San Francisco Freeway Corridor Management Study (FCMS) – Phase 1 Report

This Report summarizes the study's purpose and institutional setting; proposes a framework of Goals and Objectives for freeway corridor management; and identifies a range of strategies for performance-based assessment in Phase 2.

February 19, 2015

Contents

1 Executive Summary

The 2013 San Francisco Transportation Plan (SFTP) identified San Francisco's need for a Freeway Corridor Management Study (FCMS) to raise the performance of the current freeway system and manage expected future growth in travel along the city's US-101 and I-280 freeway corridors[1]. The study approach is designed to help San Francisco move closer towards its livability, economic, and environmental goals in an equitable manner.

The San Francisco Freeway Corridor Management Study is divided into two phases. Phase 1, captured in this document, sets the foundation for the study need and purpose, proposes a goals-based performance framework and an approach for public involvement, and identifies a range of freeway corridor management strategies to consider in Phase 2. These components are developed based on a review of existing relevant studies, the current institutional framework and regional experience in the Bay Area and beyond. Phase 2 of the study will build off the vision framed in this document, and carry out a performance-based evaluation of the existing freeway system in order to identify the set of freeway management strategies and project alternatives that best meet San Francisco's goals.

Relevant Studies

Several efforts are currently underway at the regional and state levels that will shape conditions along San Francisco's freeway corridors. Among these are managed lanes studies and projects being led by neighboring San Mateo and Santa Clara Counties considering High Occupancy Vehicle (HOV) and Managed Lanes, as well as studies such as the Bay Area Managed Lanes Implementation Plan (MLIP) led by the Metropolitan Transportation Commission (MTC) and the update to the Statewide Managed Lanes Master Plan led by the California Department of Transportation (Caltrans). These efforts are summarized in Appendix A-3. The FCMS will allow San Francisco to inform and be informed by these parallel efforts in a timely and effective way, and to involve San Francisco community members and regional stakeholders in these efforts.

In addition, FCMS will build off existing corridor and non-corridor specific planning studies. Appendices A-1 and A-2 summarize these efforts, respectively, as well as the freeway corridor planning needs and strategies identified in them which support the need for the current FCMS effort.

Study Need and Purpose.

[1] Freeway Corridors are defined to include the freeway mainline, on- and off-ramps, interchanges, parallel and immediately adjacent arterials that can serve as a route alternative to the mainline, and parallel regional transit systems including Caltrain, BART and regional bus services.

The 2013 San Francisco Transportation Plan (SFTP) found that the greatest increases in vehicle travel by 2040 are projected to be to and from the Peninsula and South Bay. Expected vehicle travel in the Bay Bridge corridor was also very significant. As a result, the SFTP recommended the need for better management of existing freeway space either through high-occupancy vehicle lanes or other strategies in order to meet the city's goals for the future.

The purpose of the SF FCMS is to recommend a set of managed lanes and complementary strategies for the existing US-101 and I-280 corridors in San Francisco that will help the city achieve its economic competitiveness, environmental and social and equity goals, through a performance-based analysis and stakeholder consultation.

The study should identify strategies that will meet the need to:

- Improve the ability of these corridors to move people and goods safely and reliably;
- Manage demand for travel on these freeway corridors sustainably and
- Support balanced local street and freeway operations.

The strategy recommended in the SF FCMS will provide San Francisco's input into related regional and state freeway corridor management efforts.

Goals Framework

The six goals of the FCMS are consistent with broader countywide goals identified in the 2013 SFTP. These goals are supported by an underlying set of objectives, which are outlined below in Table ES-1:

Table ES-1: San Francisco Freeway Corridor Management Study Goals and Objectives

	Goal		Objectives
1	Improve San Francisco freeway corridors' ability to move people (person throughput) to support economic competitiveness and accommodate existing and new residents and workers.	1.1	Improve freeway corridor productivity, utilization and efficiency.
		1.2	Increase vehicle occupancy levels.
		1.3	Reduce recurring delays on freeway corridors.
2	Improve **Trip Reliability** for all freeway corridor users & modes	2.1	Improve travel time predictability on freeway corridors.
		2.2	Reduce non-recurrent delay due to incidents on freeway corridors.
3	Improve **Travel Mode Choices** for trips on freeway corridors that start or end in San Francisco.	3.1	Increase transit competitiveness with the automobile in freeway corridors.
		3.2	Provide better traveler information.

Table ES-1: San Francisco Freeway Corridor Management Study Goals and Objectives

	Goal		Objectives
4	Support **Coordinated and Integrated** strategies and plans **across Jurisdictional Boundaries**, including Caltrans, MTC, and adjacent Counties.	4.1	Integrate and coordinate FCMS recommendations with other San Francisco citywide transportation operations and demand management strategies.
		4.2	Coordinate San Francisco FCMS recommendations with the plans and projects of neighboring Counties, the Region and Caltrans.
5	Reduce per person freeway corridor traveler emissions	5.1	Reduce vehicle tripmaking through increased occupancy, mode shift, and other means.
		5.2	Reduce average per person GHG emissions in the corridor
6	Ensure safe, equitable, and balanced local arterial and freeway operations, while minimizing traffic impacts on neighborhoods.	6.1	Mitigate the impacts of through-trips on local San Francisco streets
		6.2	Ensure equitable access and avoid disparities in distribution of benefits/impacts

Potential Strategies

To help achieve the goals and objectives laid out in this first phase, a set of potential freeway corridor management strategies is identified and prioritized. Starting from a broad framework[2] that includes transit-based improvements and Travel Demand Management (TDM), the vision identified Managed Lanes strategies and supporting Automated Traffic Management Systems (ATMS) as the set that will be developed further in Phase 2 of FCMS.

Managed Lanes strategies seek to use freeway lane space more efficiently to accommodate more travelers and include Ramp Metering, Dynamic Lane Use Control, and High Occupancy Vehicle (HOV) and High Occupancy Toll (HOT) lane conversion. These types of strategies will be evaluated in the FCMS. Table ES-2 below maps these potential strategies to how they relate at a high level to each of the six goals set out for the study.

Table ES-2: Improve the Efficiency of Existing Infrastructure: Managed Lanes

San Francisco Freeway Corridor Management Study

[2] This Framework is based on the "Four T's" framework of the Federal Highway Administration (FHWA).

Potential Strategies for Meeting Project Goals						
Strategy	Move More People	Improved Trip Reliability	Improve Travel Mode Choices	Coordinate Plans Across Jurisdictions	Reduce Per Person Emissions	Minimize Through-Traffic Impacts
Improve the Efficiency of Existing Infrastructure: Managed Lanes						
Ramp Metering	O	O	O	O		O
Adaptive Ramp Metering (ARM)	O	O	O	O		O
Dynamic Lane Use Control, including Merge / Shoulder	O	O				
Exclusive or Special Use Lanes	O	O				
High Occupancy Vehicle (HOV) Conversion	O	O	O		O	
High Occupancy Toll (HOT) / Express Lane Conversion	O	O	O	O	O	
Source: Stantec, 2014.						

In addition to Managed Lanes strategies, other supportive strategies within the ATMS category, also referred to as "Intelligent Transportation Systems (ITS), will also be considered in Phase 2. This set of strategies deploys technology and information to improve the efficiency and safety of roadway operations while giving real-time guidance to travelers. Table ES-3 below summarizes these potential complementary strategies and maps them to the goals of the FCMS at a high level.

Table ES-3: Improve Efficiency of Existing Infrastructure: Advanced Traffic Management Strategies

San Francisco Freeway Corridor Management Study Potential Strategies for Meeting Project Goals						
Strategy	Move More People	Improved Trip Reliability	Improve Travel Mode Choices	Coordinate Plans Across Jurisdictions	Reduce Per Person Emissions	Minimize Through-Traffic Impacts
Improve the Efficiency of Existing Infrastructure: Advanced Traffic Management Systems						
Incident Management	O	O		O		O
Inter-Agency Information Sharing	O	O	O	O		

Table ES-3: Improve Efficiency of Existing Infrastructure: Advanced Traffic Management Strategies

San Francisco Freeway Corridor Management Study Potential Strategies for Meeting Project Goals						
Strategy	**Move More People**	**Improved Trip Reliability**	**Improve Travel Mode Choices**	**Coordinate Plans Across Jurisdictions**	**Reduce Per Person Emissions**	**Minimize Through-Traffic Impacts**
Improve the Efficiency of Existing Infrastructure: Advanced Traffic Management Systems						
Road Weather Management		O	O			
Comparative Travel Time Displays	O	O	O		O	
Advanced Traveler Information System (ATIS)	O	O	O	O	O	
Automated Itinerary Planners (AIP)	O	O	O		O	
Event Response	O	O				O
Queue Warning	O	O				
Traffic Signal Coordination	O	O		O		O
Adaptive Traffic Signal Control	O	O		O		O
Dynamic Speed Limits	O	O				
Source: Stantec, 2014.						

Existing Institutional Setting

This first phase of the FCMS framed the potential strategies within the existing institutional setting in order to identify the requirements for implementation. Each potential freeway corridor management strategy was mapped to a set of institutional (lead agency, coordination) requirements, funding sources, and current policy setting, to inform both the interagency coordination approach outlined below, as well as the selection of alternatives in Phase 2. The existing institutional setting is presented in Appendix A-5.

Public Involvement and Interagency Coordination

Finally, a public involvement and interagency coordination approach is outlined to engage key stakeholders from all sectors, including partner local, regional, state and

federal agencies, private employers and the general public. Phase 2 of the FCMS will build off both the lessons learned from previous planning efforts and regional experience, as well as consultations with the public stakeholders identified in this document, to develop its public involvement approach and interagency coordination mechanisms.

FCMS Phase 2

Phase 2 of this effort will conduct a performance-based evaluation of alternative freeway management strategies against the proposed goals and objectives of the study. Phase 2 will ultimately identify the preferred freeway corridor management strategy for San Francisco to pursue, in order to help meet the city's broader livability, environmental, and economic goals in an equitable manner.

2 Introduction

The 2013 San Francisco Transportation Plan identified San Francisco's need for a Freeway Corridor Management Study (FCMS) to raise the performance of the current freeway system and manage expected future growth in travel along the city's US-101 and I-280 freeway corridors.[3] The study approach is designed to help San Francisco move closer towards its livability, economic, and environmental goals in an equitable manner.

In addition to existing mobility and livability conditions that warrant improvement, San Francisco's US-101 and I-280 freeway corridors are forecast to face among the highest growth in demand for travel between now and 2040. San Mateo and Santa Clara Counties are developing and implementing management strategies along these corridors, and the state and region are revising freeway management plans for California and for the Bay Area, respectively. The SF FCMS will be a performance-based evaluation of a range of freeway corridor management strategies, from signage and striping to high-occupancy vehicle (HOV) or Express Lanes. The FCMS will involve collaboration and partnership with stakeholder agencies also active in freeway corridor management, including California Department of Transportation (Caltrans), the Metropolitan Transportation Commission and its sister agencies, San Mateo and Santa Clara Counties, and the SFMTA. The recommendations of the FCMS will inform the updates to Plan Bay Area, the region's Express Lane Implementation Plan, and the Statewide Managed Lanes Master Plan.

The FCMS encompasses two phases; Phase 1 of the FCMS:

- Sets the foundation for the study need and purpose;
- Proposes a goals-based performance framework;
- Describes the regional freeway corridor management context in which San Francisco undertakes this effort; and
- Identifies a range of freeway corridor management strategies to consider in Phase 2.

Phase 1 includes consultation with agency stakeholders in the development of the goals and objectives and the identification of strategies.

[3] Freeway Corridors are defined to include the freeway mainline, on- and off-ramps, interchanges, parallel and immediately adjacent arterials that can serve as a route alternative to the mainline, and parallel regional transit systems including Caltrain, BART and regional bus services.

Phase 2 of the study will build off the vision framed in this document, and carry out a performance-based evaluation of the existing freeway system in order to identify the set of freeway management strategies and project alternatives that best meet San Francisco's goals.

3 Freeway Corridor Management Study Purpose and Need

A Purpose and Need Statement provides background and describes a shared understanding of the transportation problem to be solved. Caltrans requires that any undertaking on the state highway system be supported by a Purpose and Need Statement. A formal Purpose and Need Statement for San Francisco's freeway corridor management study will be developed in Phase 2. This section provides supportive background to the study need which guides the development of the study's purpose as reflected through the Goals and Objectives framework in the next section.

The purpose of the SF FCMS is to recommend a set of managed lanes and complementary strategies for the existing US-101 and I-280 corridors in San Francisco that will help the city achieve its economic competitiveness, environmental and social and equity goals, through a performance-based analysis and stakeholder consultation. The study should identify strategies that will meet the need to:

- Improve the ability of these corridors to move people and goods safely and reliably;
- Manage demand for travel on these freeway corridors sustainably and
- Support balanced local street and freeway operations.

The strategy recommended in the SF FCMS will provide San Francisco's input into related regional and state freeway corridor management efforts.

3.1 Demand for Travel on San Francisco's Freeway Corridors

As described in the SFTP, San Francisco is planning to add over 100,000 new residents and nearly 200,000 new jobs by 2040. Eighty percent of these new residents and sixty percent of new jobs are expected to be in San Francisco's designated Priority Development Areas (PDAs) which encompass the downtown core and the US-101 and I-280 corridors. The SFTP projected that the greatest increases in vehicle travel between today and 2040 are expected to be between downtown and eastern neighborhood PDAs and the Peninsula / South Bay along the US-101 and I-280 corridors. Specifically, vehicle trips are expected to double between San Francisco's downtown core and the South Bay by 2040.

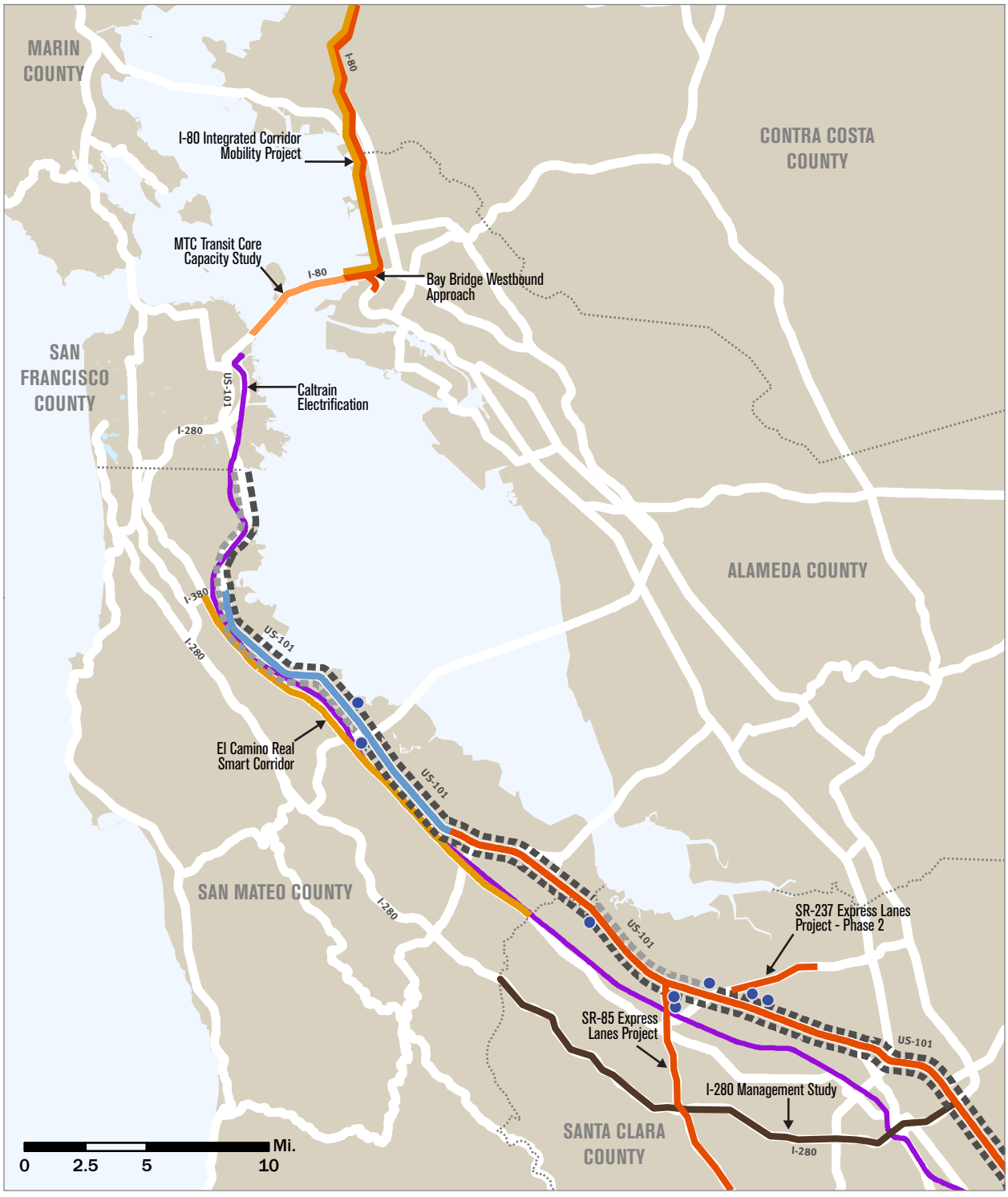
Even without the growth in demand for travel, the mobility and livability conditions along US-101 and I-280 corridors warrant improvement. These two facilities currently carry 300,000 vehicles per day and serve as the Peninsula's main regional transit corridors for

Figure X: Related Local Projects and Concepts

Existing and planned local projects related to San Francisco's I-80, US-101, and I-280 corridors.

- 9 San Bruno Rapid Project
- Caltrain Electrification
- MTC Transit Core Capacity Study
- Ramp Reconfigurations
- Ramp-Related Multimodal Improvements
- Congestion Pricing

Figure X: Related Regional Projects



Existing and planned regional projects related to San Francisco's I-80, US-101, and I-280 corridors

- Park-and-Ride Lot
- Conversion of Existing HOV to Express Lane
- Planned HOV Lane
- Planned Ramp Metering
- Existing Ramp Metering
- ITS/SMART Corridors
- MTC Transit Core Capacity Study
- I-280 Management Study
- Caltrain Electrification

SamTrans, Muni, and privately operated express bus services. Increases in congestion and transit crowding could significantly reduce San Francisco's economic competitiveness, livability, and environmental quality.

3.2 Regionwide Freeway Corridor Management Efforts

San Francisco initiates its first Freeway Corridor Management Study in a region with some existing freeway management tools already in place. In addition, other agencies continue to further develop freeway management approaches in corridors relevant to San Francisco. These efforts are opportunities to coordinate freeway management approaches across jurisdictions, and to advance San Francisco's freeway management priorities at the regional level. The FCMS will allow San Francisco to inform and be informed by these parallel efforts in a timely and effective way, and to involve San Francisco community members and regional stakeholders in these efforts. Map 1 depicts existing and planned related freeway corridor management projects and programs along the US-101 and I-280 corridors (Map 2 depicts local projects with a relevance to freeway corridor management in San Francisco), including:

- Planned conversion of an existing High Occupancy Vehicle (HOV) lane in Santa Clara County into Express Lanes. This project is led by the Valley Transportation Authority (VTA).

- Planned implementation of an HOV lane in San Mateo County from Whipple Av. to I-380. The San Mateo City and County Association of Governments (C/CAG) has initiated a Project Study Report for this project. In parallel, the Metropolitan Transportation Commission (MTC) is completing a feasibility study of other managed lanes alternatives for this stretch of US-101, in partnership with C/CAG.

- The San Mateo C/CAG is also leading the design effort for the Highway 82 / El Camino Real "SMART" corridor, which will extend parallel to US-101 from the Santa Clara County line to I-380. The vision for the project is to actively manage the operations of this arterial which serves as an alternative to US-101.

In addition to complementing the freeway corridor treatments in Santa Clara and San Mateo, the FCMS is intended to build on previous work including Caltrans' US-101 Corridor System Management Plan and the I-280 Transportation Concept Report.

Not shown on the map are several planning and policymaking efforts that will update the state and regional frameworks for freeway corridor management. In January 2015, California's State Transportation Agency issued a White Paper titled "Tolling and Pricing for Congestion Management and Transportation Infrastructure Financing," with

recommendations on the use of tolling to manage congestion and fund transportation infrastructure. The Paper called for new legislation that would provide for tolling for mobility management, not just financing. Caltrans has initiated California's first Statewide Managed Lanes Master Plan, which will integrate the management strategies of individual regions. Lastly at the state level, Caltrans is revising Deputy Directive 43 related to managed lanes. This policy statement guides Caltrans officials when managed lanes treatments are considered for state highways.

In the Bay Area, the Bay Area Infrastructure Financing Authority (BAIFA) – a Joint Powers Authority of the Metropolitan Transportation Commission (MTC) and the Bay Area Toll Authority (BATA) – is commencing the Managed Implementation Plan (MLIP) for the Bay Area region. BAIFA's governing Board is composed of an MTC and BATA Chair plus Commissioners from Alameda, Contra Costa, and Solano Counties, plus a non-voting representative of the State Business, Transportation, and Housing Agency. The MLIP updates the existing 290 mile network of HOV and Express Lanes throughout the Bay Area. The most recent adopted Bay Area Express Lane Network consists of 550-miles, 270-miles of which will be operated by BAIFA. Other express lanes in Alameda and Santa Clara Counties are operated by the Sunol Smart Carpool Lane Joint Powers Authority and the VTA, respectively.

The FCMS will identify recommendations for consideration by the Bay Area's MLIP and Statewide Managed Lanes Master Plan.

4 Goals and Objectives

4.1 Review of Planning Studies and Preliminary Needs Assessment

This section summarizes a review of relevant plans, studies, and projects for the purpose of understanding the existing and planned transportation system and institutional "context" with which the corridor management strategies must integrate and complement. The review will inform, through the sections in this document, the need and purpose statement to be further developed in Phase 2 of this study.

The following key findings have been extracted from review of the planning studies:

- San Francisco should manage the demand for and performance of its freeway corridors without expanding the footprint of freeway infrastructure.
- Transportation improvement strategies should focus on managing congestion rather than trying to eliminate it.

- Planning studies identify a need for implementing a freeway corridor management plan and identify specific strategies to support a managed corridor including the use of ITS operational strategies, demand management, and eventual lane management.

Review of recent planning studies advances Phase 2 of the FCMS by serving as a resource identifying the needs of the major corridors accessing San Francisco's downtown core; supporting an emphasis on multimodal congestion management; and identifying potentially effective strategies. The planning studies referenced in this section are summarized in **Appendices A-1, A-2, and A-3.** The summaries distill each study's findings regarding 'needs' in the FCMS study corridor and summarize each study's recommended strategies that address the needs.

4.2 Development of Goals and Objectives

This section proposes goals and associated objectives to describe what the FCMS seeks to achieve. In Phase 2, these Goals and Objectives will form the basis for performance metrics to evaluate the effectiveness of potential strategies.

The six goals of the FCMS are consistent with broader countywide goals identified in the 2013 SFTP:

- Economic Competitiveness-
- Livability
- Healthy Environment
- World Class Infrastructure

Extending these broad Goals to the freeway corridor management context, the FCMS would strive to attain the following:

- Improve San Francisco freeway corridors' ability to move people (person throughput) to support economic competitiveness and accommodate existing and new residents and workers.
- Improve trip reliability for all freeway corridor uses and modes.
- Improve travel mode choices for trips on freeway corridors that start or end in San Francisco.
- Support coordinated and integrated strategies and plans across jurisdictions, including Caltrans, MTC, and adjacent Counties
- Reduce per-person freeway corridor emissions.
- Ensure safe, equitable access, and balance local arterial and freeway operations while minimizing through-traffic impacts on neighborhoods.

The above goals will serve as guiding principles for assessing strategies and freeway corridor management scenarios in Phase 2 of the FCMS, but need measurable objectives that serve as indicators that goals are being met. Error! Reference source not found. lists the goals and their associated objectives.

Table 4: San Francisco Freeway Corridor Management Study Goals and Objectives

	Goal		Objectives
1	Improve San Francisco freeway corridors' ability to move people (person throughput) to support economic competitiveness and accommodate existing and new residents and workers.	1.1	Improve freeway corridor productivity, utilization and efficiency.
		1.2	Increase vehicle occupancy levels.
		1.3	Reduce recurring delays on freeway corridors.
2	Improve **Trip Reliability** for all freeway corridor users & modes	2.1	Improve travel time predictability on freeway corridors.
		2.2	Reduce non-recurrent delay due to incidents on freeway corridors.
3	Improve **Travel Mode Choices** for trips on freeway corridors that start or end in San Francisco.	3.1	Increase transit competitiveness with the automobile in freeway corridors.
		3.2	Provide better traveler information.
4	Support **Coordinated and Integrated** strategies and plans **across Jurisdictional Boundaries**, including Caltrans, MTC, and adjacent Counties.	4.1	Integrate and coordinate FCMS recommendations with other San Francisco citywide transportation operations and demand management strategies.
		4.2	Coordinate San Francisco FCMS recommendations with the plans and projects of neighboring Counties, the Region and Caltrans.
5	Reduce per-person freeway corridor emissions	5.1	Reduce vehicle tripmaking through increased occupancy, mode shift, and other means.
		5.2	Reduce average per person GHG emissions on freeway corridors
6	Ensure safe, equitable, and balanced local arterial and freeway operations, while minimizing traffic impacts on neighborhoods.	6.1	Mitigate the impacts of through-trips on local San Francisco streets
		6.2	Ensure equitable access and avoid disparities in distribution of benefits/impacts

5 Potential Freeway Corridor Management Strategies

Managing demand along San Francisco's freeway corridors will require a package of strategies, each with a different role in managing demand. Some travel demand could be accommodated on transit alternatives; other demand could be reduced or redirected. The last two categories of strategies both seek to use existing infrastructure more efficiently – serving more travel with the same amount of space. The approaches to managing freeway corridor demand could be classified as:

- **Accommodate demand on transit alternatives:** provide, expand, and/or improve the competitiveness of transit alternatives in the corridor to reduce demand for freeway driving.

- **Reduce or redirect demand** through Transportation Demand Management (TDM) strategies that encourage changes in travel behavior, such as employer-based incentives to not drive, services to bridge "first/last mile" travel gaps, and more.

- **Improve the efficiency of existing infrastructure using Advanced Traffic Management Systems.** These strategies deploy technology and information to improve the efficiency of roadway operations to accommodate more travelers. The strategies in this category are often called "Advanced Traffic Management Strategies (ATMS)" or "Intelligent Transportation Systems (ITS)."

- **Improve the efficiency of existing infrastructure using Managed Lanes.** These strategies seek to use freeway lane space more efficiently to accommodate more travelers. The strategies in this category are typically called "managed lanes."

These categories mirror a framework for transportation systems management strategies used by the Federal Highway Administration (FHWA) in recommending Urban Partnership Agreement (UPA) and Congestion Reduction Demonstration (CRD) grant awards.[4] The categories are somewhat fluid and serve more as a framework for thinking about different approaches to freeway corridor management. In addition, most of the strategies in each category are complementary. The 2013 SFTP recommends implementing an array of strategies for meeting San Francisco's countywide transportation system goals; similarly, effective freeway corridor management will likely require an array of strategies, each with a somewhat different role in addressing demand.

[4] The FHWA Framework is called the "Four T's."

The first two types of strategies – providing transit alternatives and TDM – are already being implemented in San Francisco. The second two types of strategies are not currently deployed in San Francisco. For that reason, the performance-based analysis in FCMS Phase 2 will focus on understanding the potential benefits and requirements of strategies in these latter two categories.

5.1 Accommodate Demand on Transit Alternatives

The US-101 corridor is currently served by transit alternatives, including Caltrain along the Peninsula from Santa Clara County to SOMA; BART between San Francisco and San Mateo County; and the T-Third Muni light rail line and Muni express bus services such as the 9-San Bruno within San Francisco. Expanding transit capacity and service is one element of serving the demand for travel along the US-101 and I-280 freeway corridors. A list of example strategies and their relationship to FCMS Goals is provided in **Appendix A-4.**

5.2 Reduce or Redirect Demand Through Transportation Demand Management (TDM)

The strategies in this category seek to reduce demand for travel or change the travel behavior of individuals, such as shifting time of travel from peak periods to off-peak periods, changing mode of travel, or reducing the need to travel. A list of example strategies and their relationship to FCMS Goals is provided in **Appendix A-4.**

5.3 Improve the Efficiency of Existing Infrastructure: Advanced Traffic Management Systems

The strategies in this category deploy technology or information to improve the efficiency of freeway and arterial operations; they are often called "Advanced Traffic Management Systems (ATMS)" or "Intelligent Transportation Systems (ITS)." **Table 2** presents the applicable ITS operational strategies grouped into informational strategies and responsive strategies. These strategies typically provide the ability to manage the operations of freeways or arterials in real-time. Each strategy also typically targets a different source of congestion (see text box).

Table 2: Improve Efficiency of Existing Infrastructure: Advanced Traffic Management Strategies

San Francisco Freeway Corridor Management Study Potential Strategies for Meeting Project Goals

Strategy	Move More People	Improve Trip Reliability	Improve Travel Mode Choices	Coordinate Plans Across Jurisdictions	Reduce Per Person Emissions	Minimize Through-Traffic Impacts
Improve the Efficiency of Existing Infrastructure: Advanced Traffic Management Systems						
Incident Management	O	O		O		O
Inter-Agency Information Sharing	O	O	O	O		
Road Weather Management		O	O			
Comparative Travel Time Displays	O	O	O		O	
Advanced Traveler Information System (ATIS)	O	O	O	O	O	
Automated Itinerary Planners (AIP)	O	O	O		O	
Event Response	O	O				O
Queue Warning	O	O				
Traffic Signal Coordination	O	O		O		O
Adaptive Traffic Signal Control	O	O		O		O
Dynamic Speed Limits	O	O				
Source: Stantec, 2014.						

5.4 Improve the Efficiency of Existing Infrastructure: Managed Lanes

These strategies use freeway lane space more efficiently to accommodate more travelers. The strategies in this category, shown in **Table 3**, are typically called "managed lanes" strategies.

Table 3: Improve the Efficiency of Existing Infrastructure: Managed Lanes

San Francisco Freeway Corridor Management Study Potential Strategies for Meeting Project Goals						
Strategy	**Move More People**	**Improve Trip Reliability**	**Improve Travel Mode Choices**	**Coordinate Plans Across Jurisdictions**	**Reduce Per Person Emissions**	**Minimize Through-Traffic Impacts**
Improve the Efficiency of Existing Infrastructure: Managed Lanes						

Ramp Metering	O	O	O	O		O
Adaptive Ramp Metering (ARM)	O	O	O	O		O
Dynamic Lane Use Control, including Merge / Shoulder	O	O				
Exclusive or Special Use Lanes	O	O				
High Occupancy Vehicle (HOV) Conversion	O	O	O		O	
High Occupancy Toll (HOT) / Express Lane Conversion	O	O	O	O	O	
Source: Stantec, 2014.						

San Francisco is already familiar with developing and implementing the types of strategies in the first and second categories (transit and TDM). The FCMS will build San Francisco's capacity to put in place the types of freeway corridor management strategies in the latter two categories.

6 State and Regional Institutional Context

The previous Section identifies a range of strategies with the potential to address San Francisco's freeway corridor management goals. This section identifies some basic "setting" information about the two types of strategies which are most unfamiliar to San Francisco: the Advanced Traffic Management / ITS strategies; and the Managed Lanes strategies. The section that follows describes:

- **Physical conditions:** Whether (and where) these strategies already are in place elsewhere on the US-101 and I-280 corridors;
- **Approval requirements and process:** What agencies have approval authority for putting the strategy in place, and what is the project development and approval process that is required?
- **Agency roles and responsibilities:** What agency is typically the lead in project development, construction, and operation?
- **Coordination:** What mechanisms exist for involved agencies to coordinate around this strategy?
- **Funding:** What sources typically fund the capital and operations / maintenance costs of this strategy?
- **Policy**: Are policy changes recently or currently being contemplated that would affect the application of this strategy in SF?

The Section begins with an overview of Caltrans' project development process; as the owner of the US-101 and I-280 facilities, Caltrans has approval authority over changes to the facilities. Most of the strategies to be analyzed in the FCMS would need to follow Caltrans' project development process.

6.1 An Overview of the California Department of Transportation's (Caltrans) Standard Project Development Process

The State has jurisdiction over San Francisco's freeway corridors and any proposed modification or improvement to the corridor requires the State's approval following established procedures and documentation requirements. The procedure used to approve a project is called the Project Development process. The details and complexity of the Project Development process and type of approval document needed varies depending on factors that can include:

- Type of modification or improvement
- Physical extents of the Project
- Estimated construction cost
- Whether Project requires a design exception
- Level of controversy caused by the Project
- Potential for environmental impacts

6.1.1 The Standard Project Development Process for Project Initiation and Project Approval

The standard Project Development process for a typical modification to a state highway with an estimated construction cost exceeding $3 million generally will follow the procedure illustrated in the flowchart in **Figure 1**.

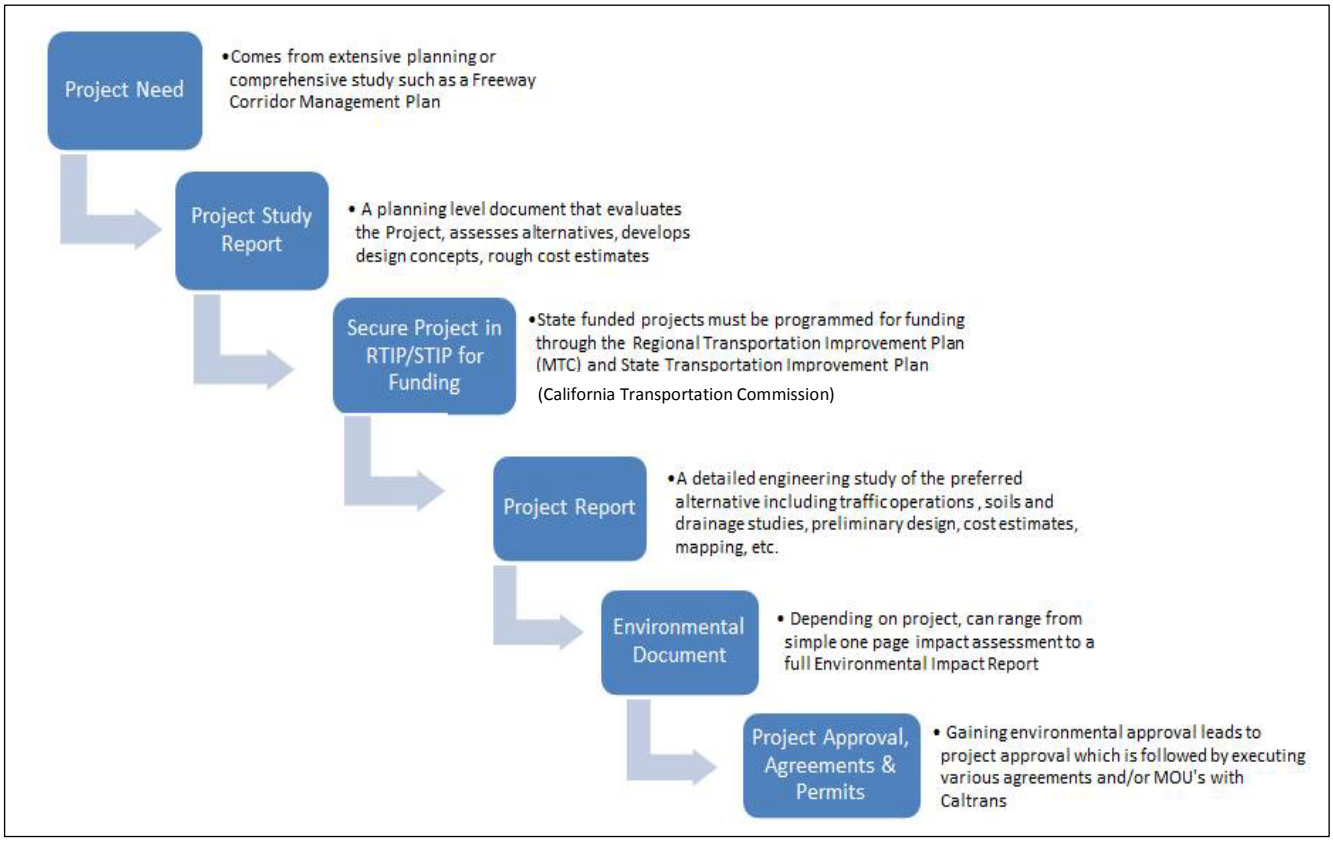


Figure 1: A simplified flow chart of Caltrans' standard project development and approval process—Project Study Report/Project Report/Environmental Document. Source: Stantec, Inc., 2014.

The process outlined above is for moderate to large highway projects. Examples of the types of projects approved using the PSR/PR/ED process include interchange construction or significant modification of an existing interchange, widening a highway to add lanes, and ramp metering. This process typically takes 18 to 24 months to gain project approval assuming no complications arise during the process.

6.1.2 Other Types of Project Initiation and Project Approval Processes

Caltrans may determine that a proposed project meets the criteria for gaining approval using a more streamlined process. Two of these processes are described below.

Encroachment Permit. Small and non-complex projects with an estimated construction cost up to $1.0 million may be reviewed and approved under the Encroachment Permit process. This is the simplest method for project approval, but

not all small projects meet the criteria. Caltrans determines the complexity of the project.

Permit Engineering Evaluation Report (PEER). Small and non-complex projects funded by a local agency or private entity with an estimated construction cost less than $3.0 million may be reviewed and approved under the PEER process. The PEER documents an analysis of the proposed project to determine if it causes drainage, maintenance, operation, and environmental impact on the state highway system.

6.1.3 Approval Process for Intelligent Transportation Systems (ITS) Projects

This section touches briefly on the approval process for certain types of low-cost ITS projects. Depending on cost and complexity, the approval process for ITS projects may be utilized more often in San Francisco's managed corridors than the approval process for traditional highway improvement projects.

The application and oversight process for Caltrans approval of ITS projects is significantly different than that used for traditional highway construction. The process varies depending on the determination of the degree of risk involved. In the world of ITS, risk is defined in terms of the ability to implement an ITS project on schedule, within budget, with expected quality, while meeting the established requirements for the project. This has become an important factor for Caltrans because studies show that nearly 75% of ITS projects are either cancelled or were challenged in one or more of the risk areas described above.

The approval process described in this section only applies to high risk ITS projects, as low risk ITS projects are approved using encroachment permits or PEERs.

High risk ITS projects are approved as the project is being developed using a Systems Engineering approach. This approach involves several layers of reviews, compliance checks, and notices to proceed to the next phase of development with participation of the project sponsor (local agency), the Regional MPO, Caltrans, and the Federal Highway Administration before authorization is given to implement the project.

The Systems Engineering approach involves several steps including development of a Concept of Operations (ConOps) and a Systems Engineering Management Plan (SEMP).

Guidance on the approval procedures and funding process are found in Caltrans' Local Assistance Program Guidelines as opposed to their Project Development manual which documents all traditional highway improvement initiation and approval procedures.

6.2 Freeway Corridor Management Existing Conditions

Appendix A-5 describes the existing presence of Advanced Transportation Management Systems (ATMS) and Advanced Traveler Information Systems (ATIS), and managed lanes strategies in the US-101 and I-280 corridors. It also describes the typical approval and project development process for each strategy, and identifies typical funding sources and agency coordination mechanisms.

HIGH RISK ITS PROJECTS

ITS projects that have one or more of the following characteristics are considered high-risk:

- Multi-jurisdictional or multi-modal
- Custom software required
- Hardware and communications are "cutting-edge" or not in common use
- New interfaces to other systems required
- System requirements not detailed or not fully documented
- Operating procedures not detailed or not fully documented
- Technology service life shortens project life-cycle

7 Stakeholder Consultation

The Study Team has identified an initial list of community and institutional stakeholders with which to seek a dialogue on freeway corridor management throughout the overall FCMS process, including and especially during Phase 2. This list is in addition to the Study Team's efforts to reach the community at-large and the travelers who utilize San Francisco's freeways. The list, which is intended as an initial set that will likely expand over the course of the Phase 2 study, is as follows.

- California Department of Transportation (Caltrans). As described in Chapter 6, Caltrans is the owner and operator of San Francisco's freeway system and therefore has jurisdiction to approve any changes to the system.
- Federal Highway Administration (FHWA). The FHWA also has jurisdiction to approve changes to the portions of San Francisco's freeway system designated as part of the federal system. In addition, projects seeking federal funding will require federal review and approval of the systems engineering development documents described in Section 6.2.

- Bay Area Infrastructure Financing Authority (BAIFA). BAIFA is a Joint Powers Authority of the MTC and the Bay Area Toll Authority (BATA). BAIFA's governing Board is composed of an MTC and BATA Chair plus Commissioners from Alameda, Contra Costa, and Solano Counties, plus a non-voting representative of the State Business, Transportation, and Housing Agency. In 2011, the Metropolitan Transportation Commission (MTC) transferred its authority to develop and implement the 270 mile regional Express Lanes network to BAIFA. BAIFA leads the Managed Lanes Implementation Plan (MLIP) to confirm and extend, set policy for, and engineer this regional network of Express Lanes.

- City/County Association of Governments of San Mateo County (C/CAG). As the congestion management agency for San Mateo County, this agency has responsibility to plan and fund transportation improvements in that county, including on I-280 and US101. C/CAG's plans for managing the portions of these freeways in San Mateo County will directly affect the consideration of strategies within San Francisco, and vice versa.

- Peninsula Corridor Joint Powers Board (Caltrain). As the operator of the Caltrain commuter rail line that operates parallel to US101 and I-280, this agency will be a key stakeholder in identifying strategies that affect Caltrain service and/or demand along the corridor.

- San Francisco Municipal Transportation Agency (SFMTA). As the operator of the local transportation system in San Francisco, this agency will be a key stakeholder in identifying strategies that affect the local street and transit network.

- Employers and business community. Businesses located both within San Francisco and along the freeway corridors in neighboring counties will be key stakeholders interested in how freeway management strategies might affect their access to workers and goods. Some employers are also providers of shuttle services.

- Private transportation providers. Companies that provide transportation services, including shuttles and other private services, will be interested in how freeway management strategies may affect travel conditions and demand for their services on these corridors.

- Neighborhoods adjacent to the freeway corridors. These neighborhoods will be interested in how travel conditions in the neighborhoods may be affected by the freeway management strategies under consideration.

- Freeway Corridor Facility Users (Travelers) and Citywide Transportation Advocacy Groups. These include but are not limited to the Automobile Association of America, the Bay Area Council, Friends of Caltrain, POWER, Senior Action Network, SFBC, San Francisco Chamber of Commerce, San Francisco Transit Riders Union, SPUR, WalkSF, and more.

8 Next Steps

The SF FCMS Phase 1 has: documented the project's background in support of the Study's Purpose and Need; drafted Goals and Objectives; identified a range of potential strategies for achieving those goals; and described the existing institutional setting in which San Francisco initiates this effort.

Projected growth in jobs and housing in San Francisco and along the Peninsula – in addition to existing mobility, livability, and environmental conditions – mean that San Francisco must take a broad and assertive approach to meeting transportation system goals as relates to these freeway corridors. A range of strategies, from transit capacity, to travel demand management, to using the existing infrastructure more efficiently through technology, information, and lane use management – are needed to meet San Francisco's long range goals. The 2013 SFTP indicates that to make progress, the freeway corridor management strategy must take a "big bite" towards shifting travel patterns in a way that advances the goals. The freeway corridor management strategy will need to focus on effectiveness, equity, and financial sustainability.

In addition, San Francisco's FCMS must identify strategies that complement and are effective paired with the freeway corridor management strategies being developed by Caltrans, MTC, San Mateo and Santa Clara Counties, and the SFMTA for local related arterials. To be most effective, the SF FCMS should influence the recommendations of our partner agencies' studies so that our actions can be reflected in overall corridor and regional plans.

Next steps following FCMS Phase 1 include:

- Develop a scope of work for FCMS Phase 2 that focuses on the most effective strategies for meeting the goals identified in Phase 1
- Identify the capabilities of existing and new San Francisco ATMS/ATIS infrastructure (e.g., SFgo corridors, the SFMTA TMC) to contribute to freeway corridor management in San Francisco
- Participate on the technical advisory committees or other coordination mechanisms for the related planning and project efforts in the corridors and region

- Participate in the statewide and regional committees and working groups to coordinate around the potential strategies discussed in Phase 1
- Track funding opportunities and legislation that could support or change how any of the potential strategies are implemented along the US-101 and I-280 corridors.

APPENDICES

Appendix A-1: Corridor Specific Planning Studies

Appendix A-2: Non-Corridor Specific Planning Studies

Appendix A-3: Current Studies & Planning Activities

Appendix A-4: Transit and TDM Strategies for Freeway Corridor Management

Appendix A-5: Existing Institutional Conditions

Appendix A-1: Corridor Specific Planning Studies

Corridor specific planning studies analyze corridors within San Francisco City limits, and thus contain the most applicable findings and strategy recommendations for the US-101 and I-280 freeway corridors. These studies include, for example:

- ☐ The San Francisco Congestion Management Program (CMP)—a program that biennially monitors congestion on freeways and major corridors within the City limits;
- ☐ The Interstate 280 Transportation Concept Report (I-280 TCR)—a regional study for the entire stretch of I-280 but contains data specific to the segment of the corridor in San Francisco;
- ☐ Planning studies prepared by transit operators serving San Francisco or providing regional transit connections to and from San Francisco such as the Caltrain Strategic Plan.

A summary of key findings and recommended strategies are presented in **Table A-1**.

Table A-1: Summary of Corridor Specific Planning Studies

Report / Source	Key Findings
Interstate 280 Transportation Concept Report (Caltrans District 4, July 2013)	**NEEDS:** • Identifies locations along I-280 where existing vehicle demand exceeds vehicle capacity regionally, including the urban core of San Francisco. • Documents the role of I-280 as an alternative travel way to US-101 - thereby both corridors should be studied in conjunction. • Ramps present challenges to bike connectivity and pedestrian activities in SF. **STRATEGIES:** • Identifies improvements including **Installing Intelligent Transportation System Related Devices** and **Ramp Metering** in San Francisco. • Work with transit operators to increase throughput using **HOV Lanes, Bypass Lanes, Park and Ride Facilities, Bus Rapid Transit,** etc. • Complete the construction of existing, partially or fully-funded projects planned for I-280.
2013 San Francisco Congestion Management Program Report (San Francisco County Transportation Authority, December 2013) – See Figure 2 and Figure 3 for AM and PM Peak LOS	**NEEDS:** • Biannual speed monitoring of freeways and major arterials in SF. • Identifies segments with slowest speeds and biannual speed trends. • Identifies average travel time for transit on roadway segment and compares it to auto travel time. - US-101 northbound between Cortland and I-80 operates at speeds below 25 mph during the PM peak - US-101 southbound between Market and I-80 operates at speeds below 20 mph during PM peak - I-80 between Fremont Exit to US-101 operates at speeds below 20 mph for both directions - I-280 degraded two grades due to lowering of average speed on the corridor relative to the last monitoring cycle
	STRATEGIES: • CMP identifies Travel Demand Management Strategies and initiatives. • Identifies Land Use Policies and framework and its relationship with transportation demand. • Lists the Capital Improvement Program (CIP) Projects and identifies the funding sources for the projects.

Table A-2: Summary of Corridor Specific Planning Studies

Report / Source	Key Findings
Caltrain Strategic Plan / Electrification Plan (Caltrain, September 2014)	**NEEDS:** • Demand is increasing with capacity constraint. • Caltrain is facing ongoing financial challenges • Caltrain modernization plan includes: – Building on the state of good repair – Improve system integration – Improve on construction and revenue service • Developing a Caltrain/High Speed Rail blended system. **STRATEGIES:** • Electrification of Caltrain corridor. • Installation of Communications Based Overlay Signal System Positive Train Control. • New Station (Transbay Terminal) at San Francisco. • Build the High Speed Rail to San Francisco.
MAPS (San Francisco County Transportation Authority, December 2010)	**NEEDS:** • Identifies impact of congestion on economy and environment. • Identifies that the majority of trips during PM peak are internal trips - 58% of PM. • Peak hour trips are from downtown SF to other parts of SF. Followed by 12% to East Bay. **STRATEGIES:** • Identifies various congestion pricing scenarios and the impacts.
Central Freeway / Octavia Circulation Study (San Francisco County Transportation Authority, June 2012)	**NEEDS:** • Octavia Boulevard brought significant urban design and land use benefits to the Market-Octavia area; however, operational challenges and concerns remain. • Trips generated to, from, and within the neighborhood have high transit first mode shares; however, the area's position at the center of the regional roadway network means that it is substantially affected by crosstown and regional traffic. • Improvements to travel alternatives have not kept pace with growing travel demand and did not accompany the reduction in vehicular capacity that the Central Freeway replacement represented.

	STRATEGIES: • Improve circulation and the multimodal network. • Shift travel to transit and non-motorized modes. • Improve safety and walkability. • Detailed designs, including operational considerations, should be developed for the reopening of closed crosswalks at Gough/Fell, Franklin/Fell, and Franklin/Oak. • Relatively inexpensive design improvements should be developed and implemented at the intersections of Octavia/Oak and Octavia/Fell. • A dedicated planning and design effort should be pursued to advance multimodal improvements to the expressway segment of San Jose Avenue, between the Glen Park and Bernal Heights neighborhoods. • The grid network should be leveraged to distribute travel demand and accommodate greater person throughput and local accessibility. • Streets which play an important traffic circulation function typically warrant features to improve safety and conditions for other modes. • As the design of streets is rebalanced to accommodate and prioritize non-automobile modes, improvements to transit service in affected corridors are also necessary. • Implement Demand Management Strategies. • Pedestrian conditions should be improved throughout the neighborhood, particularly to help achieve the City's goals regarding enhanced mobility, sustainability, and livability.
Bi-County Transportation Study (San Francisco County Transportation Authority, March 2013)	**NEEDS:** • There is a need to address significant land use growth in San Mateo and San Francisco counties. • Develop a mechanism of cost sharing and contribution from developers in both counties. **STRATEGIES:** • Recommended roadway extension and capacity improvements in Brisbane to accommodate projected growth (US101 Candlestick Interchange Re-Configuration, Geneva Avenue Extension). • **Extend Rapid Transit Services** (Harney-Geneva Bus Rapid Transit Line T-Third Light Rail Extension (Segment "S"). • Relocating and re-configuring the Brisbane-Bayshore Caltrain Station. • Mitigate impact of new regional traffic through Bicycle-Pedestrian Connection Projects. • Develop an Area-Wide Traffic Calming Program.

	STRATEGIES: • Improve circulation and the multimodal network. • **Shift travel to transit and non-motorized** modes. • Improve safety and walkability. • Detailed designs, including operational considerations, should be developed for the reopening of closed crosswalks at Gough/Fell, Franklin/Fell, and Franklin/Oak. • Relatively inexpensive design improvements should be developed and implemented at the intersections of Octavia/Oak and Octavia/Fell. • A dedicated planning and design effort should be pursued to advance multimodal improvements to the expressway segment of San Jose Avenue, between the Glen Park and Bernal Heights neighborhoods. • The grid network should be leveraged to distribute travel demand and accommodate greater person throughput and local accessibility. • Streets which play an important traffic circulation function typically warrant features to improve safety and conditions for other modes. • As the design of streets is rebalanced to accommodate and prioritize non-automobile modes, improvements to transit service in affected corridors are also necessary. • Implement **Demand Management Strategies**. • Pedestrian conditions should be improved throughout the neighborhood, particularly to help achieve the City's goals regarding enhanced mobility, sustainability, and livability.

Highlighted in Bold are the strategies identified as part of FCMS Study

Appendix A-2: Non-Corridor Specific Planning Studies

These planning studies provide information on various strategies and plans that could provide guidance and lessons learned from other regional, statewide and countrywide experiences. These references assisted in developing the FCMS strategies for the San Francisco corridors. The list of references contains documents prepared by neighboring counties and agencies and also documents like the FHWA's "Managed Lane – a primer" and "Managed Lane guidelines" that identifies the best practices for managed lanes and strategies to manage congestion effectively. These references also include regional level master plan and visioning documents which would allow San Francisco to integrate its plan with the regional plans. Regional plans include the Plan Bay Area and Regional Express Lane Network studies prepared by MTC and the BART Vision Plan developed and adopted by BART. Figure 1 Exhibit I. Managed Lanes Applications below shows how different managed lane strategies relate to the complexity of implementation. **Table A-2** summarizes the key findings and recommended strategies from these planning studies.

Figure 2- Exhibit I. Managed Lanes Applications

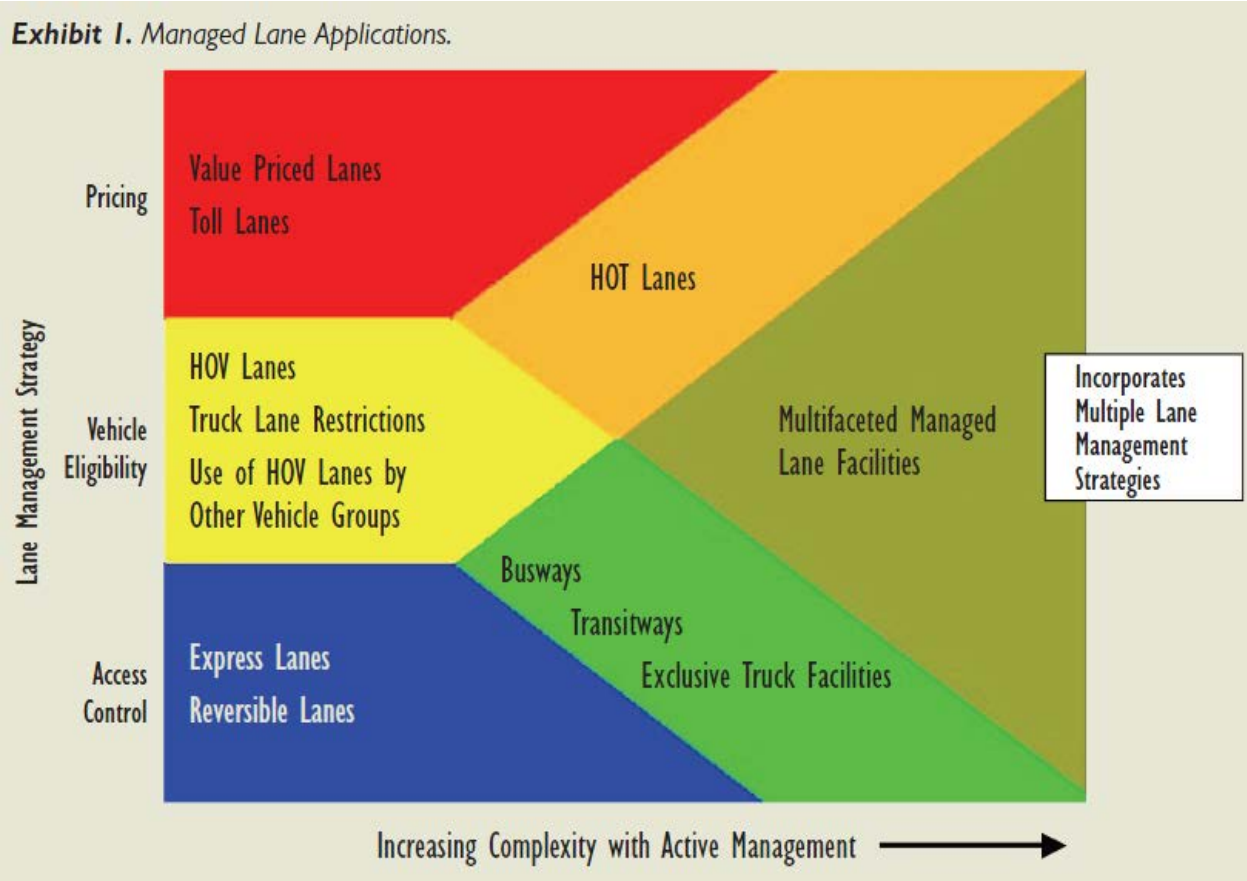


Table A-3: Summary of Non-Corridor Specific References

Report	Key Findings
Plan Bay Area (Association of Bay Area Governments; Metropolitan Transportation Commission, July 2013)	**NEEDS:** • Accommodate land use growth while fostering an innovative, prosperous and competitive economy; preserving a healthy and safe environment. • Allow all Bay Area residents to share the benefits of vibrant, sustainable communities connected by an efficient and well-maintained transportation network. **STRATEGIES:** • Build Upon Local Plans and Strategies for Preserving Local Land Use Control. • Sustain the existing transportation network. • Support Focused Growth (OneBayArea Grant Program) - provide funding for Transportation for Livable Communities, bicycle and pedestrian improvements, local streets and roads preservation, and planning activities, and provide specific funding opportunities for Safe Routes to Schools projects and Priority Conservation Areas. • **Transportation 2035 (T-2035) Plan Network** • Network is the multimodal investment strategy in the Transportation 2035 Plan. • Contains significant funding for operations and maintenance of existing system; limited expansions of highway and transit networks. • **Core Capacity Transit Network** • Significantly increases transit service frequencies along core transit network. • Keeps T-2035 investment levels for maintenance and bike/pedestrian projects; reduces T-2035 roadway expansion investments. • Requires additional capital and operating funds to pay for major expansion of transit services. • **Preferred Transportation Investment Strategy** • Devotes 87 percent of funding to operate and maintain existing transportation network. • Directs remaining funding to next-generation transit projects and other high-performing projects; to programs aimed at supporting focused growth and reducing GHG emissions; and to county-level agencies for locally designated priorities.

Table A-3: Summary of Non-Corridor Specific References

Report	Key Findings
US 101 CSMP (Caltrans District 4, December 2010) - Includes SM County & Santa Clara County	**NEEDS:** • Congestion on US 101 corridors in San Mateo County and Santa Clara counties needs to be addressed. **STRATEGIES:** • Ramp Metering Stations, Traffic Monitoring Stations, CCTV Cameras, CMS, EMS. • Recommended ITS strategies: Arterial Signalization, Ramp Metering, Detection, Traveler Information, Caltrain at-grade rail crossing advanced warning, and Incident Management. • Short-term strategies: various freeway road widening and additional auxiliary lanes. • Implement SMART Corridor System for San Mateo County. • Identify multiple non-highway improvements in San Mateo and Santa Clara County.
San Francisco Board of Supervisors Resolution 234-09	**Needs:** • Reduce greenhouse gas emissions associated with automobile tripmaking. • Reduce freeway expansion and associated environmental and livability impacts • Insufficient transit funding **Strategies:** • Prioritize transportation funding for investment in public transit maintenance and cost-effective transit enhancements over the allocation of funds to highway expansion projects. • Prioritize pedestrians, cyclists, and transit on state highways which serve as city streets • Develop a strategy for maintaining and improving the state highway system in a way that furthers the state's sustainability goals
San Francisco Board of Supervisors Resolution 304-04	**Needs:** • Increase the livability of, and support planned development in, the SOMA West Neighborhood. • Lessen the impacts of the Central Freeway on the surrounding neighborhoods. **Strategies:** • Study the possibility of replacing the Central Freeway with an alternative, such as a boulevard, when it reaches the end of its useful life. • Postpone future retrofits of the Central Freeway deck.

Table A-3: Summary of Non-Corridor Specific References

Report	Key Findings
Managed Lanes - a primer (FHWA, August 2008)	**STRATEGIES:** • Vehicle Eligibility • Access Control
Priced Managed Lane Guide (FHWA, October 2012)	**STRATEGIES:** • Traffic Management: Priced managed lanes are an effective tool to optimize the use of highway capacity, manage traffic volumes and conditions, and reduce congestion. • Revenue Generation: By charging tolls, priced managed lanes provide regions with the opportunity to generate new revenues to pay for the cost of implementing and operating the lanes themselves or support other transportation needs. New Travel Choices: Priced managed lanes provide new options to travelers in congested highway corridors, such as the opportunity to pay for a faster and more reliable trip. • Enhanced Transit Service: Priced managed lane projects provide regions with the opportunity to improve transit services by providing congestion-free highway lanes on which new transit service run. In some cases, excess revenues from the priced managed lanes can support these transit services.
Regional Express Lane Network Concept (Metropolitan Transportation Commission, online information dated 11/3/2014	**NEEDS:** • Create a seamless network of managed lanes to keep traffic moving. • Offer a new choice to highway drivers. • Provide more reliable travel times. • Encourage carpools, vanpools and express buses by closing gaps in the current HOV system. • Make the best use of HOV lane capacity. • Maintain and operate the lanes with new revenue streams. **STRATEGIES:** • MTC will convert 150 miles of existing carpool lanes to express lanes and later add 120 miles of new lanes to fill gaps in the Bay Area Express Lanes. • MTC will install equipment and observation areas to help the California Highway Patrol (CHP) enforce proper use of the lanes. The first MTC projects will convert existing HOV lanes into express lanes on: - I-680 in Contra Costa County between Alcosta Road and Livorna Road/Rudgear Road; - I-880 in Alameda County between Hegenberger/Lewelling and Dixon Landing Road - I-80 in Solano County between Red Top Road and Air Base

Table A-3: Summary of Non-Corridor Specific References

Report	Key Findings
	Parkway.
BART's Vision Plan (BART, April 2013)	**STRATEGIES:** • Oakland - NW San Francisco - New Transbay Tube and line alignment • 30th Street Mission Infill Station • Increase Core Capacity and Metro Improvements • Train Control System Modernization

Appendix A-3: Current Studies & Planning Activities

In addition to the references that are readily available, the following studies and planning activities are currently underway along the US-101 and I-280 corridors. These planning activities provide the setting and context for the SF FCMS. Current studies/projects are listed below:

- ☐ San Mateo County Project Study Report (PSR) for Auxiliary Lanes from Oyster Point to SF County line
    - C/CAG is studying a project to provide Auxiliary Lanes from Oyster Point to the San Francisco County Line. The purpose of this Project Study Report (PSR) is to develop the scope and budget of the Auxiliary Lane. The PSR is underway and expected to be completed late spring 2015.
- ☐ San Mateo County PSR for HOV lane / Auxiliary lane from Whipple to I-380
    - C/CAG is currently conducting a Project Study Report (PSR) for adding HOV lanes along US-101 between Whipple Avenue and I-380. The centermost lane (Lane 1) will be converted to HOV in parallel to the construction / extension of the Auxiliary Lane. The PSR is underway and expected to be completed Early summer 2015
- ☐ San Mateo County PSR for Harney Way interchange
    - The City of Brisbane leads this project to re-configure the existing interchange at Candlestick/Harney Way to a tight diamond design. A new US-101over- or under-crossing would connect the interchange's northbound freeway on- and off-ramps with Harney Way and the southbound freeway on- and off-ramps with the proposed extension of Geneva Avenue. The re-configuration is intended to support a major redevelopment project proposed for Brisbane, the Baylands Redevelopment project.
- ☐ San Mateo County / MTC Feasibility Study for US-101 HOV to HOT conversion. Two studies analyze the feasibility of HOV to HOT lane conversion on US-101 in San Mateo County.
    - C/CAG and MTC, currently under development, analyzes the demand, physical feasibility, and operations approach for converting the proposed US-101 HOV lane in San Mateo to an HOT / Express Lane. The Study is expected to be complete in early 2015.

- Transform analyzed the potential benefits of converting an existing general purpose lane into a HOT lane on US-101 in San Mateo.

☐ San Mateo County Hwy 82 / El Camino Real SMART Corridor, from Santa Clara County line to I-380

- The San Mateo County Smart Corridors project sponsored by C/CAG is an Intelligent Transportation System (ITS) / Advanced Transportation Management System (ATMS) under development along El Camino Real, an arterial parallel to US-101 in San Mateo County. The project will enables CalTrans and San Mateo cities to implement ATMS :
  - Arterial changeable message signs
  - Center-to-center communication between San Mateo County and the CalTrans District 4 Traffic Management Center
  - Directional Signs
  - Television Cameras and vehicle detection systems

☐ Santa Clara County I-280 Corridor Study

- In 2013, CalTrans completed a Transportation Concept Report (TCR) for the I-280 corridor from Santa Clara County to San Francisco County. The TCR considered HOV and HOT lanes, completion of a Ramp Metering network, and implementation of a Traffic Operations System (TOS) as potential strategies for this facility. The Santa Clara Valley Transportation Authority is currently developing a scope and budget for a study that may consider the TCR recommendations as well as additional strategies if appropriate.

☐ MTC Managed Lanes Implementation Plan

- The Bay Area Infrastructure Financing Authority (BAIFA) has initiated a Managed Lanes Implementation Plan (MLIP). The purpose of the MLIP is to develop a plan for implementation of regional managed lanes on the State Highway System in the nine-county Bay Area. The focus of this study are HOV lanes, High Occupancy Toll Lanes (HOT) or Express Toll Lanes (ETL). The work is expected to be completed by March 2016.

☐ San Francisco Bay Area Core Capacity Transit Study

- While the Bay Area has a strong history of investing to develop and maintain a vibrant transit system, this system is reaching capacity along many of the key corridors serving the Core San Francisco neighborhoods. The purpose of this MTC-led study is to evaluate measures to improve the transit system serving this Core, and provide enhanced connections to the workforce within the region. New investments will be balanced against the region's continued need to invest in the transit and roadway networks' state of good repair. The study is currently underway. Project Partners include BART, SFMTA, AC Transit and the SFCTA.

☐ Statewide Managed Lane Master Plan

- CalTrans' statewide Managed Lanes Master Plan is scheduled to be completed by spring 2016. This Plan is addressing the degradation of the State Highway System, a Statewide Policy on Managed Lanes, a Statewide Tolling Policy, developing a Managed Lane System Plan, and developing new Managed Lanes Guidelines.

Appendix A-4: Transit and TDM Strategies for Freeway Corridor Management

Transportation Demand Management Strategies for Freeway Corridor Management

San Francisco Freeway Corridor Management Study
Potential Strategies for Meeting Project Goals

San Francisco Freeway Corridor Management Study Potential Strategies for Meeting Project Goals						
Strategy	**Move More People**	**Improve Trip Reliability**	**Improve Travel Mode Choices**	**Coordinate Plans Across Jurisdictions**	**Reduce Per Person Emissions**	**Minimize Through-Traffic Impacts**
Accommodate Demand on Transit Alternatives						
Increase Transit Service Frequency	O		O		O	
Extend Transit Hours of Operation	O		O		O	
Express Bus Service	O	O	O	O	O	O
Park and Ride Facilities Combined with Multimodal Stations	O		O		O	O
Transit Priority Treatments	O	O	O			
Caltrain Electrification/DTX	O		O		O	
BART/Caltrain Train Control System Modernization	O		O	O	O	
Increase Commuter Rail Service (Caltrain/HSR)	O		O		O	
Interchange/Ramp HOV and Transit Bypass Lanes	O	O		O		O
Source: Stantec, 2014.						

Strategy	Move More People	Improve Trip Reliability	Improve Travel Mode Choices	Coordinate Plans Across Jurisdictions	Reduce Per Person Emissions	Minimize Through-Traffic Impacts
Reduce or Redirect Demand through Transportation Demand Management						
Transportation Management Associations Providing Essential TDM Support Services (e.g., Guaranteed Ride Home)	O		O		O	O
TDM Brokering Services	O		O	O		
Walkable Mixed Use, In-fill, and TOD Development	O		O		O	
Encourage Peak Spreading of Travel Demand	O	O		O	O	
Transit Fare Subsidies Provided by Employers or Residential Development	O		O		O	O
Residential Development TDM Services	O	O	O			
Last/First Mile Strategies: Shuttles, Bike Share, Etc.	O		O		O	O
Parking Management			O		O	
Employer Based TDM Programs: Flex time, Incentives, Etc.	O	O	O		O	O
Incentivize Low Emission Vehicles					O	
Rideshare Matching Services	O	O	O		O	
Area Congestion Pricing	O	O	O	O	O	

Source: Stantec, 2014.

Appendix A-5: Existing Institutional Setting for Freeway Corridor Management

Potential Strategies	Physical / Technical Does this strategy exist on the corridor?	Institutional - Approvals - what agenc(ies) have approval authority? What is the approval process?	Institutional - Agency Lead - What agencies are lead in project development? I ownership and operation?
Adaptive Traffic Signal Timing / Control and Transportation Management Centers (TMCs)	- SFgo technology allows for adaptive signal control. - Various local jurisdictions along the US 101 and I-280 corridors have this capability; the El Camino Real Smart Corridor and San Jose's Silicon Valley Smart Corridors are planned with the capability for adaptive signal control. - SFMTA is nearing completion of an integrated Traffic Management Center for San Francisco. The TMC consolidates five control centers: transit operations (bus and rail); transit power control; transit line management; parking control dispatch and security; amd SFGo traffic management (street traffic signals). - Many jurisdictions along the US 101 and I 280 corridors have TMCs, including Caltrans, VTA, San Mateo C/CAG, Santa Clara County, and numerous cities.	For facilities on State Highways: Caltrans has authority for signal equipment, through the simplified Encroachment Permit or PEER process. Depending on funding source, the federal systems engineering Vee process may be required. Else: Local jurisdictions.	Project development, ownership, and operation: Cities (including Belmont, Brisbane, Cupertino, Hillsborough, Menlo Park, Millbrae, Redwood City, San Bruno, San Francisco, San Mateo, South San Francisco, Woodside) or counties (Santa Clara County). Some mul city corridor projects are led through project development by sub-regional agencies (San Mateo City/County Association of Governments; Alameda CTC).
Incident Management	CHP and MTC operate a Freeway Service Patrol which identifies incidents and coordinates incident clearance with CHP. Managed lanes facilities in the Bay Area typically include supplemental incident management plans and services. The San Mateo C/CAG has led the development, ongoing, of an Integrated Transportation Incident Management Plan for San Mateo County. Many TMCs, both local and regional, integrate with local or regional emergency response communcation and command centers. For example, the City of San Jose operates a Transportation and Incident Management Center (TIMC) that coordinates incident activities with traffic, fire, and police.	MTC, Caltrans and CHP each have roles and responsibilities for incident management Bay Area-wide, executed via MOU. Express lane operating agencies have also executed supplemental incident management agreements with Caltrans and CHP.	A broad range of agencies, from state and regional (CHP, Caltrans, MTC) to sub-regional (CCAGs, Express Lane operating agencies, counties) to local cities have lead and operating roles in incident management.
Changeable Message Signs with Queue Warnings	Queue warning signs will be implemented as part of the I-80 Smart Corridor (Integrated Corridor Mobility, or ICM) Project in Alameda and Contra Costa Counties. Existing changeable message signs can also be used to warn of downstream queues; the San Francisco stretch of US-101 has one changeable message sign in place which currently reports real-time travel information.	Caltrans, using a basic basic encroachment permit and/or PEER approval process. Depending on the extent of system integration needed, the federal system engineering "Vee" process may be required.	When standalone, Caltrans leads this type of strategy. Other agencies may serve as lead when part of a larger corridor project, such as the I-80 Smart Corridor project. Caltrans also owns and operates the equipment.
Ramp Metering	Portions of US 101 and I 280 through San Mateo and Santa Clara Counties have metered ramps; Caltrans plans to extend meters to the rest of the ramps in these counties. Two locations in San Francisco are planned for ramp metering: Treasure Island and Harney Way.	Caltrans has approval authority via Ramp Metering Agreements, typically executed with the local jursidiction that is adjacent to the ramp. If ramp metering is part of a larger project, the Ageement will be executed with the lead agency on the larger project. The Ramp Metering Agreement defines the metering rates.	Ramp meters are owned and operated by Caltrans.

Appendix A-5

Potential Strategies	Institutional - Coordination What instutional mechanisms exist to coordinate around this strategy?	Financial How is the capital and O&M of this strategy funded?	Policy Are policy changes currently being considered that would affect the application of this strategy in SF?
Adaptive Traffic Signal Timing / Control and Transportation Management Centers (TMCs)	MTC's Arterial Operations Committee (AOC) meets once every two months: http://www.mtc.ca.gov/services/arterial_operations/aoc.htm. The AOC has a role in reviewing Next Gen funding applications (see next column). MTC has developed a Regional ITS Architecture (http://files.mtc.ca.gov/MTC-ITS/), which provides an inventory of ITS deployments in the Bay Area; a framework for integrating ITS systems within the Bay Area; and conceptual diagrams of individual projects' systems and integration paths.	Typically, signal projects are funded with local STP, CMAQ, TFCA, or sales tax funds. Through 2013, MTC's Program for Arterial System Synchronization (PASS) for regional arterial projects provided ~1M/year for development and implementation of signal timing plans. Starting in 2015, MTC will administer the Next Generation Arterial Operations Program. "Next Gen" will provide up to $3M annually in federal funds for adaptive traffic control systems and active traffic management strategies (transit signal priority, real time traffic monitoring, queue jump lanes, etc) that improve arterial operations.	2015 will be the first year for administration of the Next Gen funding program.
Incident Management	MTC chairs a Bay Area Incident Management Task Force (IMTF). The Task Force is a staff committee of the Freeway Management Executive Committee (FMEC), a policy committee of executive staff of Caltrans, CHP and MTC. Www.timbayarea.org	Sources include Caltrans' operating funds (for Caltrans services); regional vehicle registration fees; CMAQ; and FPI. Specialized Incident Management programs led by local agencies are funded by local funds and Express lane revenues.	A point of negotiation is the reimbursment to CHP and Caltrans for incident management on Express Lanes facilities.
Changeable Message Signs with Queue Warnings	Unknown	Where standalone, Caltrans has funded these systems through their operations budget. Where part of a larger corridor strategy, Caltrans will likely seek reimbursment for the capital and operating costs of changeable message signs, including queue warnings.	N/A
Ramp Metering	Unknown	When Caltrans is the lead agency, the capital and operating costs of ramp meters are borne by Caltrans. When a different agency is lead, that agency bears the capital costs, typically through the funding program for the larger project that the meters are a part of. MTC's Freeway Performance Initiative program can fund the capital cost of ramp meters. In these situations, Caltrans will seek reimbursment for the operating costs.	N/A

Potential Strategies	Physical / Technical Does this strategy exist on the corridor?	Institutional - Approvals - what agenc(ies) have approval authority? What is the approval process?	Institutional - Agency Lead - What agencies are lead in project development? I ownership and operation?
Adaptive Ramp Metering (ARM)	Adaptive ramp metering is a new strategy for the Bay Area; the first applications of this strategy will be as part of the I-80 Smart Corridor Project (Integrated Corridor Mobility, or ICM) in the east bay, and in San Mateo County on US 101 and SR 82 as part of the El Camino Real SMART Corridor Project.	Caltrans has approval authority via Ramp Metering Agreements, typically executed with the local jursidiction that is adjacent to the ramp. If ramp metering is part of a larger project, the Ageement will be executed with the lead agency on the larger project. The Ramp Metering Agreement defines the metering rates. Approval process includes the federal systems engineering Vee process and a Caltrans PID.	The I-80 SMART Corridor project was led by Alameda CTC, and is a cooperative effort between The California Department of Transportation (Caltrans); the ten municipalities along the corrido AC Transit; WestCAT; Alameda County Transportation Commissior (Alameda CTC); Contra Costa County Transportation Authority (CCTA); West Contra Costa Transportation Advisory Committee (WCCTAC); and the Metropolitan Transportation Commission. Caltrans typically retains ownership of the equipment. Per Frank: "For the I-80 ICM project, while the lead agency was the AC CTC, Caltrans was steadfast in the requirement that the operational authority remain with Caltrans."
Dynamic Lane Use Control, including Merge/Shoulder	US-101 and I-280 do not employ this strategy today. The I-80 Smart Corridor project will have the ability to use dynamic lane control through the use of gantry mounted lane control signs.	Caltrans; approval process includes the federal systems engineering Vee process and a Caltrans PID.	The I-80 SMART Corridor project is an example of agency roles and responsibilities in project development for this type of strategy.
Dynamic Speed Limits / Advisories	US-101 and I-280 do not employ this strategy today. The I-80 Smart Corridor project will be the first application of this strategy in the Bay Area; the limits will be advisory only.	Caltrans has approval authority; an agreement with CHP is required to identify the enforcement approach	The I-80 SMART Corridor project is an example of agency roles and responsibilities in project development for this type of strategy; CI will provide enforcement.
High Occupancy Vehicle (HOV) Conversion	- The Bryant/Essex street on-ramp to eastbound I-80 in downtown San Francisco has an HOV2+ bypass lane. - The San Mateo C/CAG is developing at least one HOV configuration for US101 between the Santa Clara County line and Interstate 380. The project is currently preparing a PID document. - VTA operates 36 miles of HOV lanes on US 101 from San Mateo County line to Morgan Hill in Santa Clara County.	FHWA approval is required to designate right of way on interstate route as an HOV. For routes on the State Highway System, California Vehicle Code Section 21655.5 gives Caltrans the authority to designate a lane as HOV; this code also requires Caltrans to obtain the MPO (MTC's) and/or county transportation commission's approval. Caltrans requires a PID document (PSR and PR) for a project of this magnitude.	- When local funds are the main funding source, the local agency v often lead project development. In the Bay Area, Alameda, Contra Costa, Santa Clara, San Mateo and Solano agencies have all led HC projects. In Alameda County, the City of Fremont was designated the lead agency for a portion of the I-880 HOV lane project. Caltra will allow a local agency to be the lead in project development provided they can meet the oversight requirements that are speci in the Caltrans design manual and the Caltrans Cooperative Agreement that is required for design of the facility. - Caltrans owns and operates all HOV facilities in the Bay Area (HO Express Lanes are different; see next row), regardless of which agency led/leads project development; this is because Caltrans is t only agency with legislative authority to do so. No legislation has been passed in California that authorizes an agency other than Caltrans to "implement and operate" an HOV lane. Express lanes different; see next row.
Congestion Pricing/HOT Conversion	- A congestion pricing toll is authorized for Treasure Island; the project is in the systems engineering phase. - No HOT/Express Lanes exist today on 101 or 280. Elsewhere in the Bay Area, HOT/Express Lanes are in place along I-880/SR-237, operated by VTA; and on I-680, operated by Sunol JPA. Additional HOT / Express Lanes are under construction on I-580, to be operated by the Alameda CTC (opening in 2015) and on I-680 in Contra Costa County, to be operated by BAIFA. - VTA is planning to convert 36 miles of US 101 into Express Lanes. The project is currently in the Design phase, and is expected to be open in Late 2018. - MTC and CCAG are currently studying the feasibility of Express Lanes on US101 in San Mateo, between the Santa Clara County line and Interstate 380.	- A federal tolling agreement is required for tolling on interstate highways. FHWA also requires that Express Lanes projects follow the Federal Systems Engineering "Vee" process. - State legislative authority is required for implementing a toll facility in California. State law prohibits converting mixed use lanes directly into Express Lanes; only HOV lanes may be converted into HOT or Express Lanes. - Caltrans must approve a PID document for Express Lanes. In San Francisco, this would also likely require Caltrans approval of design exceptions. - VTA tolling authority (and Alameda's) was originally specified in AB 2032 (Dutra 2004) which added sections 149.5 (Sunol JPA) and 149.6 (VTA) to the Streets and Highway Code allowing demonstration HOT lane projects. AB 574 (Torrico 2007) made these projects permanent. - AB 1467 in 2006 allowed regional transportation agencies to request approval from the CTC to operate HOT lanes. - MTC obtained the authority from CTC in 2011 to develop and operate 270 miles of express lanes in Bay Area in 2011 (AB 1467, 2006). In April 2013 MTC delegated this authority to "develop and operate" to BAIFA through a cooperative agreement. BAIFA was formed in 2006 by MTC and BATA to finance the state contribution to the bridge seismic program and "to plan, develop and fund transportation related projects." The BAIFA Board has representatives from MTC, BATA, and Alameda, Contra Costa, and Solano Counties. - In 2010, AB 798 established the California Transportation Finance Authority (CTFA), which was granted the power to authorize Caltrans or other regional transportation agencies to use tolls as a means of financing a transportation facility.	- SFCTA, as the Treasure Island Mobility Management Agency, has authority to own and operate the TI congestion pricing program through AB980 (2008) and AB141 (2014). -The I-680 Express Lanes are operated by Sunol JPA. Caltrans own the right of way; the Sunol JPA owns the tolling equipment. This arrangement also applies to the Express Lanes operated by VTA. Similarly, the I-580 Express Lanes will be owned by Caltrans and operated byAlameda CTC. The Sunol JPA and Santa Clara both operate in a similar manner: these agencies have operational cont and day to day responsibilities for the staffing, setting of tolls and maintenance of toll related equipment. Each has an agreement w Caltrans specifying roles and responsibilities; in these cases, Caltra maintains the pavement.

Potential Strategies	Institutional - Coordination What instutional mechanisms exist to coordinate around this strategy?	Financial How is the capital and O&M of this strategy funded?	Policy Are policy changes currently being considered that would affect the application of this strategy in SF?
Adaptive Ramp Metering (ARM)	Unknown	The I-80 Smart Corridor Project is funded by state CMIA funds, the Traffic Light Synchronization Program, Alameda County Measure B funds, and Contra Costa County Measure J funds. This is an "actively" managed project, requiring staff to monitor and provide oversight. For projects of this type (with an ongoing operations obligation) that are sponsored by a local agency, Caltrans will require a funding plan to cover Caltrans oversight and operations costs. An annual operating agreement will be required specifiying the roles and responsiblities and budget.	N/A
Dynamic Lane Use Control, including Merge/Shoulder	Unknown	The I-80 Smart Corridor Project is an example of how this type of strategy can be funded when part of a larger package of improvements.	N/A
Dynamic Speed Limits / Advisories	Unknown	The I-80 Smart Corridor Project is an example of how this type of strategy can be funded when part of a larger package of improvements.	N/A
High Occupancy Vehicle (HOV) Conversion	A Committee comprised of Caltrans, MTC and CHP oversees HOV lanes management in the Bay Area; another name for this Cmte is the Freeway Mgmt Executive Cmte. Historically, the Committee reviews and approves requests to modify Bay Area HOV lane policies (e.g., hours of operation, eligibility) to meet the legislative requirement of CVC 21655.6. A staff level version of this Cmte will oversee the technical aspects of the MLIP.	Traditional state fund sources such as STIP funds – both county share and inter-regional share – have been used to fund HOVs throughout the state. Federal CMAQ and STP funds have also been used. One-time state programs such as Corridor Mobility Improvement Account (CMIA) and Traffic Congestion Relief Program (TCRP) have also provided HOV funding. As the availability of state and federal funds has decreased, development of HOV facilities as been increasingly dependent on local funding for development and construction. These funds are primarily county sales tax measures but also may include developer impact fees and other local funds.	Caltrans is updating Deputy Directive 43 (Managed Lanes) that outlines roles, responsibilities and implementation requirements, and states the policy purpose for managed lanes on the SHS.
Congestion Pricing/HOT Conversion	- The California Toll Operators Committee (CTOC) is responsible for coordinating and setting interoperability guidelines for California Toll Facilities. The SFCTA joined CTOC in 2014. - The Express Lanes Executive Steering Committee has a similar function for the Bay Area Express Lane network. The Committee has several Technical Working Groups. The SFCTA joined the ESC in 2014. - The "HOV Committee" (see above) will provide staff and executive oversight of the MLIP.	- Capital Costs – Project development and capital costs for have been funded with VPPP, local sales tax and other state and federal discretionary funds. O&M Costs – Funded by toll revenues, typically with supplemental funding for operations during the initial years. The cost of services provided by other agencies - e.g., BATA for transaction processing; CHP for incident management; Caltrans for pavement maintenance - is negotiated. E.g., on the I-680 and I-880 Express Lanes, a portion of the Caltrans maintenance is reimbursed by the operating agencies per agreement. - Current proposed legislation, AB 194, would require that (1) HOT revenues pay for maintenance, administration, and operation of HOT lanes, and (2) that any remaining HOT revenues be spent within the corridor they are generated.	- SB 983, failed 2014 legislation, would have removed the limit on the number of allowable HOT facilities in CA; limited the implementation and operation of new HOT lanes to the RTA (MTC) and VTA; and prohibited the conversion of mixed use lanes into HOT lanes, among other provisions. Current proposed legislation, AB 194, is identical to SB 983. - The California State Transportation Agency (CalSTA) issued a White Paper in January 2015, titled "Tolling and Pricing for Congestion Management and Transportation Infrastructure Financing," with recommendations on: use of tolling to manage congestion and fund transportation infrastructure. It also proposes new legislation that would provide for the CTFA to authorize tolling for mobility management, not just financing.