counties	<u>Local PW, Caltrans</u>, adjacent counties	Improve traffic signal coordination. Improve coordination between arterial and freeway operations.
AM10 Evaluate and implement other advanced control strategies (e.g. adaptive) along key congested corridors	M	<u>Local PW, Caltrans</u>, C/CAG	<u>Local PW, Caltrans</u>	Improve monitoring and incident detection capabilities. Improve management of traffic during major events. Improve traffic signal coordination.

Notes:

1 **Bold type** = high or high medium priorities.

2 <u>Underlining</u> denotes potential lead agency. for deployment, agencies will typically take lead for portion on facilities over which they have jurisdiction. Agencies - Local PW = City/County Public Works; County OES = County Office of Emergency Services; Local ESP = City/County police, fire, medical response, etc.; SFO = San Francisco International Airport; Private = private sector entities.

3 The San Mateo County Transportation Authority (SMCTA) will be a potential participant in the planning and deployment of all projects as funding partner

Table E-3: Transit Management				
OPPORTUNITY/PROJECT CONCEPT	**Countywide Priority[1]**	**Agency Participation[2, 3]**		**Benefits**
# — **Description**		**Planning**	**Deployment**	
TM1 — **Implement AVL systems on Caltrain rail vehicles**	**H**	**Caltrain**	**Caltrain**	**Enhance coordination among the different transit providers.**
TM2 — Implement transit vehicle collision warning systems	L	SamTrans	SamTrans	Improve the safety of the transit vehicles and patrons.
TM3 — **Explore applications for transit signal priority (TSP) along key transit corridors**	**H**	**SamTrans, Local PW, C/CAG, Caltrans**	**SamTrans, Local PW, Caltrans**	**Improve transit travel times (faster and more reliable).**
TM4 — **Install electronic information signs at transit transfer and major activity centers**	**H**	**SamTrans, Caltrain, BART, Muni, AC Transit, VTA, MTC**	**SamTrans, Caltrain, BART, AC Transit, VTA, Muni**	**Enhance transit riders' experience and convenience.**
TM5 — Install electronic information signs at all transit stops	M/L	SamTrans	SamTrans	Enhance transit riders' experience and convenience.
TM6 — **Install in-vehicle electronic signs on transit vehicles**	**H**	**Caltrain**	**Caltrain**	**Enhance transit riders' experience and convenience.**
TM7 — **Expand deployment of TransLink electronic fare system**	**H/M**	**MTC, SamTrans, Caltrain, BART**	**SamTrans, Caltrain, BART**	**Enhance coordination among the different transit providers. Enhance transit riders' experience and convenience.**
TM8 — Implement center-to-center link between SamTrans and local TMCs	L	C/CAG, SamTrans, Local PW	SamTrans, Local PW	Enhance coordination among the different transit providers. Enhance transit riders' experience and convenience.
TM9 — Implement center-to-center link between all transit agencies operating in San Mateo County	M	SamTrans, Caltrain, BART, Muni, AC Transit, VTA, MTC	SamTrans, Caltrain, BART, AC Transit, VTA	Enhance coordination among the different transit providers.
TM10 — **Provide amenities such as access to the Internet on rail transit vehicles**	**H**	**Caltrain**	**Caltrain**	**Enhance transit riders' experience and convenience.**
Notes:				
1	**Bold type** = high or high medium priorities.			
2	Underlining denotes potential lead agency. for deployment, agencies will typically take lead for portion on facilities over which they have jurisdiction. Agencies - Local PW = City/County Public Works; County OES = County Office of Emergency Services; Local ESP = City/County police, fire, medical response, etc.; SFO = San Francisco International Airport; Private = private sector entities.			
3	The San Mateo County Transportation Authority (SMCTA) will be a potential participant in the planning and deployment of all projects as funding partner.			

Summary of ITS Opportunity/Project Concept

Table E-4: Traveler Information				
OPPORTUNITY/PROJECT CONCEPT	**Countywide Priority[1]**	**Agency Participation[2,3]**		**Benefits**
# — **Description**		**Planning**	**Deployment**	
TI1 — **Implement CMS's at key locations along the I-280, I-380 and US 101 freeways**	**H**	**C/CAG, Caltrans**	**Caltrans**	**Enhance en-route traveler information.**
TI2 — **Implement CMS's at key locations along Highways 92, 84, 35 and 1**	**H/M**	**C/CAG, Caltrans**	**Caltrans**	**Enhance en-route traveler information.**
TI3 — Implement CMS's at key locations along major arterials throughout the County	L	C/CAG, Local PW, Caltrans	Local PW, Caltrans	Enhance en-route traveler information.
TI4 — Expand the Highway Advisory Radio (HAR) system within San Mateo County	L	Caltrans	Caltrans	Enhance en-route traveler information.
TI5 — Implement traveler Information kiosks within the SFO baggage claim area	L	MTC, SFO, C/CAG	SFO, MTC	Enhance pre-trip traveler information services.
TI6 — Install electronic travel information signs at major activity centers	M	C/CAG, Local PW, Caltrans, SamTrans, MTC, Private	Local PW, Caltrans, SamTrans, MTC, Private	Enhance pre-trip traveler information services. Enhance en-route traveler information.
TI7 — Install electronic information signs at railroad at-grade crossings	L	Local PW, Caltrans	Local PW, Caltrans	Enhance en-route traveler information.
TI8 — **Enhance distribution of traveler information to the media for real-time dissemination**	**H**	**CHP, Caltrans, MTC, Local PW, Local Police**	**CHP, Caltrans, MTC, Local PW, Local Police**	**Enhance pre-trip traveler information services. Enhance en-route traveler information.**
TI9 — Publish traveler information on local agency websites	L/M	Local PW, C/CAG, MTC	Local PW	Enhance pre-trip traveler information services.
TI10 — Implement a link between local traffic monitoring systems and the regional 511 traveler information system	M/L	C/CAG, MTC, Local PW	Local PW, MTC	Enhance pre-trip traveler information services. Enhance en-route traveler information. Enhance inter-agency sharing of both freeway and arterial information.
TI11 — Provide a link between local TMCs and the CHP CAD system for real-time incident information	L	C/CAG, CHP, Local PW	Local PW, CHP	Enhance inter-agency sharing of both freeway and arterial information.
TI12 — Publicize and provide education to the public regarding traveler information systems	L	MTC	MTC	Enhance the effectiveness and public awareness of traveler information systems.

Notes:

1. Bold type = high or high medium priorities.
2. Underlining denotes potential lead agency. for deployment, agencies will typically take lead for portion on facilities over which they have jurisdiction. Agencies - Local PW = City/County Public Works; County OES = County Office of Emergency Services; Local ESP = City/County police, fire, medical response, etc.; SFO = San Francisco International Airport; Private = private sector entities.
3. The San Mateo County Transportation Authority (SMCTA) will be a potential participant in the planning and deployment of all projects as funding partner.

Summary of ITS Opportunity/Project Concept

Table E-5: Parking Management					
OPPORTUNITY/PROJECT CONCEPT		**Countywide Priority[1]**	**Agency Participation[2,3]**		**Benefits**
#	**Description**		**Planning**	**Deployment**	
PM1	Prepare a Parking Management System Study for various locations	L	Local PW	See PM #2	Improve parking management in larger downtown areas, around special event centers, and at major shopping centers.
PM2	Implement a real-time Parking Information and Guidance System , where appropriate	L	Local PW	Local PW	Improve parking management in larger downtown areas, around special event centers, and at major shopping centers.
PM3	Implement an electronic fee payment system utilizing FasTrak technology.	L	MTC, Caltrans, Local PW, Private	Local PW, Private, MTC, Caltrans	Improve parking management in larger downtown areas, around special event centers, and at major shopping centers.

Notes:

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2 Underlining denotes potential lead agency. for deployment, agencies will typically take lead for portion on facilities over which they have jurisdiction. Agencies - Local PW = City/County Public Works; County OES = County Office of Emergency Services; Local ESP = City/County police, fire, medical response, etc.; SFO = San Francisco International Airport; Private = private sector entities.

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Table E-6:	Incident Management			

OPPORTUNITY/PROJECT CONCEPT		Countywide Priority[1]	Agency Participation[2,3]		Benefits
#	Description		Planning	Deployment	
IM1	**Develop and implement Countywide incident management plans**	**H**	**<u>C/CAG</u>, Local PW, Caltrans, MTC, Local ESP, County OES, CHP**	**<u>Local PW, Caltrans, Local ESP, County OES, CHP</u>**	**Improve inter-agency communications at incident scenes. Enhance the ability of transportation agencies and emergency services agencies to exchange information.**
IM2	**Install CCTV cameras at key locations throughout the County**	**M/H**	**<u>C/CAG</u>, Local PW, Caltrans, County OES**	**<u>Local PW, Caltrans</u>**	**Enhance ability to detect, verify and manage incidents along major roads.**
IM3	Implement Incident Management software to support efficient incident response	M	<u>C/CAG</u>, County OES, Local PW, Local ESP	<u>County OES, Local PW, Local ESP</u>	Improve emergency vehicle response time.
IM4	Implement center-to-center links between transportation agencies and emergency service agencies	M	<u>C/CAG</u>, Local PW, Caltrans, Local ESP, County OES, CHP	<u>Local PW, Caltrans, Local ESP, County OES, CHP</u>	Enhance the ability of transportation agencies and emergency services agencies to exchange information.
IM5	Implement Automated Vehicle Location (AVL) systems for all maintenance and emergency vehicles	M	<u>Local PW, Local ESP</u>, C/CAG	<u>Local PW, Local ESP</u>	Improve emergency vehicle response time.
IM6	**Standardize emergency vehicle pre-emption (EVP) equipment countywide and implement on major routes**	**H**	**<u>C/CAG</u>, Local PW, Local ESP**	**<u>Local PW, Local ESP</u>**	**Improve emergency vehicle response time.**
IM7	**Coordinate Incident Management Plans with adjacent counties**	**H**	**<u>C/CAG</u>, County OES**		**Improve inter-agency communications at incident scenes. Enhance the ability of transportation agencies and emergency services agencies to exchange information.**

Notes:

1. **Bold type** = high or high medium priorities.

2. <u>Underlining</u> denotes potential lead agency. for deployment, agencies will typically take lead for portion on facilities over which they have jurisdiction. Agencies - Local PW = City/County Public Works; County OES = County Office of Emergency Services; Local ESP = City/County police, fire, medical response, etc.; SFO = San Francisco International Airport; Private = private sector entities.

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Table E-7: Supporting Elements				
OPPORTUNITY/PROJECT CONCEPT	**Countywide Priority[1]**	**Agency Participation[2,3]**		**Benefits**
# / **Description**		**Planning**	**Deployment**	
SE1 **Prepare an overall Communications Network Plan for the County ITS Program.**	H	<u>C/CAG</u>, Local PW, Caltrans, MTC	See SE #2	**Fill gaps in the existing communications network.**
SE2 **Design and upgrade the existing communications infrastructure**	H	<u>See SE #1</u>	<u>Local PW, Caltrans, MTC</u>	**Upgrade existing faulty or outdated communications systems. Enhance coordination, information sharing and cooperation between agencies.**
SE3 Expand the existing RCN fiber network and expand franchise agreements with Comcast	M	See SE #1	See SE #2	Fill gaps in the existing communications network.
SE4 Connect into Caltrans' proposed fiber optic backbone on US101	M	See SE #1	See SE #2	Fill gaps in the existing communications network.
SE5 Evaluate the feasibility of utilizing private infrastructure to form part of the overall communication network	M	See SE #1	See SE #2	Fill gaps in the existing communications network.
SE6 Utilize the County's microwave system to provide communications between agency systems	M	See SE #1	See SE #2	Fill gaps in the existing communications network.
SE7 Develop a standard set of communications protocols and communication channels	M	<u>C/CAG</u>, Local PW, Caltrans, MTC, Local ESP, County OES, CHP	<u>Local PW, Caltrans, MTC, Local ESP, County OES, CHP</u>	Enhance coordination, information sharing and cooperation between agencies. Ensure continued O&M of all ITS elements and the communications network.
SE8 Designate staff dedicated to transportation management	L	<u>Local PW</u>	<u>Local PW</u>	Enhance coordination, information sharing and cooperation between agencies.
SE9 Establish cooperation between the agencies to work together under the San Mateo County ITS Program	M	<u>C/CAG</u>, all others	<u>C/CAG</u>, Local PW, Caltrans	Enhance coordination, information sharing and cooperation between agencies.
SE10 **Allocate funding and resources for the O&M of ITS elements and communication network**	H	<u>C/CAG</u>, **Local PW, Caltrans, MTC, Local ESP, County OES, CHP**		**Ensure continued O&M of all ITS elements and the communications network.**
SE11 Deploy monitoring devices at select locations for the purpose of collecting historical planning data	M	<u>C/CAG</u>, Local PW, Caltrans	<u>Local PW, Caltrans</u>	Improve availability of transportation data.
SE12 Incorporate data processing and archiving features into all monitoring systems	M	<u>C/CAG</u>, Local PW, Caltrans, MTC	<u>Local PW, Caltrans</u>	Improve availability of transportation data.

Notes:

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2 <u>Underlining</u> denotes potential lead agency. for deployment, agencies will typically take lead for portion on facilities over which they have jurisdiction. Agencies - Local PW = City/County Public Works; County OES = County Office of Emergency Services; Local ESP = City/County police, fire, medical response, etc.; SFO = San Francisco International Airport; Private = private sector entities.

3 The San Mateo County Transportation Authority (SMCTA) will be a potential participant in the planning and deployment of all projects as funding partner