

Managed Lanes Implementation Plan Executive Summary



METROPOLITAN
TRANSPORTATION
COMMISSION

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Moving More People in Buses and Carpools
Through HOV Operational Strategies

Bay Area Managed Lanes Network

The San Francisco Bay Area has an extensive existing system of managed lanes, with the majority being High Occupancy Vehicle (HOV) Lanes. As of November 2017, the Bay Area Managed Lanes Network is comprised of over 494 lane-miles of non-tolled HOV and priced Express (Toll) Lanes, which includes 12 HOV lane-miles on bridge approaches and 72 lane-miles of Express Lanes. Bay Area transportation agencies are developing a 550-mile network of Express Lanes that will be completed in 2035. Express Lanes already are open on I-580 in Dublin, Pleasanton, and Livermore; I-680 southbound from Sunol to Milpitas; I-680 in both directions between Alamo and San Ramon; and on SR 237 between Milpitas and San Jose.

Background

The Bay Area is experiencing significant population and employment growth. Rising housing costs are forcing people to commute longer distances to access quality jobs. Many long trips are not well served by transit and access to transit is difficult or services are crowded, so many choose to drive. The result is a transportation network that is stressed beyond capacity. Building new highway capacity is a long, complex, costly process and is in many cases undesirable from an environmental standpoint.

The focus for transportation investment in the highway network is now on how to best make use of the capacity available today. Managed lanes, consisting of both HOV lanes and Express Lanes, have proven to be an effective means to increase the throughput of persons on our highway network. However, as pointed out in the recent Caltrans High Occupancy Vehicle Lane Degradation Determination Report, in the second half of 2016, over half (65%) of the approximately 390 HOV lane miles

How Managed Lanes Work

- HOV lanes requiring a minimum of two persons per vehicle are described as HOV2+, HOV3+ lanes require a minimum of three persons per vehicle.
- Federal law mandates that the operation of HOV and Express Lanes be monitored to ensure a minimum average speed of 45 mph at least 90% of the time during peak hours over a 180-day period, and changes be made to operating policies when the lanes are degraded.

in the Bay Area were reported to be “Degraded,” operating below 45 mph on average during at least 10% of the peak hours.

Of these, 201 miles of HOV lanes were considered either Very Degraded (degradation occurs 50% or more of the time) or Extremely Degraded (degradation occurs 75% or more of the time)

Key Elements of the MLIP

- Stakeholder Participation
- Public Outreach/Education
- Data Collection/Analysis
- Management
- Policy Guidance
 - Hours of Operation
 - Occupancy
 - Enforcement
 - Access
 - Exempt Vehicles
- Near Term Improvements
 - System Expansion/Gap Closure Planning
 - Hours of Operation Changes
 - Transit Services/Access
 - Park-Ride Availability and Access
 - Enforcement Technology Pilots

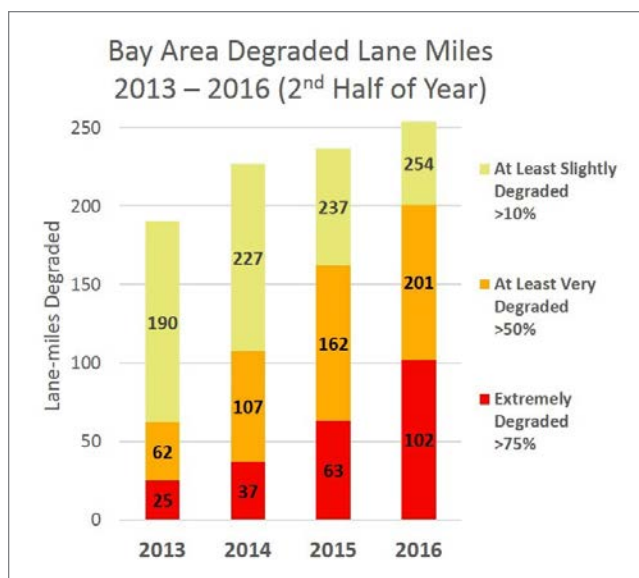
as shown in Figure 1 - Increase in HOV Lane Degredation and Figure 2 - Bay Area HOV Degradation Summary - Second Half of 2016. Moreover, degradation has worsened: both the extent and severity of degradation have been increasing annually. Between 2013 and 2016 the total number of degraded miles has increased by 64 miles (34%) and the number of Very Degraded miles has increased by over 130 miles (225%).

The Purpose of the Managed Lanes Implementation Plan (MLIP)

The Metropolitan Transportation Commission (MTC), in partnership with Caltrans and the California Highway Patrol (CHP), embarked on the Bay Area Managed Lanes Implementation Plan (MLIP) in order to address current problems of degradation on the HOV lane system, review the current practices and policies which govern managed lanes implementation and operation, and plan for the future expansion of the managed lane network in the nine Bay Area counties. A key aspect of the plan was to recognize the important role that transit and park-ride facilities play in increasing the utilization and effectiveness of managed lanes. The plan addresses policy issues related to the operation of the managed lane network.

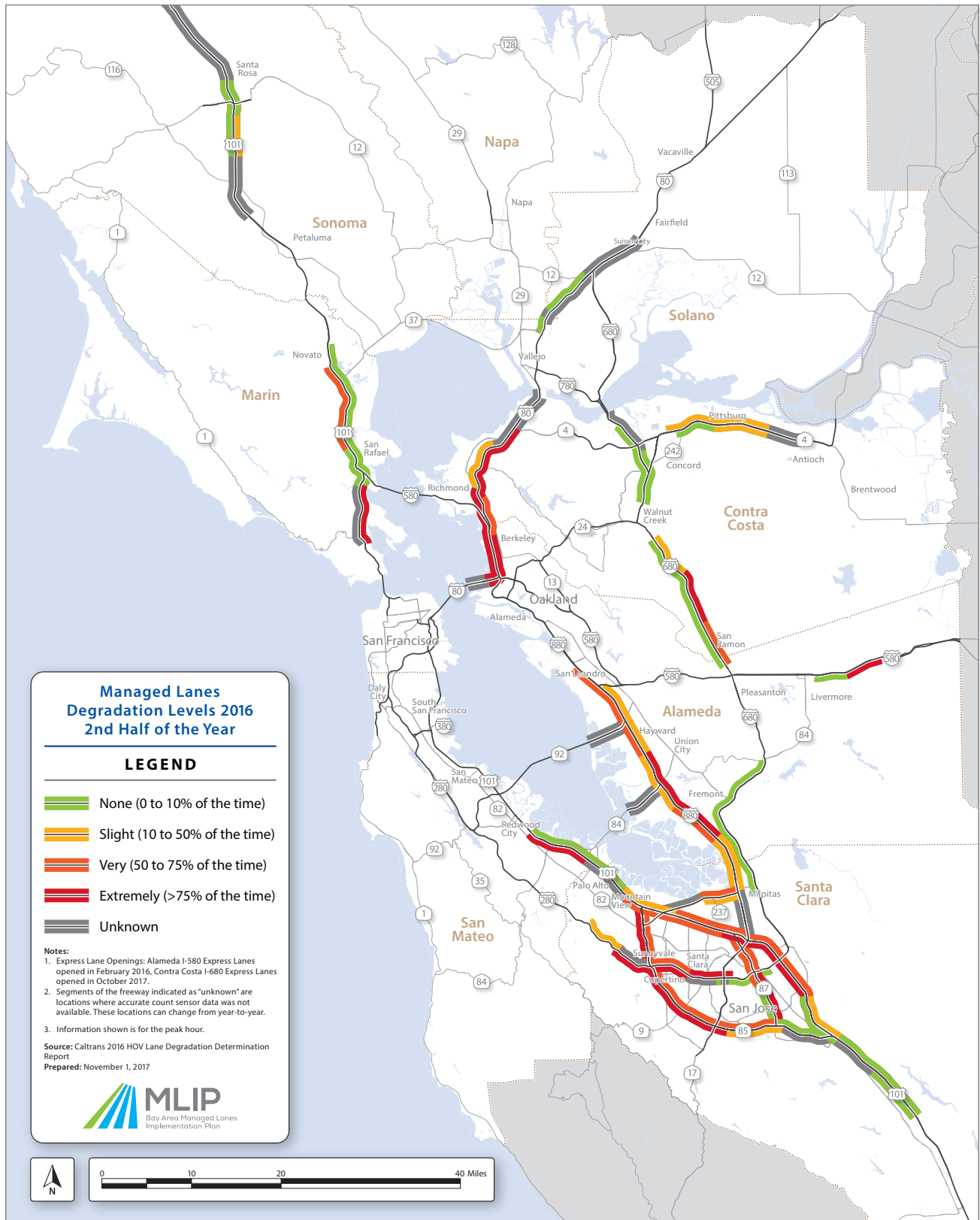
Current challenges faced by the existing managed lane system include discontinuity and gaps, as well as inconsistent operating policies that are potentially confusing to the public. There is also a need for guidance as to the appropriate policies and practices to be used throughout the Bay Area for managed lane hours of operation, vehicle occupancy rules, enforcement, access, and exempt vehicles such as Clean Air Vehicles (CAVs). In order

Figure 1 - Increase in HOV Lane Degredation



Source: Caltrans 2013-2016 HOV Lane Degradation Reports

Figure 2 - Bay Area HOV Degradation Summary - Second Half of 2016



Data Driven Approach

Collect performance data to inform decisions about how to improve the management and operation of the managed lanes network.

to accomplish this, MTC engaged Caltrans, the CHP, each of the county congestion management agencies, and the transit operators using managed lanes in developing the MLIP plan. There was outreach to the public in the form of focus groups and surveys, along with outreach to non-governmental organizations representing the interests of major employers and the traveling public.

During the course of the project it was determined that there was a substantial shortfall in the coverage of the data available to measure managed lane performance, and as a result, the development of the plan included a major regional data collection effort. This has allowed a “data-driven” approach to be adopted for MLIP, crafting findings and recommendations in response to the results of the extensive regional data gathering and evaluation effort.

MLIP Goals

The vision of the MLIP is the creation of an integrated network of:

Managed Lanes – a continuous and connected network of Express Lanes and HOV lanes in all the major travel corridors in the Bay Area including a consistent approach to the setting of hours of operation, occupancy requirements, access controls, the application of enforcement, and the use of the facilities by exempt vehicles such as CAVs.

Transit – an enhanced system of regional and sub-regional express bus service on the managed lanes network (both public and private) including existing services currently provided by the transit operators and new inter-regional express bus service connecting origins and destinations not well served by transit today.

Park-Ride – an expanded system of well-located and managed park-ride facilities to support the use of express bus service and the formation of carpools.

This vision evolved from the consideration of the MLIP goals and objectives with the agency stakeholders and the general public. Specific project goals were also identified as part of this collaborative process:

Degradation (Reliability) – The original motivation for MLIP was to find ways to address the issue of managed lane degradation. With over 65% of the region’s managed lanes being classified as degraded, there is a need to identify the specific causes of degradation and apply the appropriate strategies to address the problems. It is clear from the degradation reports that HOV lanes are not reliable in terms of delivering consistent time savings. Single Occupant Vehicles (SOVs) using managed lanes in violation of the occupancy rules were found to be a significant problem. These “cheaters” are a major public concern. CAVs also take up capacity that could be used by HOVs and transit vehicles.

Consistency – With 500 miles of managed lanes already operating or in various stages of implementation, it is clear that the system is moving beyond a group of independent highway segments with HOV or Express Lanes to a network with miles of

Table 1 - Managed Lanes Implementation Goals

| Degradation (Reliability) | Consistency | Person Throughput (Efficiency) |
|--|--|---|
| <p>Causes and Tools</p> <ul style="list-style-type: none"> • Violations and Enforcement • Clean Air Vehicles • Occupancy Policy • Access Restrictions <p>Cover Entire Peak</p> <ul style="list-style-type: none"> • Hours of Operation Policy | <ul style="list-style-type: none"> • Segments forming a Network • Policy (when possible and appropriate) • Education and Outreach • Regional/Local Management and Coordination | <p>Non-Highway Improvements</p> <ul style="list-style-type: none"> • Improve Access to HOV Options • Park-Rides • Improve Attractiveness of HOV Options • Transit Signal Priority (TSP) on Arterials Connecting to Managed Lanes <p>Encourage All HOV Options</p> <ul style="list-style-type: none"> • Transit • Carpool • Vanpool <p>Network Gap Closures (Connectivity)</p> |
| Ongoing Activities | | |
| <ul style="list-style-type: none"> • Data Collection • Public Education | | |

continuous managed lanes. Input from stakeholders and the public makes it clear that there needs to be more consistency in how managed lanes are operated. This involves looking at how and when policies such as vehicle occupancy requirements, hours of operation, enforcement practices, and access management should be consistent.

Person Throughput (Efficiency) – In order to improve the efficiency of the managed lanes network, it is essential to focus on increasing the number of persons (rather than vehicles) using the managed lanes. This is where the integration of managed lanes with transit and park-ride opportunities becomes important. The private sector is also stepping up, providing new types of transit and ride-sharing options.

During the course of the development of the MLIP, it became clear that there is a need for continuing

efforts to help fulfill the goals defined in the plan. These include:

Data Collection – A need to continue the types of data collection conducted during the MLIP process to allow for effective monitoring of the managed lanes network’s performance and allow for data driven decisions as to how to best address performance issues and enhance operations.

Public Education – While the public is generally informed about the nature and purpose of HOV lanes, outreach efforts found that there is a basic lack of understanding of the purpose of Express Lanes. There are misconceptions that tend to result in a lack of public support for Express Lanes. This engenders the need for a more comprehensive and focused program of public education regarding Express Lanes - their purpose, function, and use.

The MLIP vision is that of a regional highway system that serves as a multimodal network, embodying:

- A seamless, well managed network of HOV and Express Lanes
 - Clear, consistent messaging and operational practices to enhance public understanding
 - Emphasis on person throughput while minimizing impacts to the general purpose lanes
- Off-highway improvements to make HOV/transit use as easy and accessible as possible
 - Transit Signal Priority (TSP) on arterials
 - Park-rides
 - Shared mobility hubs for carpool formation
 - First mile/last mile connections to hubs
- Recommended projects, operational improvements, and policy changes needed to complement the existing network as well as new projects being planned/delivered by other agencies
 - Gap closures in congested areas currently lacking managed lanes
 - Off-highway projects to enhance throughput
- Policy changes
 - Make more efficient use of managed lane facilities
 - Enable HOVs and transit to take full advantage of managed lane time savings (violations, occupancy, hours of operation, exempt vehicles)
- Regional consistency
 - Connect the individual county's projects into a seamless, consistent network easily understood by the public
- Best practices going forward
 - Ongoing data collection and monitoring
 - Proactive rather than reactive policy adjustments on a corridor and regional basis

In order to achieve these goals and objectives, MLIP provides the following resources:

Documentation of Existing Conditions – MLIP provides a wealth of data regarding the current operations of managed lanes and managed lane corridors in the Bay Area. The existing managed lane network is identified and currently planned expansions to this network are documented. This includes information about travel speeds, vehicle occupancy, the extent of traffic congestion, transit services and ridership, park-ride locations and usage, managed lane occupancy rule violations, and use of managed lanes by CAVs.

Public Viewpoint – The results of focus groups and telephone surveys provide insight into the public's view of managed lanes in terms of their current level of knowledge and understanding, as well as their opinions relative to key questions such as occupancy rules, enforcement/violations, hours of operation, and CAVs.

Near Term Improvements – MLIP has resulted in the identification of near term improvements as related to:

- **System Expansion/Gap Closure** – Projects proposed by the county congestion management agencies to add new HOV or Express Lanes and close existing gaps in the network.
- **Transit Services/Access** – Improvements to existing express bus service and potential new inter-regional express bus routes.
- **Park-Ride Availability and Access** – Expanded park-ride capacity and measures to more effectively manage park-ride resources.

Guidance on Policies – Research was conducted as part of the MLIP to document current policies and practices relative to managed lanes operations throughout the country as well as specifically in California and the Bay Area. Also, input from stakeholders and the public has helped to provide some guidance on how the following policy issues should be addressed:

- **Hours of Operation** – How should hours of operation for HOV lanes and Express Lanes be set?
- **Occupancy** – Under what conditions should the occupancy rules for managed lanes be changed from HOV2+ to HOV3+?
- **Enforcement** – What can be done to address high levels of observed violations of managed lanes or vehicle occupancy rules?
- **Access** – When should access to HOV or Express Lanes be physically restricted with double painted lines or barriers?
- **Exempt Vehicles** – Given the dramatic increase in the sale of CAVs, what should the policy be for managing their use of managed lanes going forward? How should other exempt vehicles such as two-seater cars, trucks and motorcycles be treated?

Express Bus/Park-Ride Network

To improve the efficiency of the managed lanes network, the focus must be on increasing the number of persons, rather than vehicles, using managed lanes. Transit is critical to achieve the third goal of the MLIP: Person Throughput (Efficiency). Buses can move large numbers of people, greatly increasing the person-carrying ability of managed lanes. HOV and express lanes, when managed well, can offer



Integrated Managed Lanes, Express Bus, and Park-Ride Network

the benefits of travel timesavings and improved reliability for transit riders and reduced operating costs for transit providers, which may allow services to expand without additional resources.

The other element to this relationship between transit and managed lanes is providing first and last-mile options to allow commuters to access these express bus services. While there are many first and last-mile solutions, park-rides remain an important first-mile solution to providing access to higher occupancy vehicles, especially in lower-density areas. They serve as a node where people can gather to board transit vehicles or use ride-sharing.

While managed lanes that offer travel time savings and reliability can provide great incentive for travelers to carpool or take transit, without transit services in place or convenient locations to access transit or form carpools, the full potential of managed lanes to move more people may not be realized.

Figure 3 - Existing Express Bus Services



Existing Transit Services

Several Bay Area transit operators provide express bus service that use the managed lanes network, as shown in [Figure 3 - Existing Express Bus Services](#). Golden Gate Transit, AC Transit, WestCAT, and SamTrans provide express bus service for commuters to San Francisco. Other agencies such as Solano County Transit (Soltrans) and Fairfield and Suisun Transit (FAST) provide express bus routes that connect to BART. AC Transit also operates services connecting the East Bay to the peninsula across the San Mateo-Hayward and Dumbarton Bridges.

Express bus service on highways using managed lanes can have a substantial impact on the person throughput of the highways. For example, on US 101 northbound near the Tiburon interchange during the two-hour PM peak period, 85 buses representing 3% of the vehicles in the HOV lane, carried an estimated 2,465 persons. This is 37% of the persons traveling in the HOV lane and 15% of the persons traveling on the highway in that time period. These 85 buses represent 1,230 two-person carpools. The HOV lane would not be able to accommodate this many additional carpools.

The various transit agencies each have their own funding sources, service areas, and goals. Because of this, the operation of service beyond an agency's jurisdictional boundaries is usually limited, even though potential transit riders would often like to see services crossing these boundaries. As shown in [Figure 4 - Daily Express Bus Trips \(Weekday\)](#), there is a high level of service provided to and from San Francisco, but the amount of service to the major job centers outside of San Francisco, and particularly to Silicon Valley job centers, is much lower. There are rail options, but many employment sites

are not located within walking distance of train stations and may not have connecting shuttle or transit service.

The transit network is supported by an extensive system of park-ride facilities. There are over 150 park-ride facilities serving the freeway network in the Bay Area. While many of these facilities experience high levels of use and some are over capacity, there are also substantial park-ride resources that are underutilized. The most heavily used park-ride facilities tend to be those that are well served by transit and have good access to and from the highway network, especially in the morning peak direction. Park-ride lots that are further removed from the highway with little or no transit service are typically less used.

Transit/Park-Ride Network Improvements

Regional Express Bus Concept

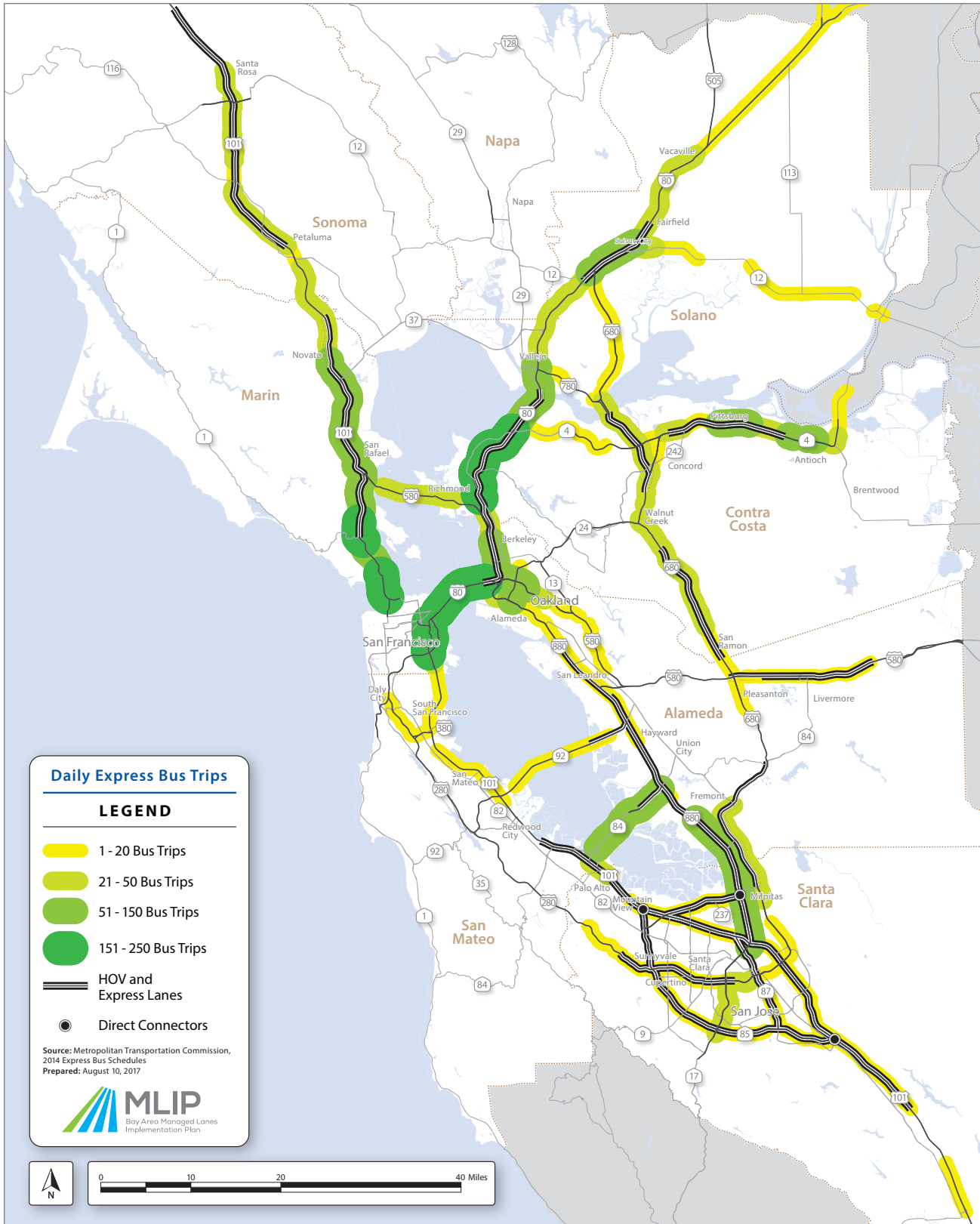
As part of a conceptual express bus pilot program, the MLIP project team identified near-term routes

Regional Express Bus Concept

Process

1. Coordinate with on-going planning efforts
2. Identify key origin – destination pairs
 - Not well served by transit today
 - Able to make use of existing and planned managed lanes
 - Home to work travel demand of over 1,000 daily trips
 - Trip lengths between 30 - 75 miles, long enough to be competitive with driving
3. Define transit routes
4. Measure potential benefits

Figure 4 - Daily Express Bus Trips (Weekday)



that focused on using existing managed lanes or those that are in the process of being implemented to maximize time savings and reliability. In addition, existing routes that showed strong performance were identified as opportunities for increased service frequency. The project team also identified other express bus routes that would take advantage of the next round of managed lanes development and focus on origin-destination pairs that showed good potential. **Figure 5 - Proposed Enhanced and New Express Bus Services** shows the express bus route concepts that were identified using this process. While the Fairfield/Vallejo route traveling directly to San Francisco may duplicate existing routes that connect to BART, providing a one-seat express bus ride using express lanes could be an attractive alternative to BART trains that are at capacity during peak hours. Additionally, Silicon Valley is a big destination for commuters from the Tri-Valley area and San Joaquin County.

Park-Ride System Improvements

A number of park-ride and transit access improvements were identified as shown in **Figure 6 - Potential Transit and Park-Ride Projects**. Ways to improve the current network of park-ride facilities include:

Parking Information – The 511.org website has a map of 182 park-ride locations with an inventory of spaces and amenities such as bike parking and lighting. The individual transit operators also provide some information for their service areas. However, there is limited to no information on parking availability.

Parking Operations/Management – Most of the facilities are available on a first-come first-serve basis to the public and there is no attempt to manage who uses the facility or how it is used. Many facilities are not maintained on a regular basis and no security is provided.

Parking Pricing – Pricing is a powerful tool that can be used to manage the utilization of parking. Golden Gate Transit implemented parking fees at their Larkspur Ferry Terminal lot to help ensure that their patrons, rather than customers of local businesses, were using their lot. Revenue generated by pricing can be used to cover operations and maintenance costs and to increase the services and amenities available at the park-ride facilities. AC Transit added security when they implemented a parking fee at their highly-utilized Richmond Parkway Transit Center.

Shared Parking – In many cases, the opportunities to develop new park-ride facilities or expand existing ones are limited due to lack of land availability and the high cost of land acquisition and construction. Shared parking arrangements offer an opportunity to make use of parking that is underutilized during the normal business day such as churches and shopping malls.

MTC is implementing a pilot program to test the effectiveness of these types of actions as part of the Bay Bridge Forward project. Bay Bridge Forward is a suite of near-term projects with \$40 million in funding to improve person throughput along the Bay Bridge corridor. Several project concepts were born out of MLIP: some projects will improve travel options on the managed lanes leading to the Bay Bridge and some concepts could be applied to other corridors.

Figure 5 - Proposed Enhanced and New Express Bus Services

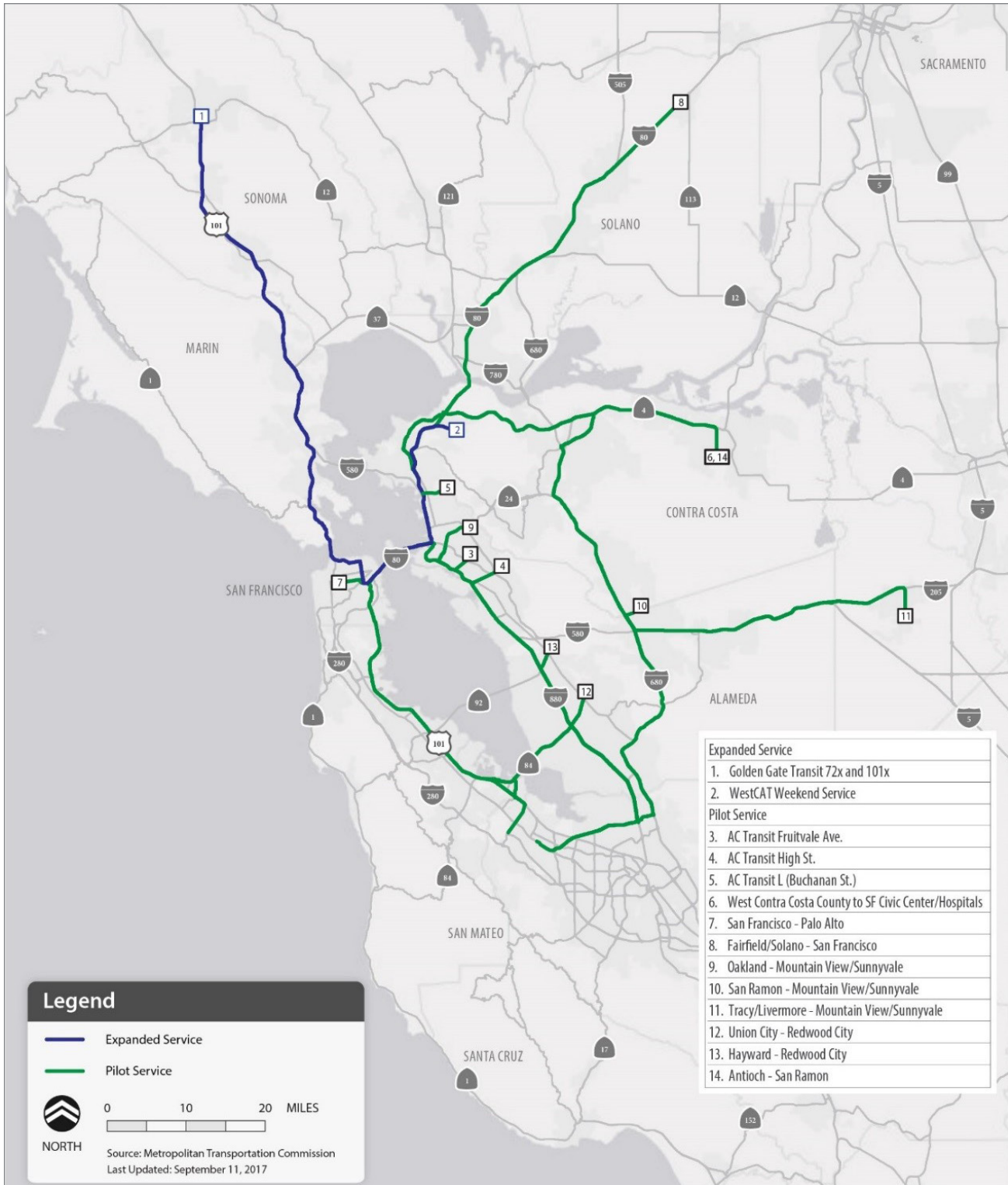


Figure 6 - Potential Transit and Park-Ride Projects

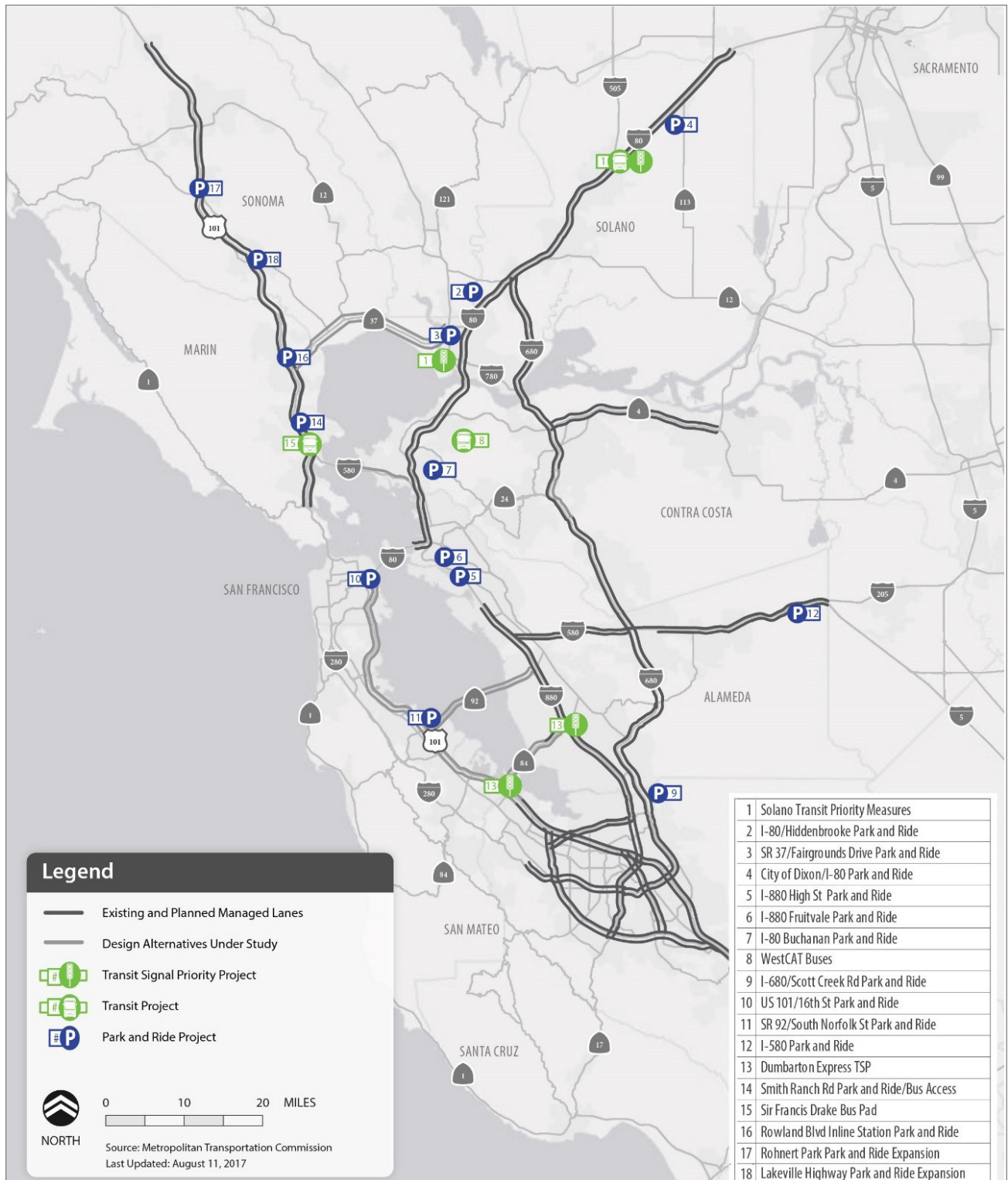
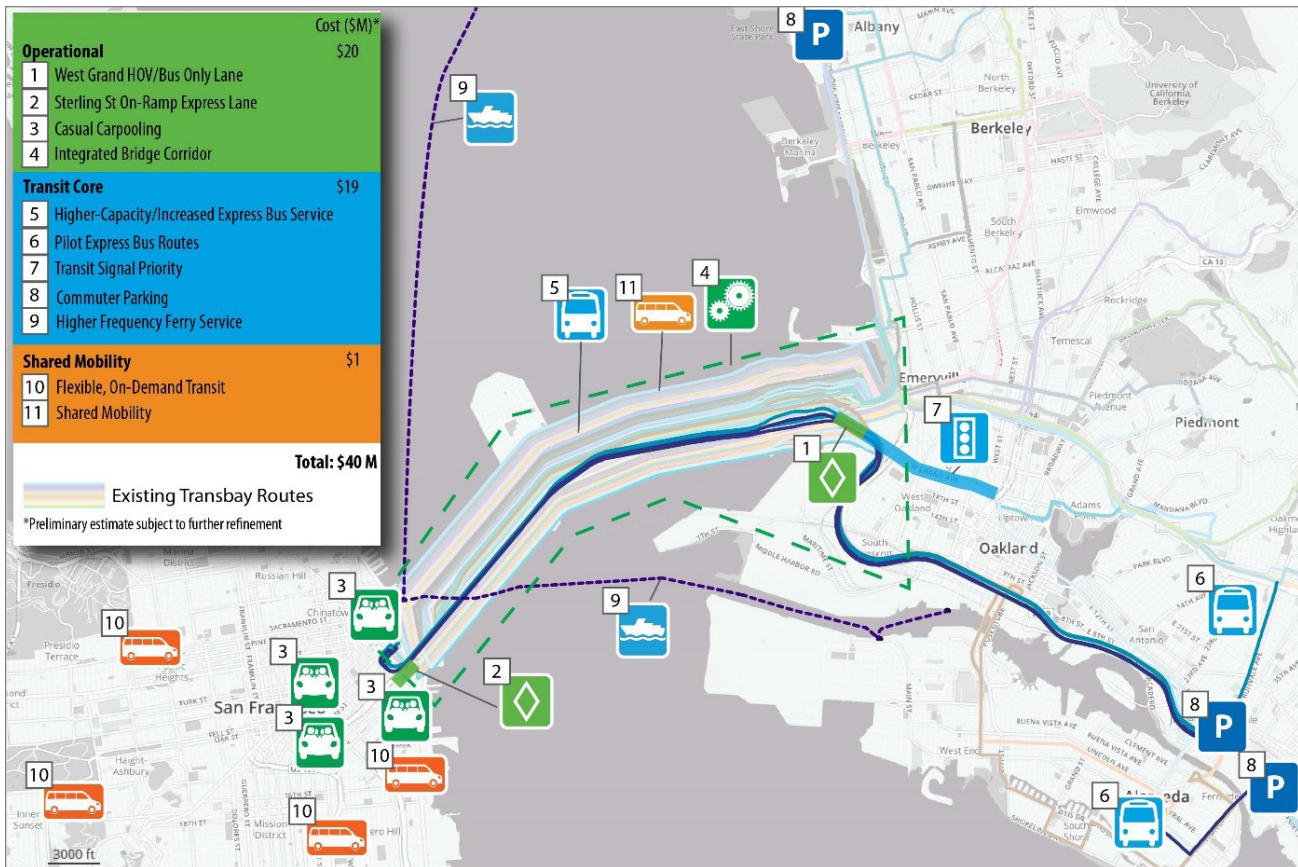


Figure 7 - Bay Bridge Forward



The projects are shown in Figure 7 - Bay Bridge Forward and a few are highlighted below.

West Grand HOV/Bus Only Lane - This project extends an existing HOV lane farther east by converting the existing shoulder to a bus lane that will be open to HOV during peak periods.

Enforcement - As part of improvements to the Sterling Street/Bryant Street on-ramp in San Francisco, there will be a pilot of vehicle occupancy detection technology at the HOV on-ramp, which currently experiences high HOV violation rates and degradation.

Increased Express Bus Service - Bay Bridge Forward helps fund the refurbishment of buses and increased service for the most productive

AC Transit Transbay bus routes, most of which are in the North Oakland/Berkeley area and use the I-80 highway.

Double-Decker Buses - Double-decker buses for WestCAT's Lynx service as well as for AC Transit's transbay service to increase capacity on their most productive routes.

Casual Carpooling - MTC is pursuing options to improve stop locations or casual carpool information on the I-80 corridor.

Commuter Parking - These lots are located in areas that would conveniently serve commuters to San Francisco and there is some interest from employers in using these facilities to serve their employees heading to the Peninsula and South Bay.

Managed Lane Operating Policies

There are several tools available to address degradation and operate managed lanes more effectively. MLIP examined the policies of hours of operation, occupancy requirements, violation enforcement, and CAV exemptions as well as access restrictions, which can impact degradation.

Violations and Enforcement

HOV violations are a growing concern on managed lanes in the Bay Area and are likely the primary cause of degradation on many of the managed lane corridors in the region. Collecting vehicle occupancy and HOV violation data is difficult and labor intensive. For MLIP, multiple rounds of occupancy and violation data was collected, which showed observed rates of HOV violations making up on average 19% (AM) - 24% (PM) of the HOV lane traffic in the region. Details are shown in [Figure 8 - HOV Lane Violation Data \(MTC\)](#). Given the importance and difficulty of collecting data, MTC, Caltrans, the CHP, and the Federal Highway Administration (FHWA) are discussing ways to improve data collection methods and take advantage of innovative detection technologies.

Because of the high rates of violations and degradation, enforcement is critical to the successful operation of both HOV and Express Lane facilities. An effective enforcement program should help ensure that operating policies such as vehicle occupancy, eligibility, and access enforcement are maintained to preserve travel time savings, discourage unauthorized vehicles, and maintain a safe operating environment.

The following enforcement related recommendations were identified:

- Pilot and evaluate dedicated managed lanes violation enforcement
- Pilot and evaluate emerging technologies to assist in analyzing violation rates and supporting enforcement
- Perform regular data collection and monitoring to understand impacts on degradation

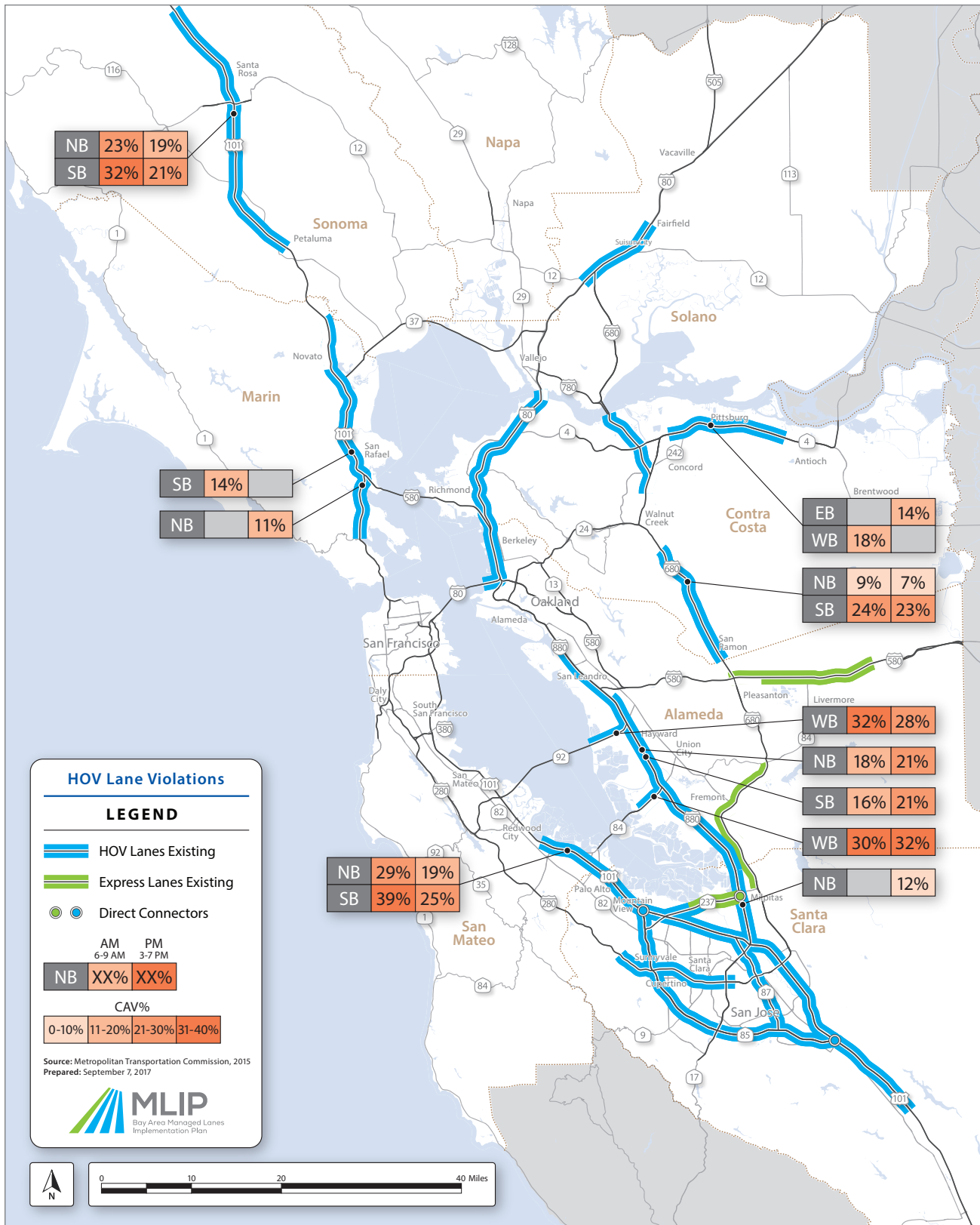
Exempt Vehicles

State law permits motorcycles (with up to three wheels) to use HOV lanes. In the Bay Area specifically, two-seater vehicles with two occupants are permitted to use the HOV 3+ lanes except at the Golden Gate Bridge toll plaza. In addition, designated CAVs are permitted to use the HOV lanes regardless of the number of occupants. Since 2005, the State has been providing this market incentive for CAVs to promote the CAV market and achieve air quality improvement goals. Owners of qualifying CAVs, such as plug-in hybrid and electric vehicles, are able to apply for decals that permit them to use the HOV lanes without a restriction on vehicle occupancy.

Clean Air Vehicles

The use of HOV and Express Lanes by exempt vehicles (primarily CAVs) has grown significantly since the State's designation of qualifying CAVs as eligible users of the HOV and express lanes, regardless of vehicle occupancy. As of October 2017, there are over 111,000 CAVs registered in the Bay Area,

Figure 8 - HOV Lane Violation Data (MTC)



up 354% in less than 4 years, and over 289,000 across California. As of April 2017, CAVs comprised approximately 1.8% of two-axle vehicles in the Bay Area, with Santa Clara County leading at 2.9%. In the rest of California, excluding the Bay Area, CAVs comprised 0.8% of two-axle vehicles.

Exempt vehicle use of HOV and Express Lanes is expected to increase significantly with the projected continued growth in the sale of CAVs. This is likely to accelerate as lower cost fully-electric vehicles proliferate. The impacts to HOV lane operation and degradation are likely to be appreciable with this market shift, and changes to the eligibility of lane use and toll exemptions will likely be required to maintain HOV lane time savings. As HOV lanes are converted to Express Lanes, changes to vehicle exemptions and discounted tolling of CAVs should be considered.

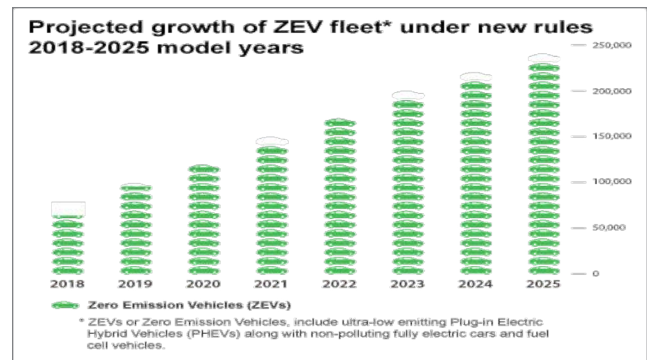
MLIP Recommendations and next steps for exempt vehicles include:

- Regular data collection on scale of CAVs using managed lanes is necessary
- Consider tolling CAVs at discounted rates on degraded Express Lane corridors

Vehicle Occupancy

Minimum occupancy requirements for vehicles allowed to use an HOV facility is an effective but imprecise policy option for addressing degradation. Because of the magnitude of its impact, increasing vehicle occupancy should be one of the final policy options considered in addressing degradation. Ideally, violation enforcement and CAV exemptions

Figure 9 - Projected Growth of Zero Emissions Vehicle (ZEV) Fleet



Source: California Air Resources Board

should be considered first as they do not contribute to managed lanes' primary purpose of increasing passenger throughput. The occupancy requirement should be set to achieve effective utilization of the lanes and encourage the use of bus transit, carpooling, and vanpooling. However, if the occupancy requirement is so low and creates so much demand that it makes the HOV facility congested, it will reduce the travel time savings and reliability that attract people to transit or carpooling. Over time as overall traffic demand and congestion in the corridor increases, usage of the HOV lane typically increases to a point that requires adjustment of the vehicle occupancy policy to restore the travel time benefits to HOVs.

HOV lanes in the Bay Area typically require a minimum of two occupants per vehicle (HOV 2+), with bridges generally requiring a minimum of three persons to use the HOV lanes (HOV 3+). Notable exceptions are the HOV lanes on I-80 in Contra Costa and Alameda counties, which require three occupants, and the San Mateo and Dumbarton bridges, which only require two occupants.

MLIP Recommendations and Next Steps for Vehicle Occupancy Changes

- Express Lanes provide a better opportunity to increase occupancy requirements than HOV lanes
- Begin tolling CAVs at a discounted rate
- Review HOV2+ occupancy requirement exceptions on bridges
 - San Mateo Bridge
 - Dumbarton Bridge
- Review HOV2+ occupancy requirement on degraded Express Lanes
 - SR-237 Express Lane
 - I-880 Express Lane
 - US-101 Express Lane
- Support strategies necessary to successfully increase to HOV3+
 - Park-Rides
 - Express Bus Service
 - Carpool Facilitation

Hours of Operation

The hours of operation of managed lanes is a critical operational policy component. Considerations for hours of operation on an HOV lane are different from an Express Lane and they will be discussed separately when appropriate.

Bay Area HOV lanes have historically primarily provided part-time operation during commute travel peak times within an individual corridor and allow all vehicles to access the lanes during all other times

to provide additional capacity. Table 2 - Bay Area Managed Lane Characteristics illustrates the existing variability in hours of operation and duration of managed lanes across the Bay Area. In general, Bay Area HOV lanes operate during the peak travel periods, typically from 5:00 to 9:00 a.m. and 3:00 to 7:00 p.m., with significantly shorter hours of operation in Marin and Sonoma counties.

As the Bay Area has grown and the economy rebounded from the 2008 recession, traffic demand has outpaced highway capacity expansions, resulting in more congested roadways and longer peak periods. Over a three-year period, from 2012 to 2015, several highways within the Bay Area have seen their peak periods of congestion expanding by an additional hour or more. Issues include:

Congestion Has Grown - The heaviest traffic congestion period, representing speeds below 25 mph, expanded in 2012 from 6:30 - 9:15 a.m. and in 2015 to 6:00 - 10:00 a.m., thus lasting more than an hour longer.

HOV Hours Do Not Match Congestion Patterns - The HOV lane hours of operation (5:00 - 9:00 a.m.) no longer fully cover the observed peak period as it has grown to extend beyond 9:00 a.m.


Less Incentive to Carpool or Take Transit - Buses and HOV lane users are impacted by the additional general purpose lane congestion and growing use and degradation of HOV lane during the hours of operation. This leads to longer and less reliable travel times for carpoolers and reduces the incentive to carpool or take transit instead of driving alone.

Table 2 - Bay Area Managed Lane Characteristics

| County-Route | Direction | Facility Type | HOV Occupancy Requirement | Existing Hours | |
|------------------------------------|------------|---------------|---------------------------|----------------|--------|
| | | | | AM | PM |
| Seven State Bridges | One Way | HOV | 2+ and 3+ | 5-10 | 3-7 |
| Golden Gate Bridge | Southbound | HOV | 3+ | 5-9 | 4-6 |
| Alameda/Contra Costa I-80 | Both | HOV | 3+ | 5-10 | 3-7 |
| Alameda I-580 | Both | Express Lane | 2+ | 5 AM-8 PM | |
| Alameda/Santa Clara I-680 | Southbound | Express Lane | 2+ | 5 AM-8 PM | |
| Alameda/Santa Clara I-880 | Both | HOV | 2+ | 5-9 | 3-7 |
| Contra Costa SR 4 | Westbound | HOV | 2+ | 5-9 | - |
| Contra Costa SR 4 | Eastbound | HOV | 2+ | - | 3-7 |
| Contra Costa I-680 | Both | HOV | 2+ | 5-9 | 3-7 |
| Contra Costa I-680 | Both | Express Lane | 2+ | 5 AM-8 PM | |
| Marin US 101 | Southbound | HOV | 2+ | 6:30-8:30 | - |
| Marin US 101 | Northbound | HOV | 2+ | - | 4:30-7 |
| Santa Clara SR 85 | Both | HOV | 2+ | 5-9 | 3-7 |
| Santa Clara SR 87 | Both | HOV | 2+ | 5-9 | 3-7 |
| Santa Clara US 101 | Both | HOV | 2+ | 5-9 | 3-7 |
| Santa Clara SR 237 | Both | HOV | 2+ | 5-9 | 3-7 |
| Santa Clara SR 237 | Westbound | Express Lane | 2+ | 5 AM-8 PM | |
| Santa Clara SR 237 | Eastbound | Express Lane | 2+ | 5-9 | 3-7 |
| Santa Clara I-280 | Both | HOV | 2+ | 5-9 | 3-7 |
| San Francisco Sterling/Bryant Ramp | Eastbound | HOV | 3+ | - | 3:30-7 |
| San Mateo US 101 | Both | HOV | 2+ | 5-9 | 3-7 |
| Solano I-80 | Both | HOV | 2+ | 5-10 | 3-7 |
| Sonoma US 101 | Both | HOV | 2+ | 7-9 | 3-6:30 |

Note: The seven state-owned bridges include the Antioch, Benicia-Martinez, Carquinez, Dumbarton, Richmond-San Rafael, San Francisco-Oakland and San Mateo-Hayward bridges.

 Express Lane

 Hours Shorter Than 5:00 to 10:00 AM or 3:00 to 7:00 PM

 Express Lane and Hours Shorter Than 5:00 to 10:00 AM or 3:00 to 7:00 PM

MLIP Recommendations and Next Steps for Modifying HOV Hours of Operation

- Finalize focused analysis and determine if changes to the HOV hours are warranted
 - Marin US 101
 - Sterling/Bryant St I-80 On-ramp – PM
 - South Bay HOV Corridors – AM
 - I-280
 - I-880
 - SR 85
 - SR 87
 - SR 237
 - US 101
 - Bay Bridge Toll Plaza (Midday and Weekend)
- Identify supportive strategies necessary to efficiently utilize HOV lane capacity when extending HOV hours of operation
 - Park-Rides
 - Express Bus Service
 - Carpool Facilitation
- Identify and analyze additional corridors with extended congestion
- Continue proactive monitoring of HOV operations

Access

The types of access provided for HOV and Express Lanes influence the demand for the lanes and affect the operational performance, design, and cost of implementation. Tolling strategy, locations, and enforcement mechanism are all dependent on the types of access provided.

HOV lanes in the Northern California have historically operated as open access or continuous access facilities, while those in Southern California operate as limited or restricted access facilities. While experience has shown that HOV lanes can operate equally well under both open or limited access, recent national practice has been to restrict access when the lanes are converted to Express Lanes to facilitate toll collection and violation enforcement.

This norm has recently been reconsidered as agencies have faced dual challenges of maintaining access to communities along the corridors and constrained right of way in dense urban corridors. Initial Bay Area Express Lanes were implemented as limited-access lanes (I-680 Sunol and SR 237). More recent Express Lanes, such as those implemented on I-580 in Alameda County and I-680 in Contra Costa County, are operated as open access lanes with restrictions only in specific, highly congested sections.

Based on available research, both open and limited access HOV and Express Lane operations appear to be viable options.

Recommendations on access include the following:

Evaluate Open and Limited Access - Both open and limited access options should be evaluated when designing new HOV or Express Lanes, including restrictions on access for specific roadway sections that present operational challenges.

Limit Access for Operations and Safety - Where operational problems due to merging or diverging traffic cause degradation on open access managed lanes, short sections of limited access should be considered as a solution similar to those on the I-580 Express Lanes near the I-680/I-580 interchange in Alameda County.

Access for HOV to Express Lane Conversions -

Driver experience and familiarity with existing open access HOV lane operation in the Bay Area is a significant factor to consider in determining the type of access selected for HOV to Express Lane conversions.

Consistency - Consistency in the type of access is more important within a specific corridor than across the region. While regional consistency in the selection of HOV and Express Lane facilities access is desirable, clear roadway signage and pavement marking can largely address driver expectations and guidance needs among corridors with varying access applications.

MLIP recommendations for access restrictions include:

- In specific locations where the existing managed lane access configuration causes safety or operational issues, consider piloting access restriction changes.

Summary

Over a two-year process, the MLIP has resulted in a number of accomplishments and actions that set the stage for an enhanced, more effective managed lanes network in the Bay Area. Key elements include:

Managed Lanes Data Base - MLIP entailed the collection of the most comprehensive data set regarding managed lane usage, occupancy, vehicle types, and occupancy violations ever assembled.

Public Outreach - MLIP used surveys and focus groups to gain important insights on the public's perspectives on the managed lane network and the way it is operated as well as desires and concerns about the future of managed lanes.

Transit and Park-Ride Improvements - MLIP recognizes transit as critical to the success of the managed lanes network. Concepts for improving transit and park-ride opportunities to increase the person usage of managed lanes were developed, as well as specific improvement projects such as the Bay Bridge Forward program.

Managed Lanes Policies - MLIP provides specific recommendations relative to key managed lane policies such as:

- **Violations and Enforcement** - Identifies measures to address current high violation rates
- **Vehicle Occupancy** - Provides guidelines and recommendations as to how and when the vehicle occupancy rates in specific managed lane facilities should be changed
- **Hours of Operations** - Provides a basis for determining when the hours of operation of managed lanes should be changed to address increased congestion and delay
- **Exempt Vehicles** - Addresses the issue of increased use of managed lanes by CAVs and other exempt vehicle types
- **Access Restrictions** - Provides guidance as to how and when access to or from managed lanes from the general purpose lanes should be restricted to address traffic operations and safety issues



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