



FREEWAY CORRIDOR MANAGEMENT STUDY PHASE 2

FINAL REPORT | NOVEMBER 2018



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Freeway Corridor Management Summary: Executive Summary

San Francisco's freeway network is facing a critical problem: more people than ever are using US 101 and I-280 to travel to, from, and through the city.

Delays and lack of reliability on our freeways result in lost time and longer commutes. And congestion is expected to increase: by 2040, there will be more than 100,000 additional daily trips between San Francisco and the South Bay.

Left unaddressed, congestion on the freeways will continue to grow, exacerbating the delays, lack of reliability, and environmental impacts we see today.

The Transportation Authority has conducted a study to understand how we can address this growing challenge in the near-term. The Freeway Corridor Management Study Phase 2 focuses on addressing congestion while achieving the following goals:

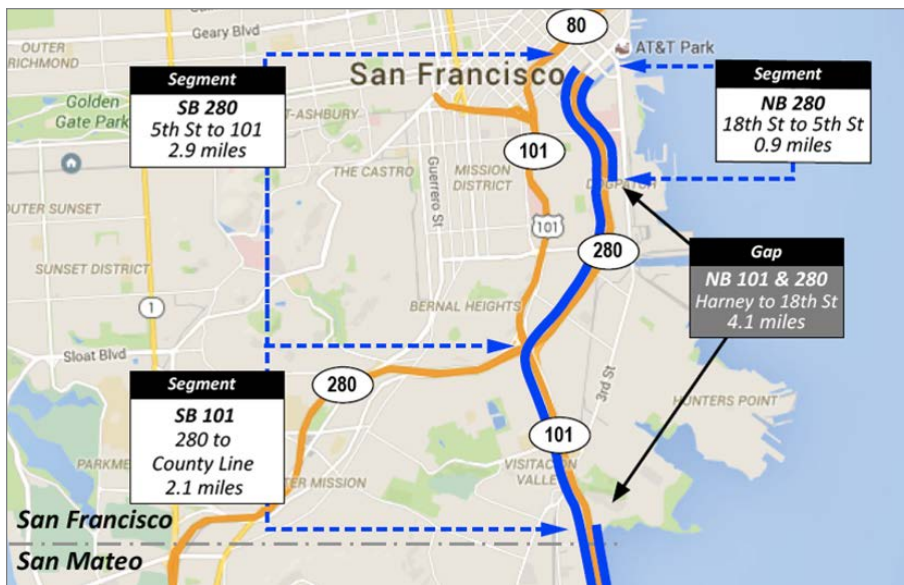
- **Move people efficiently:** We need to get more travelers to their destinations as quickly and reliably as possible in the existing freeway footprint.
- **Increase trip reliability:** More reliable travel times will help everyone, from parents picking up their children from school to commuters who need to get to work on time.
- **Enhance travel choices:** Better transit and incentives to carpool give commuters convenient new travel options.
- **Contribute to a regional network:** San Francisco's freeway management strategies will be coordinated with similar projects in San Mateo and across the region.
- **Reduce emissions:** Moving more people in the same or fewer vehicles will help achieve our climate goals as our population grows.
- **Support community well-being:** We must ensure that any changes to freeway operations support equity and safety in nearby neighborhoods.

SEEKING SOLUTIONS WITH MANAGED LANES

Building off of these goals and guidelines, the study team focused this study on implementation of managed lanes, broadly referred to as any lanes on a freeway reserved for carpools or vehicles that are charged for access (these lanes are often known as "express lanes").

Without any changes to the current operation of the freeways in San Francisco, buses and carpools will continue to be stuck in the same traffic as all other vehicles, providing travelers with no incentive to ride transit or carpool. Managed lanes could give transit and carpools a faster ride, incentivizing more efficient trips.





MANAGED LANE CONFIGURATION

Given the existing configuration of our freeways, carpool or express lanes could be implemented in the below segments:

Southbound lanes: the existing configuration of the I-280 and US 101 freeways allows for the creation of a continuous lane by converting the left-most existing general purpose lane into a managed lane. A carpool or Express Lane could operate along I-280 between the intersection of 5th and King Streets and US 101, continuing through the interchange to US 101 into San Mateo County, covering a distance of about five miles in San Francisco proper. This extension would be the northern end of a 65-mile managed lane from San Francisco to Morgan Hill.

Northbound lanes: because I-280 exits from the right side of northbound US 101, any carpool or Express lanes entering San Francisco from San Mateo county will likely end at or near the county line. However, the study identified an opportunity to provide priority for northbound carpools and buses for approximately one mile along I-280N headed into South of Market, from about 18th Street to 5th Street.

This study evaluates four managed lane options for a 2020 timeframe:

1) No Build: The configuration of freeways remains as it is today.

The study found that under this scenario, congestion continues to get worse, with some bottlenecks resulting in an additional 2 to 5 minutes of travel time over existing

conditions. Despite this, there remains no incentive to use transit or carpool in the corridor, as both buses and carpools remain subject to these increasing delays.

2) HOV2+: High Occupancy Vehicle (carpool) with a two-person minimum requirement.

The study found that this option is not expected to provide travel time savings to transit riders and carpools and should not advance to further study.

3) HOV3+: High Occupancy Vehicle (carpool) with a three-person minimum requirement.

The study found that this option creates substantial additional congestion in the corridor, reduces person throughput, and should not advance to further study.

4) HOT3+: Express Lane with a three-person minimum carpool requirement. In this scenario, transit and carpools of three or more can access the lane at no cost. A demand-based, variable toll will be available to others who may pay to access the lane.

The study found that this option could advance the goals of this study and warrants more detailed evaluation in subsequent study phases.

In addition, important public policy concerns related to the equity impacts of express lanes should be considered, studied further, and mitigated.



1. Introduction

Congestion on San Francisco's freeways is bad and getting worse. The San Francisco County Transportation Authority's latest congestion monitoring data identifies that average speeds on San Francisco's most trafficked freeways, I-280 and US 101, have dropped each year since 2009. Delays and the lack of reliability inherent in travel on roadways that are at or over capacity results in lost time by all travelers that use the freeways, reduced business efficiency from slower deliveries, and environmental and livability impacts on surrounding neighborhoods from traffic diverted to local streets and increased pollution from stop and go traffic.

Looking ahead, travel is projected to continue to grow on major freeway corridors through 2040. Based on the 2017 San Francisco Transportation Plan, between San Francisco and San Mateo Counties alone, over 100,000 additional daily trips are forecast. This is equivalent to one full bus every two minutes between the two counties. Left unaddressed, congestion on the freeways and crowding on transit will continue to grow, exacerbating the delays, lack of reliability, and environmental impacts we see today.

1.1 PREVIOUS STUDIES

The 2013 Countywide Transportation Plan first identified the need for a comprehensive review of strategies to more effectively utilize San Francisco's existing freeway infrastructure, and included a recommendation to set a vision for managing the city's freeway network. Work on this

recommendation began in 2014, resulting in the adoption by the SFCTA board of the Freeway Corridor Management Study Phase 1 report in 2015. The Phase 1 report inventories potential strategies for increasing the efficiency and functionality of freeways to provide congestion relief along with proposing a set of goals by which these improvements should be evaluated. These goals, which form the basis of the evaluation in this Phase 2 report, are summarized below and detailed in Appendix A:

- **Move people efficiently:** We need to get more travelers to their destinations as quickly and reliably as possible in the existing freeway footprint.
- **Increase trip reliability:** More reliable travel times will help everyone, from parents picking up their children from school to commuters who need to get to work on time.
- **Enhance travel choices:** Better transit and incentives to carpool give commuters convenient new travel options.
- **Contribute to a regional network:** San Francisco's freeway management strategies will be coordinated with similar projects in San Mateo and across the region.
- **Reduce emissions:** Moving more people in the same or fewer vehicles will help achieve our climate goals as our population grows.
- **Support community well-being:** We must ensure that any changes to freeway operations support equity and safety in nearby neighborhoods.

San Mateo County Transportation Authority

The San Mateo County Transportation Authority is currently seeking environmental clearance for a project that proposes to build an express lane in both directions on US-101 in San Mateo County. The express lanes would connect with existing carpool lanes which would be converted into express lanes themselves, creating new continuous express lanes that extend from I-380 in San Bruno to San Antonio Road in Mountain View.

See <http://www.dot.ca.gov/d4/101managedlanes/> for more details.

1.2 FREEWAY CORRIDOR MANAGEMENT STUDY PHASE 2

This study, the Freeway Corridor Management Study Phase 2, aims to identify near- to medium- term improvements that will enable more reliable and efficient access between San Francisco and the region via San Francisco's US-101/I-280 North extension corridor. These improvements would complement and support major transit investments such as the electrification of Caltrain and its extension to the Salesforce Transit Center. This study was guided by the goals of the Phase 1 report (summarized in Section 1.2), and focuses on strategies that move more people in the same or fewer number of vehicles, and within the same footprint of today's freeways.

Without any changes to the current operation of the freeways in San Francisco, buses and carpools will continue to be stuck in the same traffic as all other vehicles, providing travelers with no incentive to ride transit or carpool. San Francisco, along with Napa, are the only two counties in the nine-county Bay Area that do not provide any preferential treatment for transit or carpools on its freeways. Given this, the study team for Phase 2 – including project partners at Caltrans (the owner of the freeway facilities), the San Mateo County Transportation Authority, the San Mateo City/County Association of Governments, and the San Francisco Municipal Transit Agency – have collaborated to conduct a feasibility-level analysis of options for extending managed

lanes, broadly referred to as any lanes on a freeway set aside from general-purpose lanes, either by occupancy requirements, pricing or access limitations (i.e. carpool or HOV and/or “Express” or HOT lanes), from their current planned endpoint near San Francisco International Airport to downtown San Francisco.

This focus is also in alignment with state SB 1 Congested Corridors Program priorities and MTC/BATA regional express lane network plans, both of which identified US 101 as a high priority corridor for multi-jurisdictional solutions to congestion. San Francisco wishes to support regional efforts to create a continuous transit and carpool priority lane along the US 101 corridor, creating a more reliable way to travel between downtown San Francisco, downtown San Jose, and points in between that may not be easily accessible from Caltrain's commuter rail service. Santa Clara, San Mateo and San Francisco counties coordinated with Caltrans to update the 101 Corridor System Management Plan to provide a tri-county vision for a continuous managed facility with complementary transit and mobility strategies up and down the Peninsula. **Figure 1** shows the status of managed lanes efforts in the three counties.

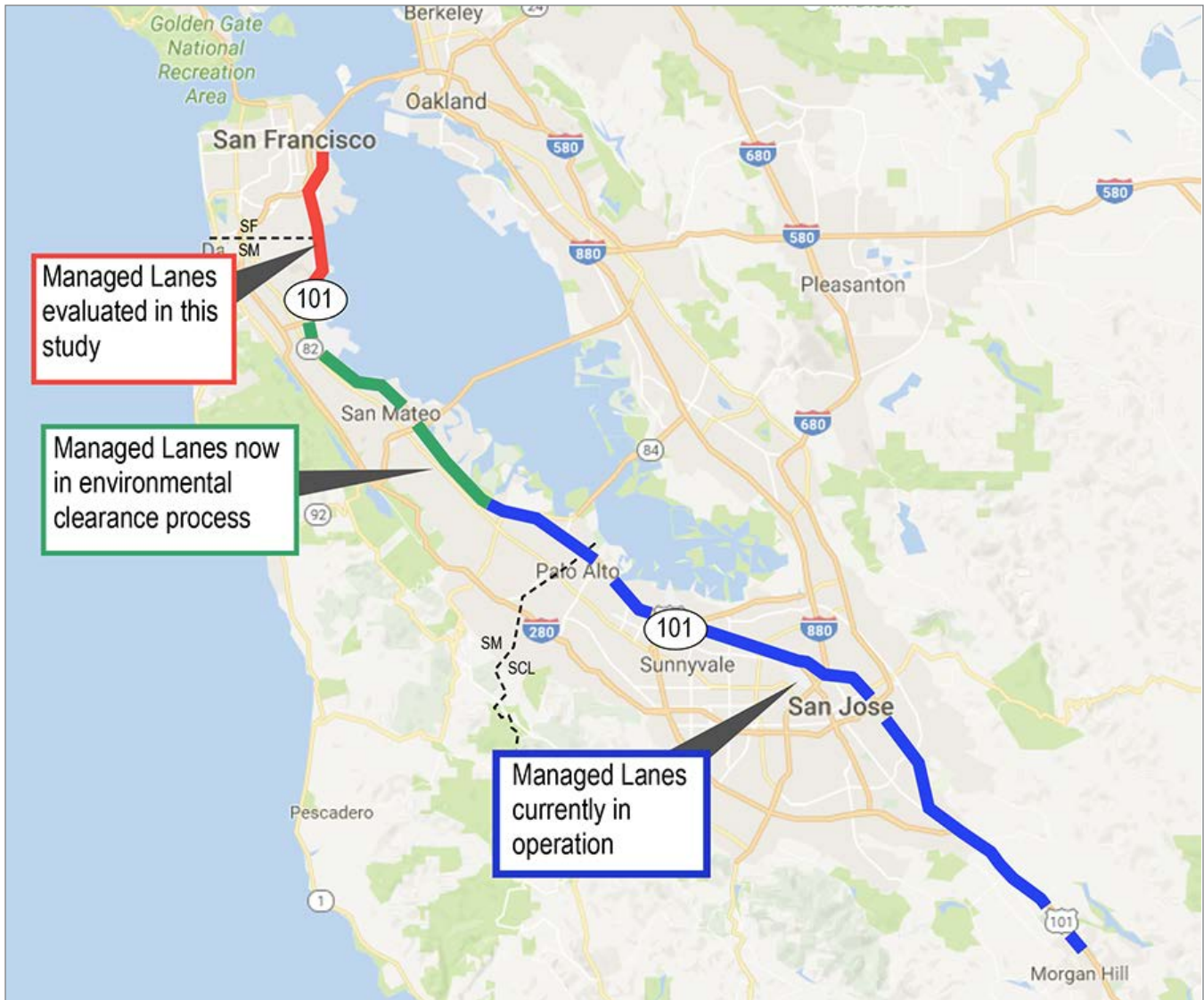


FIGURE 1

The results of this study represent an early understanding and recommendation on feasible managed lane options that could be implemented in the near- to medium term. Like all feasibility studies, this analysis is intended to provide a high-level investigation into the viability of proposed concepts and suggest promising alternatives for further study. The level of detail generated at this stage is commensurate with the best data currently available and the understanding that more comprehensive and detailed multi-modal analyses

need to be conducted in subsequent development phases of the project, including further alternative development and scoping, traffic analyses, environmental review, and final design. The intent at this stage is to identify conceptual alternatives that can achieve the project goals identified during Phase 1, and to provide a preliminary assessment of their feasibility from both a physical, operational and public policy perspective.

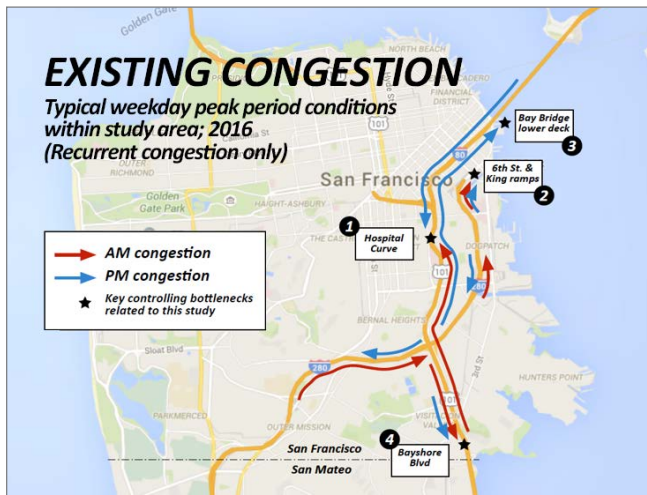


FIGURE 2



FIGURE 3

2. Existing Conditions and Needs Assessment

To begin, the study team conducted a review of the operational conditions and physical geometry of the freeway network in order to identify opportunities to quickly and cost-effectively address congestion and create a more reliable connection from the county line to downtown. **Figures 2 and 3** show existing congestion and bottlenecks within the study area in the year 2016 as well as projected congestion and bottlenecks in future year 2020.

As shown in Figures 2 and 3, congestion continues to worsen as travel grows in the corridor. In 2020, the locations of bottlenecks will largely remain the same, though the delay created by each bottleneck will worsen, resulting in longer queues of traffic building at each location.

Early on, the study team assessed the potential to develop managed lanes on US 101 through to the San Francisco-Oakland Bay Bridge, but determined that several operational and geometric constraints pose significant challenges to utilizing US 101 north of the US 101/I-280 interchange. These included:

- **Volume:** Heavy traffic volumes on the Bay Bridge throughout the day and at peak periods create queues extending to and onto I-280 to the south on US 101 and backing up to the SF-Oakland Bay Bridge to the north/east;
- **Capacity:** Though there are generally four lanes in each direction on US 101, only three of these lanes continue through the US 101/I-280 interchange. The

structural design of this interchange also severely limits any expansion opportunity without completely reconstructing the interchange at high impact;¹

- **Configuration:** Exits from both the right and left side of the facility that effectively prevent use of existing left lane as a carpool or express lane. Only a single lane of US 101 continues without exiting on either the right or left side between the Bay Bridge and the San Francisco/San Mateo county line.
- **Jurisdiction:** Caltrans owns all freeways, and the Metropolitan Transportation Commission has jurisdiction over I-80 east of the Fifth Street on-ramp, so any potential project would need to be studied in close partnership with multiple agencies to properly assess costs, benefits and impacts.

For these reasons, the study team concluded that the I-280 extension provides the more feasible initial managed lanes opportunity. The question of how to bypass congestion on US 101 north of the US 101/I-280 interchange and on the approach to the Bay Bridge must still be addressed, and along with studies of I-280 west of US 101, will be advanced in the San Francisco Streets and Freeways Study, a component of ConnectSF, San Francisco's ongoing long-range transportation planning program.

¹Existing supports for the northbound connector from I-280 to US 101 straddle the three-lane cross-section of US 101 at the interchange. Thus, widening that portion of the freeway would likely require reconstructing the entire connector.

Operationally, I-280 northbound from the interchange to its terminus at 5th and King Streets near AT&T Park and the Caltrain station represents a good opportunity to introduce a managed lane. It is a newer freeway with lower traffic volumes than US 101, previously included an HOV lane (prior to the 1989 Loma Prieta earthquake) and has the potential to be restriped to provide a carpool or express lane without significant impacts on existing traffic. While the I-280 facility west of US 101 is congested, these delays are primarily caused by the connection to northbound US 101 and the controlling bottleneck on Interstate 80 at the approach to the San Francisco-Oakland Bay Bridge.

In addition to the physical characteristics, the study team focused on understanding the current operations of both the US 101 and I-280 freeways - where and when is congestion present, what delay does it create, and what is its cause? These performance characteristics are described in the FCMS Existing Conditions Report (Appendix B), and summarized in **Figures 2 and 3** above. This portion of the study included a review of traffic conditions in northern San Mateo county as well, resulting in coordination with the San Mateo County Transportation Authority and C/CAG to identify congestion and address ways to fill a gap between the end of San Mateo's Managed Lane project at I-380 and the San Francisco/San Mateo county line.

Why Not Widening?

As opportunities to address congestion within the project limits took shape, the team began to outline the set of potential solutions for analysis in the Study. In line with existing San Francisco policy meant to discourage personal car use and protect San Francisco's neighborhoods, designs that included significant expansion of freeway capacity were not advanced. Policy 3.1 of the Transportation Element in the San Francisco General Plan reads:

"The existing capacity of the bridges, highways and freeways entering the city should not be increased for single-occupant vehicles, and should be reduced where possible. Changes, retrofits or replacements to existing bridges and highways should include dedicated priority for high-occupancy vehicles and transit, and all bridges should feature access for bicyclists and pedestrians."

Policy 3.2 reads:

"New elevated and surface freeways should bypass or terminate outside San Francisco, rather than pass through the city."

And Policy 18.3:

"The existing single-occupant vehicular capacity of the bridges, highways and freeways entering the city should not be increased and should be reduced if needed to increase the capacity for high-occupancy vehicles, transit and other alternative means of commuting, and for the safe and efficient movement of freight trucks. Changes, retrofits, or replacements to existing bridges and highways should include dedicated priority for high-occupancy vehicles and transit, and all bridges, where feasible, should feature access for bicyclists and pedestrians."

3. Study Alternatives

To develop managed lane alternatives for evaluation, the study team reviewed the physical and operational characteristics of San Francisco's freeways along with policy and legal constraints, as described in the previous section. As a result of this review, in addition to and in service of the study goals, a few key guidelines emerged for the purposes of this study:

- Potential for quick implementation:** The study team sought to develop alternatives that would not require extensive construction and could leverage the existing configuration of the freeways. This priority is also in line with San Francisco's other adopted priorities to limit freeway construction and to prioritize investments in transit.
- Focus on travel to/from Downtown San Francisco & Eastern Neighborhoods:** Significant growth is expected in both downtown San Francisco and the City's Eastern and Southeastern neighborhoods. By improving the reliability and efficiency of freeways that serve these growing areas, more productive travel choices can be made available and more attractive.
- No expansion of freeway capacity:** San Francisco's general plan calls for no freeway expansion in San Francisco, instead recommending the provision of bus and carpool priority lanes. Expansion of freeways also carries the potential for substantial negative impacts on neighborhoods adjacent to freeways, many of which are Communities of Concern.
- Increase in person throughput while minimizing impact on traffic:** The study team prioritized opportunities to provide travel time savings and reliability increases for transit and carpools while minimizing the impact on other vehicles. Primarily, this meant identifying freeway segments that are not critically congested today but may become so without intervention in the future, such as I-280 between US 101 and Downtown.

Using the study goals and the guidelines described above, the team focused on a single potential managed lane project configuration with three options for operational strategies. This alternative is detailed below.



FIGURE 4

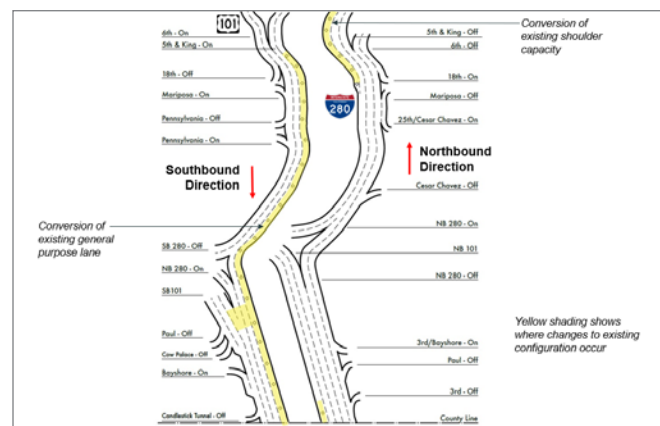


FIGURE 5

3.1 PHYSICAL CONFIGURATION:

Southbound, the existing configuration of the I-280 and US 101 freeways allows for the creation of a continuous lane by converting the left-most existing general purpose lane into a managed lane. A carpool or Express Lane could operate along I-280 between the intersection of 5th and King Streets and US 101, continuing through the interchange to US 101 into San Mateo County, covering a distance of about five miles in San Francisco proper. This extension would be the northern end of a 65-mile managed lane from San Francisco to Morgan Hill, south of San Jose.

Headed northbound, because I-280 exits from the right side of northbound US 101, any carpool or Express lanes entering San Francisco from San Mateo county will likely end at or near the county line. This is necessary to avoid weaving across 101 to reach the right-side exit to northbound 280. However, the study identified an opportunity to provide priority for northbound carpools and buses for approximately one mile along I-280N headed into South of Market, from about 18th Street to 5th Street. This is accomplished by converting the existing wide shoulder into a managed lane, effectively increasing capacity along this portion of northbound I-280.

3.2 OPERATIONAL CONFIGURATIONS (OCCUPANCY, TRANSIT, AND PRICE):

The physical configuration of the lane described above could be implemented with a variety of operational policies, including both traditional carpool (HOV) and Express Lanes (HOT). When considering a traditional carpool policy, the lanes could have minimum occupancy requirements of either two or three persons, consistent with other carpool lanes in the Bay Area.

The study team also explored whether price management, in the form of Express Lanes, could be used with either of these configurations. Express Lanes could provide the right tool to achieve a balance of traffic that gives buses, carpoolers, and other vehicles in the lane faster travel time and reliability without adding significant delay to the remaining general-purpose lanes. While eligible carpools and buses would access the lane at no cost, the price to enter for non-carpools would be determined by demand, thus ensuring that all available capacity in the lane would be used without becoming congested, and therefore keeping traffic in the lane moving at 45mph, the federal standard for managed lanes.

3.2.1 OCCUPANCY

To test the feasibility of both carpool and Express Lane options, the study team developed operational alternatives around three themes, plus one no-build future scenario:

- No Build, where the configuration of freeways remains as it is today. This serves as a point of comparison for the following three build scenarios.
- High Occupancy Vehicle (HOV) with a two-person minimum requirement (HOV2+).
- HOV with a three-person minimum requirement (HOV3+).
- Express Lane with a three-person minimum requirement to access the lane at no cost and a demand based, variable toll for others to access the lane (HOT3+).

3.2.2 TRANSIT

All three build alternatives included projected increases in transit service utilizing the lane, which were developed in coordination with Muni and SamTrans. This is important to boost person-throughput and to help ensure access to the lanes for all uses, particularly low-income travelers. These changes included both routing modifications for existing

What are HOT/ Express Lanes, and who can use them?

Traditional high-occupancy vehicle (HOV) lanes require passenger vehicles to have a minimum number of passengers. “HOT” lanes is short for “high-occupancy toll” lanes. HOT lanes are HOV lanes that allow vehicles that don’t meet occupancy requirements to pay a toll to use the lane, while transit and carpools continue to use the lane for free. Variable pricing is used to manage the lane so that reliable performance is maintained at all times, and transit and carpools are prioritized over vehicles that might pay to use the lanes - if the lane is full of buses and carpools, then the system would not even allow other drivers to pay the toll to enter, restricting the lane only to high occupancy vehicles.

Dynamically priced HOT lanes have been implemented around the Bay Area and throughout the United States, and have proven to be more effective than traditional HOV lanes. While communities may call them by different names, such as Express Lanes, the basic operation is the same—HOT lanes encourage carpooling and other transit alternatives while offering vehicles that do not meet standard occupancy requirements another option.

routes like the 8BX, implementation of planned routes like the Hunter’s Point and Candlestick Express services, and incorporation of the preliminary results of SamTrans’s 101 Express Bus study. The details of this analysis are described in the following section.

What about private commuter shuttles?

Private commuter shuttles, taken together, would represent the Bay Area's seventh largest transit agency by passengers served, and play a significant role in travel in the US 101 corridor. There are 800 shuttle buses that transport around 34,000 people per day across the Bay Area. Of these passengers, approximately 1,800 cross the San Francisco-San Mateo county line on US 101 each day in the morning and evening peak hour. While SFMTA collects data about shuttle routes and stops within San Francisco, it is difficult to estimate what changes may occur to these networks in response to changes on the freeways. For the purpose of this analysis, the project staff rerouted private buses to the carpool or express lane where they would achieve time savings over their current routes and considered their presence in person throughput calculations, but otherwise did not evaluate any changes to ridership or frequency of any private shuttles.

4. Alternatives Analysis

The purpose of the study is to assess the overall performance of the proposed carpool or express lane alternatives to determine whether any of the options should be recommended to move forward in the planning and project development process. As a result, the analysis was a high-level assessment of future peak hour conditions to provide insight on the expected operations to establish overall feasibility of the alternatives. The level of detail and accuracy was commensurate with the data and forecasts available, and should be considered a precursor to more detailed studies (involving refined forecasts and microsimulation traffic analyses) that must be conducted during subsequent project development and environmental review phases.

The physical configuration detailed above was analyzed at a high-level for performance across four potential operational policies in the near term (2020), as noted in the previous section:

- No Build, where the configuration of freeways remains as it is today. This serves as a point of comparison for the following three build scenarios.

- High Occupancy Vehicle (HOV) with a two-person minimum requirement (HOV2+).
- HOV with a three-person minimum requirement (HOV3+).
- Express Lane with a three-person minimum requirement to access the lane at no cost and a demand based, variable toll of \$0.25-\$1.00 per mile for others to access the lane (HOT3+).²

In pursuit of the City's Transit First policies and equity goals, improvements and additions to Muni and SamTrans service were included in all build scenarios. Muni service includes an enhancement to the 8BX service to run all day and take advantage of the lanes within San Francisco, as well as the addition of the Hunters Point Express and Candlestick Express service, currently planned to come online as development in each neighborhood proceeds, serving both new and existing residents. Improved SamTrans service is based on the early findings of the in-progress US 101 Express Bus Feasibility Study, and was modeled to include eight new express routes that serve both San Mateo County resident trips to San Francisco and San Francisco trips to job centers in San Mateo County.

The analysis was performed by determining the demand for travel across all modes and routes in each scenario in the Transportation Authority's travel demand model, SF-

²This toll rate was developed by the study team to represent a price that would allow the lane to be fully utilized without becoming congested, and is only representative. Should this option advance, additional studies, including traffic and equity studies, would be conducted to gain further clarity on potential toll rates and their impacts on freeway users. Coordination with regional partners would also be crucial.

CHAMP, and then applying these demands to a high-level, morning and evening peak hour traffic model. This analysis provided information about travel times and delays for both carpool/Express Lane users and non-users, estimates of the change in number of people moved through the corridor, and city/area-wide metrics like overall vehicle miles traveled and air quality impacts. Appendix C contains additional details about the analysis methodology and approach.

5. Analysis Results

5.1 FREEWAY OPERATIONS

Results of the operational analysis indicate technical feasibility of the proposed lane configuration (based on overall person throughput of the facility and level of delay to vehicles in general purpose lanes) under at least one of the three evaluated operational policies. In 2020, in all of the operational scenarios being considered (HOV2+, HOV3+, HOT3+), the analysis indicates that the Managed Lane will be uncongested and offer a time savings advantage compared to the general purpose lanes, and thus provide an incentive to rideshare or use transit. However, there are tradeoffs in how this incentive is achieved:

- In portions of the corridor where the Managed Lane is created by converting an existing lane, the magnitude to which general purpose lane users will experience increased delays will directly correspond to how many vehicles use the Managed Lane - the more vehicles being moved in the managed lane, the fewer vehicles remain to congest the general purpose lanes. The HOV3+ option has the lowest Managed Lane usage, and thus has the greatest increase in general purpose lane delay, up to an additional 13 minutes (in the southbound evening peak hour).
- The HOV2+ option has the highest use of the Managed Lane and thus the least effect on the general purpose lanes. However, the HOV2+ option has the least potential for growth in carpools as the current level of 2 person or more carpools on the corridor would fill the lane on opening day, and is also not compatible with guidance from the Transportation Authority board to avoid privileging Transportation Network Company (TNC) solo customer trips, which would qualify for HOV2 status. Moreover, the HOV2+ Option

presents operational challenges at the transition from San Mateo's US 101 Managed Lane's proposed operations requiring a 3 person or more occupancy. This could cause adverse operational and enforcement impacts for users and system managers.

- In some locations where a Managed Lane is created by utilizing the freeway shoulder and retaining the existing number of general purpose lanes (i.e. northbound 280 north of Mariposa), travel times in the general purpose lanes will decrease slightly as vehicles leave the general purpose lanes to utilize the managed lane.

Picking the best option amongst the operating policies is a balancing act, including weighing time savings incentives, opportunities to increase ridesharing and transit usage (raising person-throughput), and the impact on the general purpose lanes. Based on this feasibility level analysis, the HOT3+ option strikes the best balance among these factors. Changes in travel time and person throughput for each scenario are detailed in Appendix C and summarized in **Tables 1 and 2**. Projected congestion and bottleneck locations are shown in **Figures 6-9**.



PHOTO CREDIT: SRTA

TABLE 1 - CHANGES IN TRAVEL TIME BY SCENARIO

DIRECTION	OPERATIONAL SCENARIO IN 2020	AM Peak Hour		PM Peak Hour	
		GP Lane	Managed Lane	GP Lane	Managed Lane
Northbound I-380 to Downtown SF	No Build	24 minutes	-	20 minutes	-
	2-person carpool (HOV2+)	-2	-7	+3	-8
	3-person carpool (HOV3+)	-2	-7	+6	-9
	3-person carpool with option for non-carpools to pay to use the lane (HOT3+)	-3	-7	+2	-8
Southbound Downtown SF to I-380	No Build	17 minutes	-	15 minutes	-
	2-person carpool (HOV2+)	+2	-6	+2	-4
	3-person carpool (HOV3+)	+10	-6	+13	-4
	3-person carpool with option for non-carpools to pay to use the lane (HOT3+)	+4	-6	-3	-4

TABLE 2 - CHANGES IN PERSON THROUGHPUT BY SCENARIO

SEGMENT	SCREENLINE LOCATION	OPERATIONAL SCENARIO IN 2020	AM	PM
US 101 NB	Between Harney Way off-ramp and Harney Way on-ramp (SF County Line)	2-person carpool (HOV2+)	+14%	+13%
		3-person carpool (HOV3+)	-12%	-9%
		3-person carpool with option for non-carpools to pay to use the lane (HOT3+)	+7%	+14%
US 101 SB	Between Bayshore Blvd on-ramp and Alana Way off-ramp (SF County Line)	2-person carpool (HOV2+)	+17%	+19%
		3-person carpool (HOV3+)	-5%	-8%
		3-person carpool with option for non-carpools to pay to use the lane (HOT3+)	+11%	+26%
I-280 NB	Between 18th Street on-ramp and 6th Street off-ramp	2-person carpool (HOV2+)	+40%	+18%
		3-person carpool (HOV3+)	+33%	+10%
		3-person carpool with option for non-carpools to pay to use the lane (HOT3+)	+24%	+8%
I-280 SB	Between 18th Street off-ramp and 18th Street on-ramp	2-person carpool (HOV2+)	+16%	+43%
		3-person carpool (HOV3+)	+7%	+19%
		3-person carpool with option for non-carpools to pay to use the lane (HOT3+)	+2%	+43%



FIGURE 6



FIGURE 7

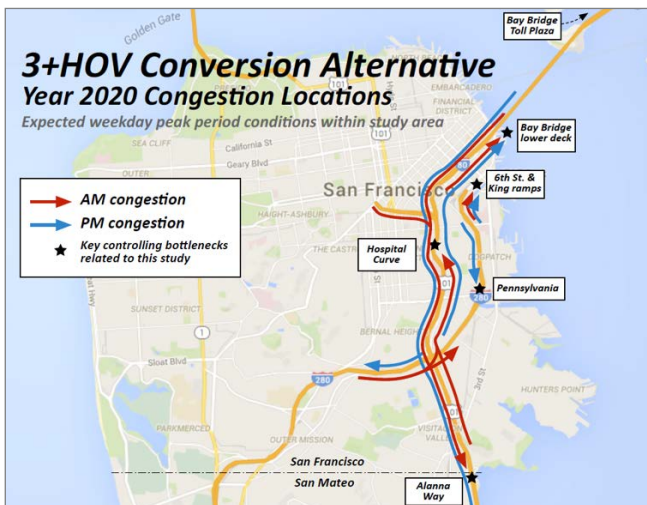


FIGURE 8

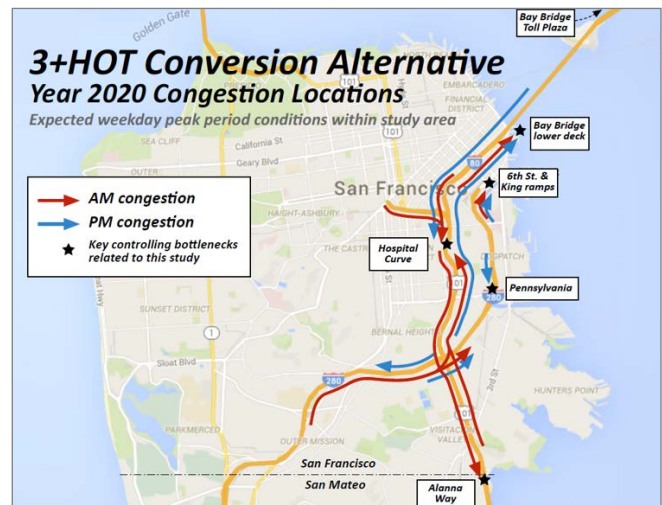


FIGURE 9

5.2 LOCAL STREET INTERFACE

The analysis also conducted a sensitivity analysis on the potential for traffic to divert to local streets when faced with the slightly increased travel times found in this study. The study team initially identified local streets including Bayshore Boulevard, 3rd Street, Alemany Boulevard, Potrero Avenue, and Monterey Avenue as routes where special attention must be paid to potential increases in traffic as a result of the proposed alternatives, and ultimately developed an analysis that would test for increases in volumes on all local streets. The results of this analysis, conducted using SF-CHAMP, showed that under both the HOV2+ and HOT3+ scenarios, no additional traffic was anticipated on any of these or other corridors. Under the HOV3+ scenario, some potential diversions were identified, the largest of which are:

- Southbound Third Street: Up to 90 additional vehicles in the peak hour, with greatest increases in the blocks leading toward Cesar Chavez Street and in the Bayview between Evans Avenue and Oakdale Avenue
- Eastbound Cesar Chavez Street: About 60 more vehicles in the peak hour approaching I-280
- Southbound South Van Ness and Southbound Potrero Avenue: Both streets see about 30 more vehicles per hour in the Mission

As a result of the degradation in travel times and person throughput, along with the potential for local street diversions in the HOV3+ scenario, the study team does not recommend that this operational scenario advance to future phases of project development and evaluation.

TABLE 3 - ANALYSIS RESULTS SUMMARY

GOAL	KEY METRICS	HOV2+	HOV3+	HOT3+
Move More People	Person Throughput	○	–	+
Increase Reliability	Travel Time & Variability	○	–	+
Enhance Travel Choices	Availability and Attractiveness of Non-SOV Options	○	○	+
Contribute to a Regional Network	Regional Connections & Policy Alignment	–	○	+
Reduce Emissions	Critical Pollutants & PM	TBD	TBD	TBD
Support Community Well-Being	Diversions & Community Investment	○	–	+

– = WORSE THAN NO-BUILD ○ = SAME AS NO-BUILD + = BETTER THAN NO-BUILD

5.3 OTHER PERFORMANCE FACTORS

Though the HOV2+ scenario initially appeared to be the most promising in a 2020 timeframe based on the results of the travel time and person throughput analyses, a more detailed investigation into the results provides reason to not advance this operational policy at this time. At numerous segments, the traffic analysis shows that the HOV2+ lane would be at capacity - 1,650 vehicles per hour - in 2020, assuming no “cheaters”, or vehicles with only one passenger, use the lane. Given that the average occupancy violation rate on Bay Area carpool lanes is approximately 20%, the study team has significant concern that an HOV2+ lane would ultimately not be able to provide the travel time savings shown in this analysis. The Transportation Authority board also expressed a preference to ensure that the lanes were not merely being used by TNCs (e.g., Uber and Lyft) that included only a driver and one passenger, which were not reflected in the travel demand modeling work and would also have the potential to add additional vehicles to the lane.

Regional policy conversations and consistency of driver experience factors also point to the need to look more critically at an HOV2+ scenario. The two existing carpool facilities into and out of San Francisco, the Bay Bridge and Golden Gate Bridge, both require 3 person or more carpools today. Additionally, Caltrans and MTC are currently leading an effort to increase the carpool occupancy requirement on I-880, CA 237, and US 101 in Alameda and Santa Clara counties to 3+ under an Express Lane Scenario, and San Mateo County’s preferred alternative for implementation

of Express Lanes on US 101 as far north as I-380 is also 3+ occupancy to travel at no cost. Adopting a different occupancy policy along a single corridor or connected facility would create significant driver confusion, traffic operations, and occupancy enforcement difficulties.

Due to these additional factors, the study team does not recommend that the HOV2+ scenario advance to future phases of project development.

5.4 TRANSPORTATION PERFORMANCE CONCLUSIONS

A summary of the transportation performance feasibility analysis conclusions in the context of the goals of the study is detailed in Appendix A and summarized in **Table 3**.

After review of the evaluation of the three operational alternatives, the results indicate that from a transportation performance perspective, a lane conversion alternative operating under either an HOT3+ could advance the goals of this study and warrant more detailed evaluation in subsequent study phases, including a robust review of public policy and equity implications, as detailed in Section 6. HOV3+ creates substantial additional congestion in the corridor, reduces person throughput, and should not advance to further study. HOV2+ is inconsistent with regional and corridor policy and will likely not achieve the outcomes calculated by the travel demand model in real-world conditions, and should also not advance to further study.

6. Outreach and Public Policy Considerations

The study team has met with numerous community, advocacy, and business groups to introduce and hear feedback on the concept of a freeway management strategy in San Francisco, including the potential for Express Lanes. Feedback from outreach conducted to date has been generally neutral to positive, with most participants agreeing with the need for and goals of the study. Many people had specific questions about the proposed physical configuration and some expressed early support or skepticism. Nearly all emphasized the importance of questions of socio-economic equity and transparency: which travelers would benefit from this project, who would pay, and how net fees, generated from any Express Lane alternative, would be spent. It is important to consider carefully project design, subsidy, and revenue investment policies to reduce risks and mitigate potential negative socio-economic impacts of the project, and ensure net benefits to vulnerable communities.

6.1 SOCIOECONOMIC EQUITY

At this feasibility phase of the project, the outreach strategy was focused on educating stakeholders about the project and the concepts under evaluation while collecting questions and concerns that are important to community members. While the scope of this study limits the extent that each major theme can be addressed, it is clear that socio-economic equity is an area that requires further study and analysis, as well as deeper public engagement and policy development.

The study team engaged in extensive coordination with peer agencies in response to this feedback, in an effort to better understand best practices to address socio-economic equity concerns related to Express Lanes. As an example, in Los Angeles, Metro's experience highlighted the need to design a package of strategies to complement the lanes, including additional public transit services, and the need to perform an equity analysis to identify potential benefits and impacts for vulnerable communities, including low-income travelers and residents living in neighborhoods adjacent to freeways. Based on Metro's experience in Los Angeles and that of similar studies being conducted in Seattle and Portland, the proposed equity analysis should:

- Utilize various methods including license plate surveys and other means to estimate the demographics of motorists utilizing the study area freeways during peak periods, and assess low-income users willingness and ability to pay to use an Express Lane;
- Conduct extensive direct outreach to Communities of Concern and neighborhood stakeholders regarding Express Lane pricing and revenue reinvestment policies;
- Document environmental and health impacts under existing conditions and potential managed lane scenarios; and
- Identify design features and strategies for mitigating socio-economic impacts and creating benefits for low-income and freeway adjacent communities.

As an example, in Los Angeles, Metro's approach to understanding and addressing community concerns and needs related to socio-economic equity included roughly 800 community meetings with communities along their Express Lane corridors. After considering the input received in these conversations, Metro developed a three-prong strategy to ensure equitable access to the benefits provided by Express Lanes:

- After hearing that the primary need from the community was for more and improved bus service, Metro made significant investments in buses that used the Express Lane and traveled through the neighborhoods adjacent to the Express Lane.
- In addition to this improved bus service, Metro developed two programs to assist low-income drivers who did not have the option of using transit. The first program, available to any person or household that met low-income eligibility criteria as defined for California assistance programs, provided a FasTrak transponder that included \$25 of pre-loaded credit and whose account included with a waived monthly maintenance fee.
- Another program, available to all enrolled transit riders with no income thresholds, provided travelers with toll credit for frequent use of transit within the Express Lane corridors. Under this program, regular transit usage provides travelers with the option to use the lane at no cost, even as a solo driver, should they occasionally need to travel alone by car.

Metro considered all three of these strategies an important part of the overall Express Lanes program. While the expanded bus service was initially funded by a federal grant, the ongoing operation of all three components is now funded by net revenues generated from the Express Lanes themselves (See Section 6.2)

The study team recommends advancing more detailed analyses and conversations around equity in pricing, detailed multimodal traffic studies, and additional improvements to transit as priorities should the study move into subsequent phases of environmental review and design.

6.2 NET REVENUE AND REVENUE RE-INVESTMENT

While it is too early to assess the potential for any San Francisco Express Lanes (HOT3+) to generate net revenue (after covering operating, maintenance and financing costs), there is reason to believe that a managed lane corridor in San Francisco on US 101/I-280 could generate positive revenues in the future. Currently operational lanes in Alameda and Santa Clara Counties generate positive net revenue (after an initial operational period of not doing so), and San Mateo County's studies is similarly expected to generate positive net revenue, which could then be re-invested into the corridor. For Express Lanes in San Francisco, future project studies would examine the financial risks and projections of costs and revenue more fully, as well as policies governing the use of net revenue for improvements benefitting the corridor in which they were generated, consistent with state law.



7. Recommendations & Next Steps

The study team recommends that the Transportation Authority advance project development and evaluation for a lane conversion, Express Lane (HOT3+ operational policy) management strategy for the US 101 and I-280 freeways in San Francisco.

Additional project development steps include a detailed review of full-day multimodal traffic operations and performance on both the freeway and local streets (particularly in the vicinity of the touchdown location in San Francisco), the inclusion of complementary system and demand management strategies (e.g. park and ride lots and 3rd party carpool services), and further consideration of strategies to maximize transit utilization of the Express Lane in conjunction with Muni, SamTrans, and others. Possible smart freeway/technology strategies that could be considered in order to maximize the performance of both the safety and operational performance of the managed lane itself as well as the entire corridor include:

- Adaptive Ramp Metering and Transit Priority Measures
- Interchange/Connector Metering
- Vehicle occupancy detection systems
- Enhanced Incident Detection (Cameras, Video, Detectors, etc.)
- Enhanced Incident Response (Freeway Service Patrol, Call Boxes, etc.)
- Enhanced CHP Enforcement
- Park & Ride Facilities
- Traveler Information and Signage
- Signal Coordination
- Transit Service Enhancements
- Carpool services
- Bike/Ped Connectivity (especially to Transit or Shared Rides)
- Local or regional policies around private shuttles use of managed lanes
- Local policy around rideshare use of managed lanes

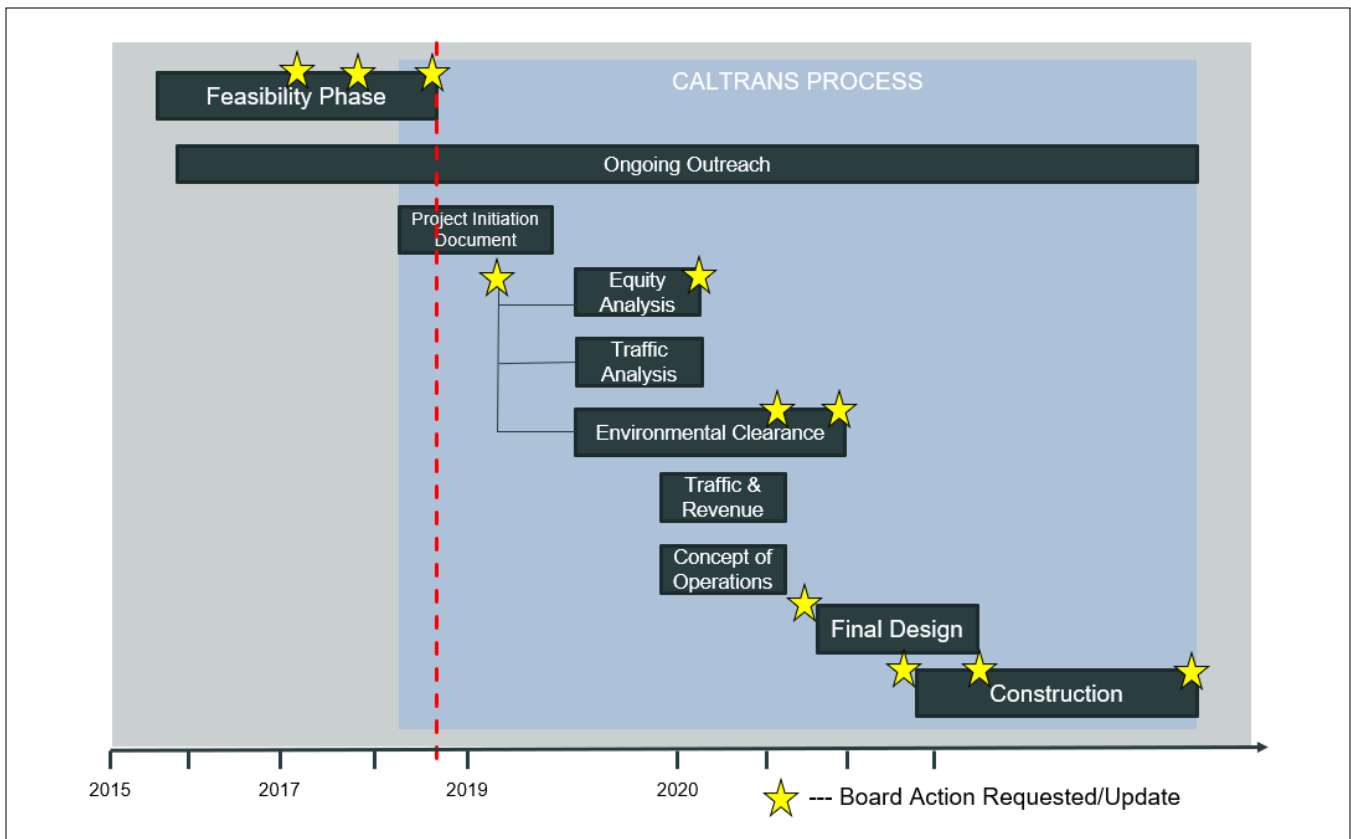


FIGURE 10

From a project design and environmental review standpoint, the next phase of advancing the concept identified here would be for the Transportation Authority enter into a Cooperative Agreement with Caltrans to develop a Project Initiation Document (PID), required for any changes or improvements on the state highway system. A Project Study Report-Project Development Support (PSR-PDS) is the recommended project initiation document that will provide a key opportunity for Caltrans and regional and local agencies to achieve consensus on the purpose & need, scope, and schedule of the project and its environmental review. The purpose for using the PSR-PDS document is to gain approval for project studies to move into the Project Approval and Environmental Document (PA&ED) phase. **Figure 10** summarizes the future project phases and SFCTA Board actions/updates along the way.

In addition to the PID document, successful implementation of a managed lane, particularly one created by the conversion of existing capacity, will involve significant interagency coordination on a variety of policies and legislative actions. For example:

- The status of the legal framework around conversion of a lane to an Express Lane will need to be confirmed and will potentially require changes to state legislation and/or the development of interagency agreements with FHWA³⁴
- Passage of AB2865 (Chiu) in 2018 provides San Francisco with the option of utilizing Santa Clara Valley Transportation Agency (VTA) in addition to BATA as a tolling partner, and both options would need to be further explored to support this decision.

³ Tolls and Federal Highway Funding Consequences: <https://www.cga.ct.gov/2018/rpt/pdf/2018-R-0244.pdf>

⁴ Current Laws on Tolling Existing and New Facilities on Federal Interstate Highways: https://www.dotdata.ct.gov/ct_congestion_site/reports.html



- Strategies to maximize the occupancy of vehicles in the corridor and encourage usage of the lane by transit and carpools to the fullest extent will need to be considered and developed. San Francisco, San Mateo, and Santa Clara Counties, with Caltrans, MTC, and CalSTA are currently beginning this process through the 101 Mobility Action Plan, which will develop recommendations for policies and programs to encourage carpooling and transit in the corridor in a future where a continuous managed lane is available.
- Evaluation of the impacts of any priced scenario on low-income commuters, and the development of programs to address these impacts, is critical to the project's success. The SFCTA is in process of developing a detailed investigation into the profile of drivers to, from, and within San Francisco to gain a better understanding about who might be impacted by projects such as Express Lanes.

Further study is recommended for these and other policy considerations in parallel with the Caltrans project development and environmental review process. Information developed and reviewed during this study will create an important foundation for subsequent studies and detailed understanding of the operations and impact of any managed lane in the corridor.

Appendix A: Goals, Metrics, and Evaluation Results

Appendix B: Existing Conditions Report

Appendix C: Traffic Analysis Methodology and Results