

5 Appendices

5.1 Additional Considerations for Upcoming Disruptions

5.1.1 Additional GHG/VMT Reduction

The future of GHG and VMT reduction as it pertains to the Express Lanes Network hinges upon two current unknowns: the impacts of Senate Bill 743 on infrastructure building in California and the impacts of other possible future road pricing strategies on Express Lanes Network operations.

5.1.1.1 Senate Bill 743

SB-743's implementation has resulted in transportation projects needing to measure their impacts by estimated changes in VMT under CEQA. Previously, impacts were measured by level of service, a concept which primarily measured changes in congestion or traffic. By focusing on avoiding increases to congestion, developers were incentivized to build outside densely populated cities, causing urban centers to sprawl. In contrast, an increase in VMT would mean that more vehicles are taking trips or that vehicles are taking longer trips, with both outcomes implying that total GHG emissions are also increasing. Reducing VMT requires shorter or less frequent vehicle trips, or a greater number of people per vehicle (i.e., carpooling or transit). Improvements in GHG emissions associated with congestion relief will also factor into the environmental analysis; however, these improvements would need to be demonstrated to outweigh any longer term VMT impacts.

If a project is found to increase VMT during environmental impact analysis under SB-743, sponsors will be required to mitigate that increase by building projects or implementing programs that will provide matching VMT reduction, unless there is a finding of overriding consideration. Here are some mitigation strategies:

5.1.1.1.1 On-Site Mitigations

Mitigation measures for infrastructure projects are traditionally applied on-site or in the immediate area of the project. For express lane projects, these types of mitigations can include programs or policies to increase HOV mode adoption, such as transit and carpool improvement programs. Pairing new lane projects with more aggressive demand management strategies could also serve to mitigate VMT impacts. For example, implementing an occupancy requirement that only permits qualified vanpools and buses to travel toll-free, paired with a pricing regime that effectively manages demand from toll-paying vehicles, could be more effective at mitigating VMT impacts than a HOV-2+ occupancy policy.

However, it may not always be possible for a project sponsor to demonstrate that the impacts of an on-site mitigation are enough to counter the projected VMT impacts of the project. For example, if a new transit service was proposed as a mitigation for an express lane project that involved new lane construction, it would have to be shown that enough drivers would switch to riding transit to outweigh the impacts of the induced demand caused by the new lane. This could be difficult if the transit service is localized or if the project is in an area not well-served by transit or where transit is not cost effective. An added complication arises if the transit service would best be implemented at a regional level, preventing a locally based mitigation from generating maximum effect. Additional challenges can also arise when planning for mitigation solutions is needed before there is a good understanding of its funding solutions. For example, CEQA documents are typically circulated years in advance of a project opening, while toll rates are usually not settled until shortly before opening. This could create a disconnect when toll rates are an integral component of a mitigation strategy.

5.1.1.1.2 Emerging Mitigation Concepts

Because on-site mitigations may not be feasible depending on the scale and location of a specific project, the concept of VMT mitigation banks and exchanges are being explored to facilitate maximally efficient overall regional VMT reduction. These strategies, explored in more detail below, allow governmental bodies to remove the need for projects to have on-site mitigations by coordinating VMT impacts with possible mitigations over different geographies and timeframes.

At the outset, it is important to emphasize that while mitigation banks for habitat conservation have been successful for transportation projects in California, their conceptualization for VMT is a relatively new idea that has predominantly been discussed in the housing and commercial development space thus far. They are discussed here as they may apply to public transportation infrastructure projects, but their application to this sphere may require further CEQA review.

VMT Mitigation Exchange

In a VMT Mitigation Exchange, as currently conceptualized for housing and commercial development, a developer agrees to implement a predetermined VMT-reducing project or proposes a new one,¹ essentially exchanging a VMT increase for an equal VMT decrease. Unlike on-site mitigations, the mitigations in an exchange may be located outside of the immediate project vicinity, so long as mitigations are equal to impacts. There is also flexibility in whether a mitigation is a capital, maintenance, or operations project, or a policy or program that would promote a strategic goal, such as an equity program or policy to promote transit.

A VMT exchange could prove an attractive option for express lane projects. Implementing agencies could opt to invest in additional strategies within the express lane corridor that serve to offset any VMT impacts of the express lanes. These may additionally be synergistic with existing multi-county efforts that focus on cross-county corridor planning such as those being undertaken in conjunction with the Bay Area Partnership's Connected Mobility Subcommittee. Investments could be complementary to the express lanes, such as investments in transit, and could be wholly or partially subsidized using express lane revenues. Additionally, the concept is applicable to a variety of geographies from corridors to counties to regions.

VMT Mitigation Bank

A VMT Mitigation Bank is related to the exchange concept in that it allows developers to fund off-site mitigation projects. But instead of the developer directly implementing the mitigation project, a mitigation bank allows a developer to purchase credits that are then applied to VMT reduction projects by the entity in charge of the bank. Compared to exchanges, banks have a more flexible application to facilitate transfers within their geographical scope but require more robust program administration to collect fees from developers and to fund mitigation projects.

A simplified VMT bank could take the form of traditional development impact fee programs that charge developers a fee in proportion to the extent of the impact, with the fee being used to fund demonstrated VMT mitigation projects. The City of Los Angeles Westside Mobility Plan Transportation Impact Fee Program was the first impact fee program based on VMT reduction. The program used VMT as a measure to exact fees from developers, generating funding for improvements to transit, active

¹ https://www.fehrandpeers.com/wp-content/uploads/2020/04/VMT-Fees_Exchanges_Banks-White-Paper_Apr2020.pdf

transportation, intelligent transportation systems, and auto-trip reduction programs. The program is noted for low administrative costs, limited to construction cost updates and complying with state reviews of funding distribution.²

Alternatively, VMT banks could be structured as market-based systems, similar to California's Cap-and-Trade Program. In this way, developers needing to mitigate could buy VMT credits through open trading markets and the funds can be used towards approved mitigation projects. Such a system could be established at a regional level; however, concerns associated with VMT credits being used to fund projects in other jurisdictions would need to be addressed.

In the Express Lanes Network, banks could provide the same options as exchanges by generating funding for complementary VMT-reducing benefits like increased transit or carpool services and infrastructure. However, it provides the added benefit of allowing sponsors to help fund a current mitigation, like a regional express bus service, in exchange for future credits against express lane projects yet to be built.

VMТ Mitigation Exchange and Bank Considerations

It is important to note that in either the exchange or bank concept, the cost of mitigation is likely to be expensive and may even exceed the cost of the development causing the impact. To provide context, initial high-level estimates by MTC for initial planning purposes indicate that for each lane-mile of new capacity, the cost to offset GHG in 2019 dollars would likely be approximately:

- \$50 million if spent on bike improvements
- \$80 million if spent on local bus frequency improvements
- \$120 million if spent on express bus frequency improvements

VMТ mitigation exchanges and banks require high levels of oversight, administration, subject matter expertise, and governmental coordination. In general, the level of oversight and need for nexus analysis increases as the application of funds becomes more flexible and impacts become more separated from mitigations. This raises several questions on how such a system would function:

- Who makes program decisions?
- How are decisions made?
- Who is accountable for decisions?
- How are projects/decision-makers held accountable?
- How is the equitability of impacts and mitigations measured and ensured?
- Specific to express lanes, how/where can express lane revenue be used, and what is the backstop if toll revenue drops and the funds for mitigation are needed for basic express lane operations and maintenance?

5.1.1.2 Express Lanes and Other Highway Pricing Strategies

As the Bay Area continues to explore GHG reduction strategies for the future, one of the key questions that arises for the Express Lanes Network is how express lanes may fit into a future where pricing is applied more broadly to roadways. One such strategy, referred to as All-Lane Tolling, was included in Plan Bay Area 2050 as a longer-term measure to address traffic congestion that was resilient to uncertainties like varying levels of population growth. This started a discussion about how two pricing schemes may interact on the same facility. Although future pricing strategies can take many forms, this

² https://planning.lacity.org/odocument/f70a7b90-3613-49ce-a65c-2be4a98c6e8c/ordinance_168104_and_168105.pdf

section focuses on issues that may arise from tolling all lanes of a highway (referred to as highway pricing) that has an express lane.

Different forms of pricing are typically designed to emphasize one or more specific objectives such as generating revenues, managing traffic congestion, or incentivizing use of high-occupancy modes to reduce greenhouse gas emissions. Some of the pricing strategies in place or under consideration in the Bay Area include:

- Bridge tolls: purpose is to generate revenue for bridge rehabilitation and replacement, and other voter approved transportation improvements;
- Express lane tolls: purpose is to make efficient use of freeway capacity and incentivize carpooling by maintaining travel time reliability for high-occupancy users and those who choose to pay to use the Express Lanes Network;
- Highway pricing: intended to manage demand over entire corridors, or sets of certain connected corridors, by tolling all lanes in an effort to reduce GHG/VMT;
- Cordon pricing: seeks to disincentivize driving in congested city centers; and
- Mileage-based user fees (also referred to as VMT fees or Road User Charge): purpose is to charge roadway users based on miles traveled as a replacement for the gas tax.

There is much work to be done to study highway pricing and to determine if and where it would be feasible in the Bay Area. This includes a detailed analysis of traffic impacts, including impacts to local streets as a result of traffic diversion from tolled facilities; considering how highway pricing would interact with other forms of pricing, including mileage-based user fees, cordon pricing and express lanes; addressing equity concerns of pricing all highway lanes; building public and political support; and obtaining statutory authority to price all lanes in the first place. Even though it is not certain that highway pricing will be implemented, if it were, it could have significant impacts on traffic congestion and mode shift. These impacts could affect express lane operations.

Imagining a future where express lanes operate on facilities where all lanes are tolled raises fundamental questions about how the express lanes would function. In terms of operations, the ability of highway pricing to reduce or eliminate congestion and to create an incentive for drivers to change modes could warrant significant changes in the current express lanes business model. These changes come to light when exploring the following hypothetical use cases for the Express Lanes Network, which imagine how express lanes could adapt based on the impacts of highway pricing:

1. Surcharge for Travel Time Benefit: If congestion is not entirely eliminated by highway pricing, the express lanes can continue to operate as a complementary component within a priced-highway environment to provide travel-time benefits;
2. Discount Lane for HOVs: If highway pricing encourages more people to carpool and use transit to reduce travel costs, the express lanes could operate as dedicated lanes accessible only to transit and high-occupancy vehicles to receive a travel time savings while providing a discount option relative to other lanes; and
3. Free Lane for Transit: With sufficient demand shift to transit, the express lane right-of-way could be dedicated for use by transit vehicles.

Exploring these hypothetical use cases, where express lanes continue to operate within a broader context of pricing, raises several challenges, including:

- Fiscal challenges: Considerations for express lane projects that are no longer able to sufficiently cover operating costs, debt service, or other obligations as a result of highway pricing will need

to be addressed. All express lanes debt will need to be covered if highway pricing necessitates changes to the express lanes that cause a reduction or elimination of toll revenues. Subsidies will also be needed to reimburse express lane infrastructure investments, cover capital costs like sign replacement, and to support any programs that may rely on net toll revenues in the future.

- Public acceptance and communication: Public messaging and communication are critical to build support for any system that uses multiple pricing strategies and changes the status quo;
- Equity: Charging express lane tolls on top of other highway tolls imposes an even higher barrier for low-income users that would need to be mitigated;
- Operations and network consistency: Emphasis on seamless connectivity and consistent operating policies may need to be balanced with localized operational needs should broader pricing have disparate impacts throughout the network; and
- Administration: A mechanism for aligning the goals and objectives of the Express Lanes Network and any other highway pricing strategy will need to be established to ensure the two programs do not operate counter to one another.

The following questions are proposed to be incorporated into MTC's future study to understand how the Express Lanes Network may interact with future forms of pricing:

What is a feasible pricing scheme to reduce GHG/VMT and meet other regional goals, and how might it interact with the investments being made in express lanes?	<p>From an express lane perspective, it is important to understand the type of pricing that may be deployed, considering the varying strategies being considered at different levels of government in California. Strategies proposed at the regional level such as all-lane tolling, compared to those proposed at the state level like road user charging,³ have the potential to impact congestion and mode shift differently, which has an impact on the express lanes. Considerations for a pricing strategy should also consider:</p> <ul style="list-style-type: none"> • Whether there is a technology solution that can serve all needs; • The complexity that is introduced when users must pay for the use of multiple connected transportation facilities; and • The potential for a regional mobility account.
What is the expected impact on levels of congestion as a result of highway pricing?	<p>This question is fundamental when considering future use cases for the Express Lanes Network. Not only will it be important to understand the impact on the magnitude of congestion by corridor, but also to understand how congestion patterns may shift during the day (e.g., more congestion during off-peak periods when the highway rate is lower). Once the impact on congestion is better understood, more informed recommendations can be made about the potential future role of the Express Lanes Network.</p>
What is the expected impact on mode shift as a result of highway pricing?	<p>This question is also fundamental to inform future use cases for the Express Lanes Network. For example, if there are greater volumes of high-occupancy vehicles, there may be little or no capacity available for toll-paying vehicles in the express lanes. In corridors where existing parallel transit service does not have enough capacity to accommodate mode shift, there could be a desire to invest in express bus service. Each of these would impact how the express lanes operate and even how they are planned and built.</p>

³ <https://caroadcharge.com/projects>

5.2 VMT/GHG IMPACTS AND MITIGATIONS WHITE PAPER

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1 Executive Summary

The Bay Area Express Lanes Network is a transportation infrastructure project which seeks to improve the efficiency of the regional highway network with the stated Express Lane Network goals of incentivizing the use of high-occupancy vehicles, increasing connectivity to manage congestion, improving equity, delivering projects in a timely manner, using public funds responsibly, and reducing greenhouse gas (GHG) emissions and vehicle-miles traveled (VMT). In addition to these network goals, the network also strives to achieve regional goals identified under Plan Bay Area 2050, including the mandated 19% per capita reduction in regional GHG emissions by 2035 when compared to 2005 levels. The California Environmental Quality Act (CEQA), Senate Bill 375, and current implementation of Senate Bill 743 (SB-743) by the Governor's Office of Planning and Research (OPR) now require that VMT be used to analyze transportation impacts to help meet these targets. However, the projects which make up the Express Lanes Network, and the diverse characteristics of the Bay Area, mean that different types of projects have different considerations when it comes to GHG and VMT impacts.

When planning an express lane, the decision to convert an existing lane or build a new lane is influenced by operational, political, financial, and equity considerations, as well as the project's effect on GHG emissions. This paper examines the potential implications of pursuing four types of projects that fall under two categories:

- Lane conversions: while converting a lane to an express lane is unlikely to have adverse VMT impacts, lane conversions must not increase GHG as a result of increased congestion. Two types of lane conversions are explored:
 - HOV lanes
 - General purpose lanes
- New construction: building one or two lanes of new capacity may increase VMT to a point that require mitigation under changes to CEQA guidance in response to SB-743,⁴ although new capacity does serve to close critical gaps and can improve operations. Since VMT impact analysis and mitigation is a relatively new development, a prescribed solution does not yet exist. Two types of new construction projects are explored:
 - Single lane
 - Dual lanes

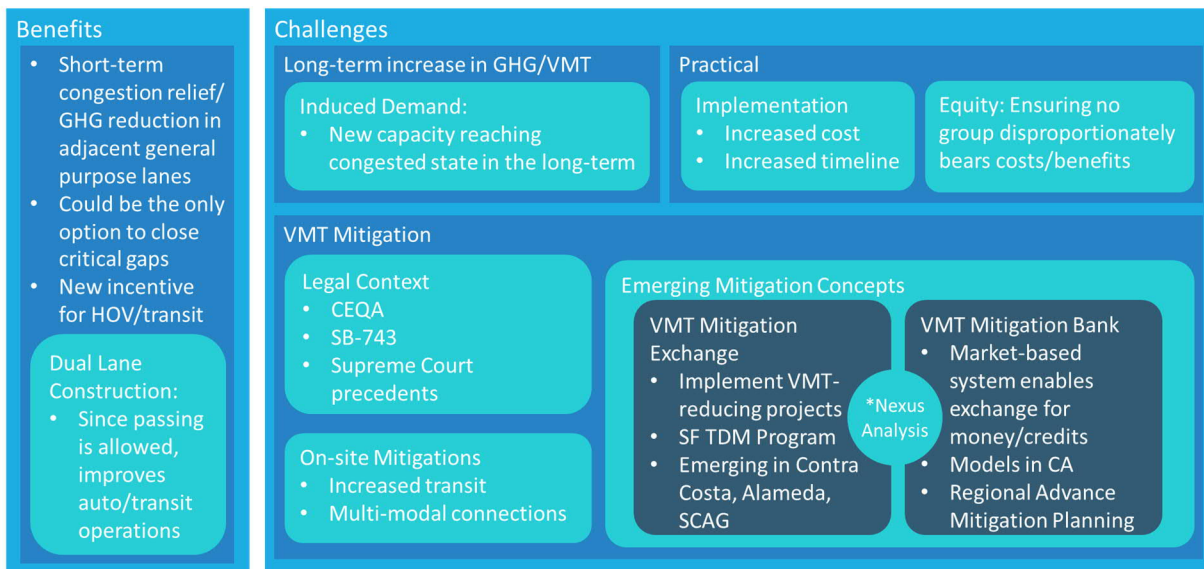
A graphical summary of topics covered in these categories is provided below.

⁴ Please note: the paper will refer to VMT analysis/mitigation as a requirement of SB-743 for simplicity, however it is actually the CEQA guidelines revised by the Governor's Office of Planning and Research in response to SB-743 that name VMT as a measure to be used to determine impacts. Please see Section 4.4.1, below, for more details.

Lane Conversion



New Construction



Research suggests two recommendations:

- Participate with partners to promote regional mitigation solutions: As VMT mitigation strategies develop across the region, MTC and express lanes partners should closely track and contribute to the development process; and
Advocate for legislation: MTC and express lanes partners' authority to directly convert general purpose lanes to express lanes is unclear, as are the operational conditions that make such a strategy feasible (see Section 3.2, below, for more information). MTC and express lane partners should continue to advocate for clear laws and policies that allow testing or implementation of general purpose lane conversion.

2 Introduction

2.1 Background

Highway systems in the United States face great challenges as municipalities seek to balance growth with the cost and negative externalities of the auto-focused infrastructure that has traditionally accompanied growth. In California, evidence linking greenhouse gas (GHG) emissions to global climate change has inspired the enactment of new legislation to curb GHG emissions and vehicle-miles traveled (VMT) impacts. Two key bills, enacted in state law, embody this: California Senate Bill 375, which requires the California Air Resources Board to establish GHG emissions reductions targets at the regional level, and California Senate Bill 743 (SB-743), which requires new projects to measure, analyze, and mitigate as necessary the impacts of a project on VMT due to its relationship to GHG emissions and other factors such as particulate emissions and safety. Most recently, Governor Gavin Newsom has issued Executive Order N-19-19, which confirms the state's commitment to reducing GHG emissions originating from transportation.⁵ This has placed increased scrutiny on proposed new infrastructure projects that have a potential to increase VMT, and therefore GHG emissions. New highway construction particularly exhibits this emerging conflict: while growth continues to result in highway congestion and creates pressure to increase capacity, highway expansion both enables a greater number of autos to emit GHG and has high capital costs that may be increased when factoring in new VMT mitigation requirements.

The Bay Area Express Lanes Network is an emerging infrastructure project that sits at the intersection of these topics. This extensive regional network of managed lanes is intended to be a solution that makes better use of the region's existing High-Occupancy Vehicle (HOV) lane capacity while also filling in critical gaps to provide a reliable, seamless guideway for high occupancy modes like carpools and transit. This is a key strategy to meet the region's mobility needs while minimizing growth in traffic congestion and emissions.

While the goals of the Express Lanes Network projects work toward a unified outcome of encouraging these modes, the wide variety of potential improvements stand to have variable impacts on VMT and GHG. This requires planners to assess how different types of projects may be built while continuing to minimize emissions. In the past, some express lanes have been planned to be built by converting existing HOV lanes, while other critical gaps in the network were planned to be closed by building new capacity. Regional goals, such as those in Plan Bay Area 2050 described in Section 2.3 below, and state policy, as reflected in statute and regulations targeted at reducing GHG emissions, require that we look more closely at strategies that add capacity going forward.

This paper explores likely impacts and mitigation strategies for GHG emissions and VMT as the region continues to build out the Bay Area Express Lanes Network, focusing on implications of converting existing lanes compared to constructing new lanes. This paper articulates general considerations and implications. It does not replace specific, detailed project level analysis of travel, traffic and emissions necessary to assess the impacts and mitigations of a given project.

2.2 A Note on the COVID-19 Pandemic

This paper recognizes the continuing impact that the COVID-19 pandemic has at the societal level in the United States. From a transportation perspective, the long-term effects of the pandemic on travel behavior are speculative at this point, but may result in long-lasting impacts on travel patterns,

⁵ <https://www.gov.ca.gov/wp-content/uploads/2019/09/9.20.19-Climate-EO-N-19-19.pdf>

particularly as they relate to the willingness to use high-occupancy modes, as well as commuting and work travel. With that in mind, the Bay Area Express Lanes Network is also a long-term project that is being undertaken over the next thirty years, during which time travel patterns may be restored to a pre-COVID state, or be subject to many other systemic changes. Operating within this uncertainty, it is still imperative that we continue to plan to meet GHG reduction targets and prepare for related changes to planning systems, like those introduced by SB-743. This paper presents strategies and recommendations that will likely maintain relevance in a post-COVID-19 world, but recognizes that the extraordinary conditions of the pandemic may affect recommendations as we learn more about its long-term effects.

2.3 Plan Bay Area 2050

Traffic congestion is reaching a crisis point in California, threatening the region's economic and environmental viability. However, instead of expanding highways to increase the supply of transportation infrastructure, state, regional and county transportation entities in the San Francisco Bay Area are focusing more on managing the demand to use highways. Strategies are increasingly focused on improving speed and reliability for carpools and transit so they are attractive options compared to driving alone. Getting more people into individual vehicles by encouraging them to shift to carpool and transit means that each traveler has a smaller impact both on overall congestion and VMT/GHG emissions, while removing the need for costly highway expansion.

The goals of Plan Bay Area 2050,⁶ the Bay Area's Regional Transportation Plan and Sustainable Communities Strategy expected to be adopted in 2021, are emblematic of this paradigm shift from building capacity to managing it, including:

- Transportation:
 - Maintain and optimize existing infrastructure
 - Create healthy and safe streets
 - Enhance regional and local transit

While not directly addressing transportation, several other aspects of the Plan⁷ can also be seen to affect road use and transportation systems through changes in land use and other policy considerations:

- Economic Strategies:
 - Improve economic mobility
 - Shift the location of jobs
- Housing Strategies:
 - Spur housing production and create inclusive communities
 - Protect, preserve, and produce more affordable housing
- Environmental Strategies:
 - Reduce risks from hazards
 - Reduce our impact on the environment
- Equity Strategies: Weave affordable, connected, diverse, healthy, and vibrant community goals into all strategies in the Plan Bay Area Blueprint.

Plan Bay Area 2050 also includes an ambitious GHG reduction mandate: 19% per capita reduction in GHG for light-duty vehicles by 2035, compared to 2005 levels. This is closely related to the SB-743 requirement to measure project impacts in VMT, which serves as a proxy to GHG increases resulting

⁶ https://www.planbayarea.org/sites/default/files/pdfs_referenced/PBA2050_Draft_BPStrategies_071320_0.pdf

⁷ https://www.planbayarea.org/sites/default/files/pdfs_referenced/PBA2050_Draft_BPStrategies_071320_0.pdf

from increases in auto trips. Since VMT is defined as the number of miles traveled per vehicle, reducing the number and length of trips and increasing the number of people per vehicle are central to demand management strategies.

2.4 Bay Area Express Lanes

The Bay Area Express Lanes are a local network of managed lanes currently being implemented across the Bay Area through close coordination among regional agencies. Although many agencies are involved in the implementation of the express lanes, there are currently four agencies⁸ with the authority to implement and operate express lanes. Express Lanes build on the concept of High Occupancy Vehicle Lanes, which are further described in Appendix Sections 7.1 and 7.2. As of Fall 2020, there are approximately 125 lane-miles of operating express lanes in an overall planned regional network of 737 lane-miles.

Bay Area Express Lanes generally operate according to the following principles:

- Lanes are largely open access, meaning drivers can enter and exit at will;
- Variable tolls change with demand to maintain reliable travel times in the express lanes;
- Tolls are paid electronically using FasTrak®. Solo motorists pay tolls with a FasTrak® or FasTrak Flex® toll tag set to 1 person. Carpools, vanpools, buses, and motorcycles use a FasTrak Flex® toll tag set to 2 or 3+ people to pay no toll or half-price toll, depending on the tolling rules; and
- Clean Air Vehicles (CAVs) use a FasTrak® CAV toll tag to pay no toll or half-price toll.⁹

The goals of the Express Lane Network include quickly and cost-effectively delivering the network to manage congestion, increase person throughput by incentivizing use of higher-occupancy vehicles, increase connectivity, improve equity, and reduce GHG emissions and VMT. The effectiveness in reducing GHG emissions and VMT impacts is dependent upon the type of project that is being pursued as well as the accompanying operational and mitigation strategies deployed.

2.5 Express Lane Project Types

When planning an express lane, there are a number of operational, financial and political considerations that influence the design of the project. The following sections examine four types of projects that fall under two categories:

- Lane Conversion:
 - HOV Lane: building infrastructure improvements to convert existing HOV lanes to express lanes (Section 3.1, below)
 - General Purpose Lane: building infrastructure improvements to convert a general purpose lane directly into an express lane (Section 3.2, below)
- New Construction:
 - Single Lane: building additional lane capacity by adding a new express lane or opening a shoulder lane to some level of vehicle use (Section 4, below)
 - Dual Lane: expanding an existing single-lane HOV facility to a dual express lane facility by (1) converting an existing HOV lane and building an additional new lane or (2) converting an existing HOV lane and converting an existing general purpose lane (Section 4.2, below)

⁸ Bay Area Infrastructure Financing Authority, Alameda County Transportation Commission, Valley Transportation Authority, and San Mateo County Express Lanes Joint Powers Authority

⁹ https://mtc.ca.gov/sites/default/files/BAIFA_EL_Program_Report_2020_Q1_0.pdf

A map of the Bay Area Express Lanes Network is shown in Figure 1. The map depicts project types throughout the network as they are currently operating or planned. New construction and proposed general purpose lane conversions are grouped to reflect the fact that the feasibility of both projects types is undetermined in some cases due to the current transitional state of environmental impact analysis and/or legal statutes. Table 1 lists the number of lane-miles for each project type in the network.

Figure 1: Bay Area Express Lanes Network Project Types

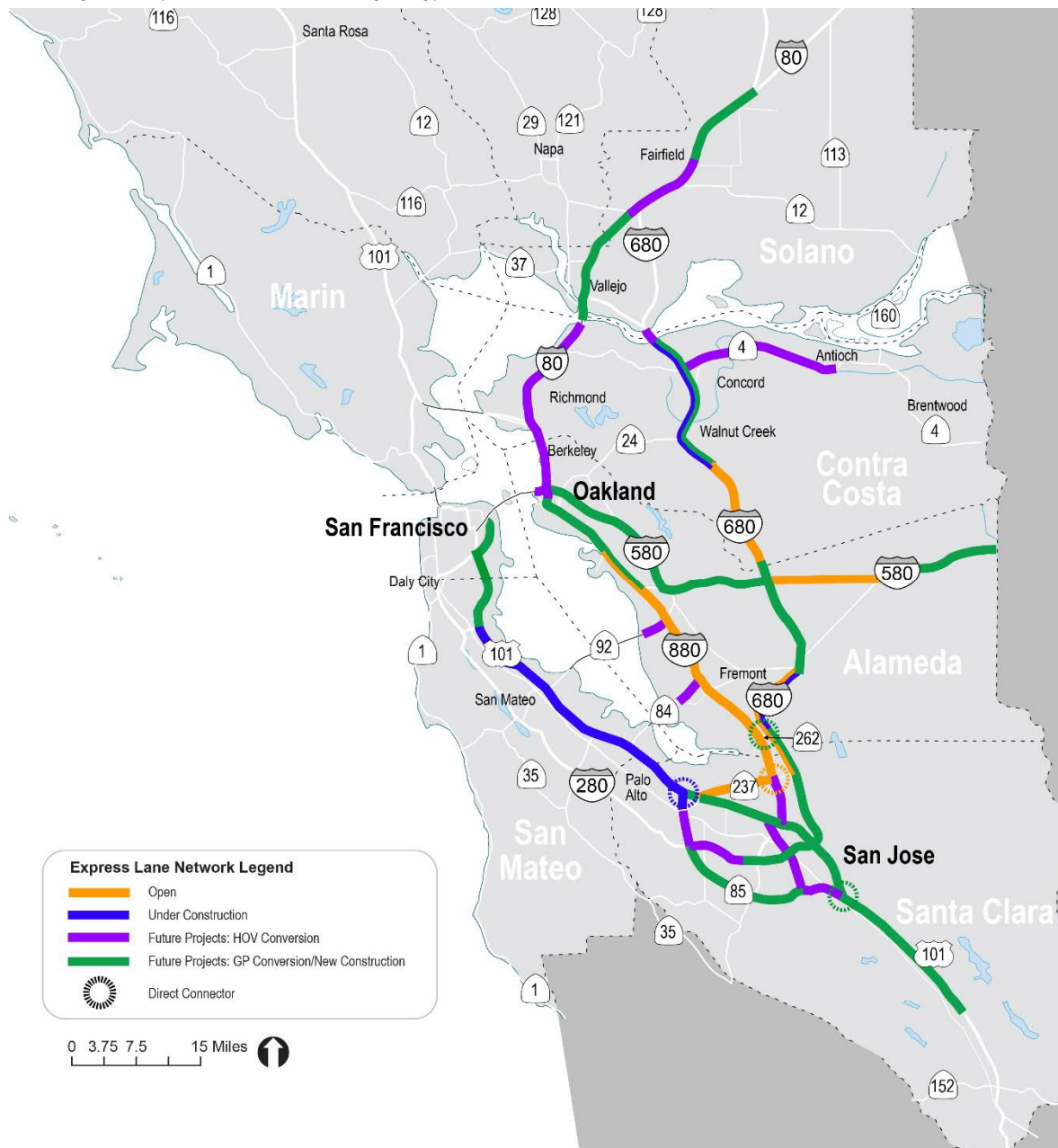


Table 1: Express Lane Network Total Lane-Miles by Project Type

Project Type	Lane-miles		Total
	Open/Under Construction	Upcoming Projects	
HOV Conversion	168	150	318
General Purpose Lane Conversion/ New Construction	40	379	419
Total	208	529	737

3 Lane Conversion

When considering GHG emissions, conversion offers the benefit of applying the demand management capabilities of express lanes to existing highway capacity and therefore not likely increasing VMT in the long term, particularly in comparison to projects which add capacity. HOV-to-express lane conversion projects have the advantage of being able to build off an already established carpool and transit base. This can provide benefits to vehicle- and person-throughput in a less expensive and faster manner compared to new lane construction, assuming the lane is priced to avoid overuse by SOVs, and HOV usage is maintained at a similar level to that prior to conversion. Conversions of general purpose lanes to express lanes, however, raise political, operational, and public perception challenges that need to be addressed to ensure that these projects are viable and that they maintain or decrease congestion to a point where they avoid counterproductive increases to GHG emissions. These two lane conversion types are explored further below.

3.1 HOV-to-Express Lane Conversion

HOV conversion projects are commonly regarded as being the most “friendly” of the implementation options when it comes to VMT/GHG impacts. They use existing freeway capacity to continue to provide benefits to carpools and transit while managing additional, unused capacity with pricing. HOV conversion projects do not add new freeway lane capacity, which can result in inducing additional VMT and GHG in the long term. However, HOV conversion projects do allow use of capacity that may have otherwise not been fully utilized (e.g., when an HOV lane is underutilized), and they can restrict capacity that would have otherwise been utilized by general purpose traffic (e.g., extending operating hours to include mid-day periods). Applying appropriate operational strategies can help ensure that HOV conversion projects are unlikely to increase congestion, which may contribute to GHG emissions in the short term.

In addition to likely providing good GHG outcomes, converting an existing HOV lane to an express lane is often the fastest and least expensive approach. Converting an HOV lane to an express lane represents very little change in terms of the current functioning of the lane. HOVs, clean air vehicles, and motorcycle customers are still permitted to use the facility for free or for a reduced toll. Since demand-variable tolls help ensure that only a limited number of toll-paying vehicles can use the lane, the reliability and travel time benefits of using the lane are maintained, or even improved as automatic charging and enforcement deter cheaters that may degrade the functioning of the lane. At the same time, opening the HOV facility to more users provides some immediate congestion relief for corridors that may experience reductions in travel speed during peak hours. A literature review conducted by

Caltrans in 2013 summarizes observed improvements for express lane conversion projects around the country.¹⁰

Financially, HOV conversion comes at a fraction of the per-mile cost of total new lane project cost. While some variation can be expected in a heterogeneous geography like the Bay Area, when averaging per-mile lane costs for planned express lane projects in the Bay Area, HOV conversion projects were found to be 20-40% the per-lane-mile cost of new construction.¹¹ Compared to new lane construction, conversion also offers reduced project timelines. New construction projects require additional project development time for environmental clearance and design and have a longer construction timeframe associated with the physical widening of the freeway.

3.2 General Purpose-to-Express Lane Conversions

Significant general purpose lane conversion projects have not been attempted in the United States.¹² Although theoretically similar to HOV conversion when considering construction scope, cost, and timeline, general purpose lane conversions pose additional challenges regarding practical and political viability and most likely require changes to state and federal statute. The effects on GHG/VMT associated with converting a general purpose lane are speculative at this point for several reasons. It is unlikely that a corridor heavily trafficked by low-occupancy vehicles will shift to other modes immediately in the aftermath of such a change. Therefore, if a general purpose lane conversion is not paired with aggressive, preemptive strategies to increase vehicle occupancy, the results could stall mode shift, leading to increased congestion, GHG emissions, and general backlash in the near-term. However, if successfully paired with robust strategies to promote, incentivize and subsidize high-occupancy modes, conversion of a general purpose lane could result in increased person throughput without contributing to an increase in GHG emissions associated with congestion.

3.2.1 Practical Challenges

The dominant challenge associated with general purpose lane conversions is with reducing vehicle capacity within a corridor, typically considered in a project's environmental impact analysis. The commonly cited capacity for a general purpose lane is 2200 vehicles per hour, whereas the capacity of a managed lane is typically considered to be no more than 1650 vehicles per hour to meet state and federal performance criteria for travel speed. Conversion of a general purpose lane to an express lane would therefore theoretically reduce the vehicle carrying capacity of a corridor. As a result, general purpose conversion projects must be supplemented with robust investments that promote greater adoption of high-occupancy modes to reduce the overall vehicle demand. Otherwise, general purpose conversion projects risk contributing to degraded operating conditions in a corridor, resulting in increased congestion and GHG emissions.

Although the prospect of reducing vehicle demand in a corridor may seem daunting, there is evidence to demonstrate that it only takes a small reduction in vehicle volume to have a big impact. In the Bay Area, MTC has noted a phenomenon where holidays that result in a 3-5% reduction in traffic demand annually

¹⁰ <https://dot.ca.gov/-/media/dot-media/programs/research-innovation-system-information/documents/preliminary-investigations/hov-and-hot-lanes-pi-03-25-13-a11y.pdf>

¹¹ Based on cost estimates for future projects provided by industry professionals at Bay Area Express Lanes Network partner agencies.

¹² Minnesota DOT has converted a small segment of I-35 East from a general purpose lane to an express lane, described in further detail in Section 3.2.4 Legal Context below.

yield a 50-70% reduction in delay.^{13, 14} This demonstrates that a small mode shift to high-occupancy modes in congested corridors during peak weekday hours may result in meaningful reductions in delay.

3.2.2 Congestion Mitigation Strategies

The following sections describe strategies that can be paired with general purpose conversions to promote reductions in vehicle demand and increased person throughput. They are presented in this section to emphasize the fact that general purpose lane conversions would not be viable without robust strategies to reduce vehicle demand. This does not mean that these strategies are exclusive to general purpose lane conversions and should not be considered as strategies to complement all types of express lane projects. These strategies could be applied to any project to aid in reducing GHG/VMT.

3.2.2.1 Transit Improvements

The implementation of express lanes provides opportunities to improve regional transit services, allowing road-based transit services to traverse the region with increased travel time savings and reliability benefits. This paper does not address the challenges associated with making transit a cost-effective strategy, and it is important to note that transit's viability as a strategy varies among corridors, depending, to a large extent, on existing land use patterns. Project-level analysis is needed to determine whether transit is viable and to assess how transit could offset any loss of capacity.

If transit is shown to be viable, building up transit ridership will likely not happen instantaneously and will require convincing those who rarely or never use transit to shift a portion of their ride to transit modes. The main challenges to increasing transit usage in California are attributed to:

- Declining transit service levels and inaccessibility of existing routes;
- Increased private vehicle ownership/access;
- Low cost of auto travel; and
- Ease of driving.¹⁵

Encouraging commuters to shift to transit will require providing transit service that is much more attractive than driving. Although the topic of integrating express bus with express lanes is discussed in a separate white paper, a few key points related to transit service and infrastructure improvements are summarized below:

- Improve frequency, travel time, and reliability by providing direct, connected routes with ease of access by buses. In some cases, this may require dedicated bus-only right-of-way, bus-only shoulder options, and optimized placement and frequency of stations/stops.
- Invest in comfortable, accessible, multi-modal stations which provide real-time information to waiting transit users.
- Emphasize park-and-ride and walkable access to attract a variety of transit users, from commuters to all-purpose riders.
- Use net toll revenue to reinvest in transit by subsidizing transit service, funding incentive programs, increasing frequency, adding days of service, making station improvements, or adding infrastructure that supports multi-modal connectivity.

¹³ https://www.ibtta.org/sites/default/files/documents/2014/14SanDiego/Fremier_Andy_CA%20Dreaming.pdf

¹⁴ https://mtc.ca.gov/sites/default/files/Heminger_AMPO_Annual_Meeting_Sept_2018MTCG2_FINAL.pdf

¹⁵ https://www.scag.ca.gov/Documents/ITS_SCAG_Transit_Ridership.pdf

One example of how transit service can be paired with express lanes comes from Los Angeles. LA Metro uses \$7 million in express lane toll revenue annually (approximately 11% of FY19 toll revenues¹⁶) to help fund the Metro Silver Line and other transit lines operating on the express lanes, and provide supporting programs like toll incentives for regular transit users. This has supported an increase in Silver Line ridership of 50% from 2012 to 2016.¹⁷ While it is difficult to ascertain the percentage of these customers that have shifted from an auto commute, it is reasonable to assume that some proportion of them have, contributing to reductions in congestion.

3.2.2.2 Employer Programs

Highway corridors are consistently the most congested during peak morning and evening commute hours, making commuters the target demographic when considering VMT/GHG and congestion reduction strategies. While programmatic strategies reviewed so far have focused on and around the actual express lane facility, there are also several strategies to be pursued within the broader travelshed of a corridor which can focus on encouraging commuters to make travel decisions that will help reduce congestion. These can include working with employers to promote the following strategies:

- Employee parking pricing: eliminating free employee parking provided by companies;
- Enforce parking cash out: California law requires giving employees a cash equivalent to parking value for using other modes;
- Transit and vanpool benefits: free or discounted fares provided to employees;
- Employer shuttles: high-occupancy modes provided directly by employers which can benefit from express lane policies;
- Company travel reimbursement policies: companies reimbursing employees for miles of transit travel at the same rate for auto travel;¹⁸
- Expand commute options: working with employers to provide or subsidize carpool, vanpool, or shuttle commute options. For example, MTC's SHIFT program provides grants to employers to help set up, subscribe, and manage commute-benefit incentives and other congestion-relief tools through platform vendors Luum, RideAmigos, or RideShark;¹⁹
- Flex hours: allowing employees to commute outside of typical peak hours to help spread traffic demand across the day. While this may not reduce overall VMT, it may reduce excess GHG emissions due to congestion; and
- Telecommute: encouraging and providing support to employers and employees to telework.

Working with employers within the travelshed of an express lane project would represent a shift in how express lane projects have typically been delivered in the Bay Area. The 101 Mobility Action Plan is a local example of how an express lane can be integrated into a larger corridor strategy that involves working with employers. Such strategies could be effective in encouraging commuters to carpool or use transit modes in their work trips. Business-centered programs would require significant collaboration between private and public partners, and would likely require terms which maintained long-term employer commitments to commute programs. Encouragement of this kind may be further motivated by strategies listed in Section 4.4 VMT Mitigation, below.

¹⁶ http://media.metro.net/about_us/finance/images/fy20_adopted_budget.pdf

¹⁷ http://media.metro.net/projects_studies/expresslanes_105/fact_sheet_exl_2019-05.pdf

¹⁸ Shoup, Donald C. Parking cash out. American Planning Association, 2005.

¹⁹ <https://mtc.ca.gov/whats-happening/news/new-partnership-program-helps-big-employers-shift-workers-commute-choices>

3.2.2.3 Other Transportation Demand Management (TDM) programs:

While express lanes create an incentive for carpooling, both in terms of reduced cost or free usage and time savings and reliability, there are obstacles that prevent people from engaging in high-occupancy modes. The main barriers to carpooling include:

- Lack of an HOV lane/facility, particularly over high proportions of the trip;²⁰
- Flexibility of driving alone/difficulties finding or managing carpool partners; and
- Safety/security.²¹

In addition to continuing to close infrastructure gaps in the Express Lanes Network, strategies that make it easier to access carpooling services and transit modes and incentive high-occupancy modes could go a long way towards achieving goals. These could include the following strategies:

- Carpool programs are intended to make it easier for commuters with similar origins and destinations to form carpool groups. MTC offers a ride-matching service in MERGE, which encourages commuters to ride together for free by matching those with similar origins and destinations, splitting ride costs, and earning rewards.²² Carpool apps like Scoop and Waze Carpool provide dynamic carpool matching, and MTC has partnerships with these app providers to market their services. Partnerships with Express Lane operators, including incentives as described below, could lower the cost of app-based matching and increase the benefits of using such a service to users. Carpool programs can be supported by guaranteed ride home programs like those that currently exist in the Bay Area, which serve to increase confidence in carpooling and transit modes.
- Incentive programs can encourage HOV behavior. For example, from February to August 2019, MTC provided “Five Rides Free” to any new Scoop or Waze carpoolers. Over 11,000 new carpoolers received incentives and completed over 180,000 carpool trips.²³ LA Metro ExpressLanes automatically enter carpoolers into a Carpool Loyalty Program, which also enters FasTrak® holders into a monthly drawing for a chance to use toll credits.²⁴ MTC’s MERGE program also facilitates carpool rewards. Carpoolers earn points for e-gift cards for their carpool trips. Providing connectivity between toll system data and carpool trips could enable more seamless rewards delivery. Similarly, providing connectivity between FasTrak® and transit card services like Clipper could enable discounted transit fare programs. These types of programs would be enhanced by subsidies on using services provided through toll revenue.
- Vanpool programs place groups of commuters together in 7 to 15 passenger vanpools. The Bay Area had nearly 1,000 vanpools pre-COVID; most rented by employers for their employees. Of the other vanpools, MTC supports about 120 owner-occupied vans with empty seats subsidies and outreach to find riders. MTC also subsidizes nearly 200 vanpool groups who rent their vanpools from Commute with Enterprise. By subsidizing vanpool costs, riders pay less and the demand for vanpooling grows.

²⁰ Giuliano, Genevieve, Douglas W. Levine, and Roger F. Teal. “Impact of high occupancy vehicle lanes on carpooling behavior.” *Transportation* 17.2 (1990): 159-177.

²¹ Olsson, Lars E., Raphaela Maier, and Margareta Friman. “Why do they ride with others? Meta-analysis of factors influencing travelers to carpool.” *Sustainability* 11.8 (2019): 2414.

²² <https://merge.511.org/#/>

²³ <https://mtc.ca.gov/whats-happening/news/five-free-rides-incentive-program-launches-february-1-2019>

²⁴ <https://www.metroexpresslanes.net/offers-discounts/carpool-loyalty/>

3.2.3 Historical Challenges

The practical challenges presented by general purpose lane conversion are compounded by the fact that there are no precedents in the United States for converting a general purpose lane directly to an express lane. The most similar comparison would be conversion of general purpose lanes to HOV lanes, but even this is not commonly done in California. Since a failed 1976 HOV conversion pilot program in Santa Monica, every new HOV lane implemented in California has been accomplished via new construction rather than conversion.

The Santa Monica pilot, intended to help reduce air pollution in compliance with the Clean Air Act, converted a general purpose lane to an HOV lane during peak hours. Its initial rollout was unsuccessful. High levels of congestion (<5 mph speeds) resulted from poorly calibrated ramp meters. While speeds later improved, public perception had turned against the concept of HOV conversion. This resulted in protest actions like scattering nails on the facility, creating a negative feedback loop that further discouraged use. After the five-month program, expected levels of mode shift to carpool and transit never materialized, and the concept was abandoned.²⁵ While some aspects of the program's failure could be attributed to specific conditions of the highway and its users, it had lasting ripple effects on public perception and political sensibility in California regarding lane conversions.

This real historical event is also compounded by conventional perceptions that suggest removing a general purpose lane in a corridor that is already congested will lead to higher costs in terms of travel time and spread peak travel times or diffuse demand onto alternate routes and surrounding areas. However, it is likely that these are the exact areas that would benefit the most from an increased incentive to engage in carpooling and transit behaviors. It is also important to note that converting a general purpose lane to an express lane would be less impactful to existing traffic flow than conversion to an HOV lane, since express lanes are inherently less restrictive, allowing single drivers to continue use, if desired.

3.2.4 Legal Context

The practical and historical challenges of general purpose lane conversion provide context for the current state of legislation around lane conversion, which varies at the federal and state levels. Generally, this leads to lack of clarity on what is permissible, and an increased level of risk in pursuing general purpose lane conversion projects without more explicit authority. The lack of clear mandate at the state or federal level to even pursue a pilot project in the Bay Area limits the ability to pursue bold, creative solutions to meet GHG reduction targets.

Federal law governs the conversion of general purpose lanes to HOV lanes, allowing conversion when it would increase the efficiency of any Federal-aid Highway (23 CFR§ 810.108(b)). Federal law (23 USC §166 (b)(4)), also allows for express lanes by permitting low-occupancy vehicles to pay to access an HOV lane if the facility:

1. Establishes a program that allows motorists to enroll to participate in the toll program
2. Develops, manages, and maintains a system that will automatically collect the toll
3. Establishes a policy and procedure to
 - a. Manage demand to use the facility by varying the toll amount
 - b. Enforce violations of use
 - c. Ensure that private and public buses are provided access under the same conditions
4. Establishes and manages a performance monitoring, evaluation and reporting program

²⁵ <http://onlinepubs.trb.org/Onlinepubs/trr/1978/663/663-002.pdf>

There are provisions in federal and state law that explicitly prohibit the conversion of a non-tolled lane to a tolled lane, except as a pilot project. For example, 23 USC §129 (a)(1)(B) allows federal participation in the construction of a tolled lane so long as the number of toll-free lanes is not reduced. California law also does not explicitly permit the conversion of a non-tolled lane to a tolled lane, except when converting an HOV facility to an express lane ((Streets & Highway Code §143(q), §149.7(m); Government Code §64112(b)).

An important exception at the Federal level is the Value Pricing Pilot Program (VPPP), which was created under the Intermodal Surface Transportation Efficiency Act §1012(b). VPPP expressly waives the Federal restrictions described above to create a pilot program, with the approval of the Secretary of Transportation. While funding has not been available under this program since 2012, the program can still provide tolling authority to State, regional or local governments to implement congestion pricing applications and report on their effects.²⁶ At the state level, approval would also be needed by Caltrans.

Outside of a pilot program, there is some ambiguity as to how federal and state laws would apply to the direct conversion from general purpose lane to express lane. Conversion from general purpose lane to express lane is not expressly permitted because an express lane is tolled, but Federal and state law would seem to allow conversion from general purpose to express lane as a two-step process: general purpose lane to HOV to express lane. This process was undertaken in Minnesota for a small segment of I-35 East, which converted in a condensed two-step process without ever functioning only as an HOV lane. However, the 1-mile long segment had a special circumstance as a bifurcated interchange that was co-designated with I-694, and connected new capacity that was constructed on either side.²⁷

It is unclear whether the legal strategy that justified this conversion would be applicable to a larger scale project with greater exposure to opposition. Furthermore, unless the steps could be executed simultaneously, a two-step process that first converts a general purpose lane to an HOV lane would likely create a negative impact by creating congestion in that first step. If a longer corridor would need to create a longer intermediate step in the conversion process, this would add to cost and timeline, severely reducing the viability of this strategy.

Therefore, even before implementation, general purpose lane conversion is challenging on two fronts: cultural attitudes toward removing a free general purpose lane and the lack of clear authority to convert a general purpose lane in state and federal law. Cultural attitudes potentially could be shifted somewhat through communication strategies that seek to inform public perceptions of traffic management. Such public outreach would emphasize the fact that encouraging carpool and transit behavior, particularly in areas with high congestion, will ultimately provide congestion reduction benefits, even if congestion does not improve in the short term. However, the ambiguity of federal law raises questions that are serious enough to stymie political will to pursue such projects, and would benefit from additional legal interpretation and/or change.

One such change may be forthcoming at the federal level. The proposed INVEST (Investing in a New Vision for the Environment and Surface Transportation) in America Act would replace the current Fixing America's Surface Transportation (FAST) Act. The draft version of the INVEST Act explicitly allows the authorization of conversion from non-tolled lanes to express lanes (§1110(E)) if the conversion is

²⁶ https://ops.fhwa.dot.gov/congestionpricing/value_pricing/index.htm

²⁷ <https://www.dot.state.mn.us/mnpass/mnpassexpresslanes.html>

accompanied by investments in non-tolled alternatives in the corridor and the establishment of a performance, monitoring, evaluation, and degradation reporting program.²⁸ It is worth noting that the bill would sunset the VPPP and impose some additional requirements beyond those in the VPPP in exchange for the benefit of explicit legality.

At the state level, such a law would help justify a pilot program or legislative change to state legislators, who could explicitly permit pilot programs in Bay Area corridors. Initial state legislation could permit MTC or a county express lanes partner to pursue pilots on limited corridors (ideally not named in statute). Such a pilot would still require operational analysis to determine if the proposed pilot is viable.

3.2.5 Equity Considerations

MTC's working definition of equity is just and fair inclusion into a Bay Area where everyone can participate, prosper, and reach their full potential. MTC pursues its equity agenda with a racial justice focus by investing resources for historically underserved groups including low-income and communities of color at a scale to meaningfully reverse the disparities in access that diminish our region. If a highway project benefits higher-income car owners, and exposes lower income communities to increased auto exhaust, it is inequitable on two counts. The importance of considering equity is codified in Plan Bay Area 2050, in which express lane partners have been tasked with aligning Express Lane Network goals with five guiding principles, emphasizing affordability, connectedness, diversity, health and community vibrancy.²⁹

Therefore, in addition to practical, historical and legal challenges, the equity impacts associated with general purpose lane conversions will also need to be considered. A conversion that results in increased general purpose lane congestion could raise significant equity concerns since this would more consistently impact highway users with less ability to pay to access the express lane, unless mitigated. Similarly, mode shift strategies that accompany potential general lane conversions must be ensured to be accessible to communities of concern, particularly those community members who depend on auto travel in the corridor.

4 New Construction

New lane construction in the Bay Area Express Lanes network is proposed in many cases to close or reduce gaps that currently exist in the HOV lane network or to improve the capacity of an existing HOV facility by adding a second lane. In some cases, these new lanes are being sought to bring relief to corridors that suffer from recurrent congestion that spills onto local arterial networks during peak periods. Although these strategies can bring operational benefits by serving demand that already exists in a corridor, they have also been shown to contribute to increases in VMT/GHG by creating new demand for the corridor. New lane construction may relieve general purpose congestion temporarily and provide short-term relief, possibly even reducing GHG in the short-term by allowing cars to run at more efficient speeds. However, numerous studies have shown that short-term beneficial effects can be overtaken and reversed as general purpose lane capacity is filled up by induced demand.³⁰

²⁸ <https://www.congress.gov/116/bills/hr2/BILLS-116hr2eh.pdf>

²⁹ <https://mtc.ca.gov/our-work/plans-projects/horizon>

³⁰ Johnston, Robert A., and Raju Ceerla. "The effects of new high-occupancy vehicle lanes on travel and emissions." Transportation Research Part A: Policy and Practice 30.1 (1996): 35-50.

4.1 Induced Demand and Latent Demand

Induced demand is the concept that expanding road capacity generates new traffic. The extra capacity introduced can serve to encourage more people to drive, either in the form of encouraging existing users to make more frequent or longer trips, by drawing new users to the facility, or by drawing people away from carpool and transit modes. This has the effect of reversing any short-term congestion relief impacts over time as new trips and longer trips can return the corridor to a congested state. Another type of demand that can result in increased VMT when new capacity is added is latent demand, which is demand that exists to use a facility but is suppressed by the inability of the facility to handle it. Latent demand may manifest in the form of mode shifts or changes in trip route after new capacity is added, further contributing to increased usage of new capacity. Beyond this initial period, longer-term impacts include shifts in land use and increases in car ownership that can also cause increased demand.³¹

For new construction of general purpose lanes, the elasticity of increase in highway lane-miles to increase in VMT has been cited to be around 1.0, meaning that every one percent increase in capacity results in one percent increase to VMT. Increases in VMT associated with increases in capacity are likely to come from several sources. These include changes in driving behavior (e.g., making more frequent trips), population growth that could be spurred by improvements in roadway capacity, and diversions from other roads.³² It is worth caveating that new managed lane capacity, such as a new express lane, would likely result in less induced demand than the construction of a new general purpose lane. This is because express lanes incorporate occupancy restrictions and pricing to manage demand to a lower threshold than a general purpose lane. Even so, adding new express lane capacity can serve to free up capacity in the general purpose lanes, which could serve to trigger additional demand over time, depending on regional behavioral and growth trends.

Under Revised CEQA Guidelines §15064.3(a) in response to SB-743, VMT impacts only refer to the amount and distance of automobile travel, removing the need to account for commercial VMT. However, commercial vehicles still contribute significantly to congestion, reducing travel speed along the corridor and reducing the ability of autos to run efficiently. Even so, due to the economic benefit of freight movement, commercial vehicle GHG impacts are likely to focus on technological solutions rather than mode shift.

4.2 Dual Lanes

Dual lane projects involve converting existing single-lane HOV facilities and adding a second lane to the facility to increase capacity and improve safety and operations. Similar to HOV conversion projects, these projects build on an existing HOV and transit user base, but because they also add capacity, the concept of induced demand may still factor into these projects. In concept, dual lane projects may also convert an existing HOV lane and convert a general purpose lane. This would reduce the expense of new construction and reduce the GHG/VMT impacts of widening, but under this strategy the practical challenges and legal context issues described previously for general purpose lane conversions would also need to be considered. While either conceptualization would add some capacity, these projects warrant special consideration because they also serve to further enhance the performance of express lane systems.

³¹ Cervero, Robert. "Induced travel demand: Research design, empirical evidence, and normative policies." *Journal of Planning Literature* 17.1 (2002): 3-20.

³² Duranton, Gilles, and Matthew A. Turner. "The fundamental law of road congestion: Evidence from US cities." *American Economic Review* 101.6 (2011): 2616-52.

Throughput on single-lane HOV facilities in California is often the product of frictional effects of slow-moving vehicles in the adjacent general purpose lanes, as well as slow moving vehicles in the HOV lanes themselves. These effects can reverse some of the congestion-reducing benefits of HOV lanes by preventing vehicles from traveling at optimal speeds, and introduce some safety concerns due to the speed differentials between open access lanes. Dual lane facilities provide an additional lane that provides more separation from slow-moving general purpose lane traffic, decreasing frictional effects. The additional lane also allows vehicles to pass slow moving vehicles in the express lane or merge into and out of the express lanes without disrupting traffic in the express lanes. This is also particularly beneficial to express lane usage by regional transit like express buses, since maintaining speed and consistency are highly important to making transit an attractive option and encouraging mode shift.

Caltrans is conducting a literature review on dual lane operations in preparation for the Santa Clara County dual express lanes on US-101. This facility is planned to be mostly open access with some buffers when needed for operational reasons. The eastbound direction of I-580 Express Lanes in Alameda County also operates as a dual lane facility with near continuous access. An After Study of the I-580 Express Lanes completed in 2018 summarizes the results of an evaluation of the facility. The study showed:

- Increases of daily traffic volumes by 2-4% per year since opening;
- Reduced peak period travel times by 20-30%;
- Express lane travel time savings of 4 minutes compared to general purpose lanes; and
- Increased vehicle and person throughput.

This demonstrates the expected effects of providing operational benefits, while also inducing some demand to take up new capacity.³³

4.3 Additional Considerations

Economically, new construction projects are also generally more expensive to build and maintain, estimated to be between two-and-a-half to five times more expensive than conversion projects based on Bay Area cost estimates. New construction also requires more time to implement due to the additional studies required during the environmental process, as well as the lengthier design and construction timeframes. Significant environmental impacts will also require the added expense of mitigation.

There is some opposition to inclusion of express lane widening projects in Plan Bay Area 2050 to build out Bay Area Express Lanes because of their expense and potential to increase GHG/VMT. Additionally, with the requirements borne from SB-743 to analyze and mitigate VMT increases associated with transportation projects, new lane construction projects that have not already been environmentally cleared could face hurdles to implementation unless VMT impacts can be demonstrated to be mitigated.

4.4 VMT Mitigation

If highly congested corridors use an expansion strategy, expanding with a managed lane at least provides greater motivation for users to adopt carpool and transit modes when compared to adding a traditional general purpose lane. However, for any major infrastructure project, environmental impacts must be assessed and mitigated per CEQA. Until recently, predicted impacts of transportation projects

³³ https://www.alamedactc.org/wp-content/uploads/2018/11/580_Express_Lanes_After_Study_FINAL-1.pdf

were primarily measured by change in level of service, a metric which focuses on vehicle speed, density, or congestion. Projects that increase road capacity often have positive impacts on level of service and GHG reduction in the short term, but can undermine the goals of reducing VMT/GHG by inducing demand and adding even more congestion in the long term.

SB-743 effectively eliminated level of service as the primary measure of impact for transportation projects under CEQA, since the need to improve level of service encouraged capacity increases that were likely to return to a congested state over time. Instead, impacts are now determined primarily by estimated changes in VMT. An increase in VMT would mean that more vehicles are taking trips or that vehicles are taking longer trips, with both outcomes implying that total GHG emissions are also increasing. Reducing VMT requires either shorter or less frequent vehicle trips or a greater number of people per vehicle (i.e. carpooling or transit). Improvements in GHG associated with congestion relief will also factor into the environmental analysis; however, these improvements would need to be demonstrated to outweigh any longer term VMT impacts.

If a project is found to increase VMT during environmental impact analysis under SB-743, sponsors will be required to mitigate that increase by building projects or programs which will provide matching VMT reduction, for example those described in Section 3.2.2 Congestion Mitigation Strategies, above. The most straightforward way to fulfil a mitigation requirement is to directly implement the mitigation on the project site or its surrounding areas. However, this may not always be feasible depending upon the scale, location, and other specifics of a project. Instead, new ideas are emerging to create VMT-based markets, exchanges, and banks.

The revenue stream generated by express lanes potentially could be used to fund mitigations directly or through the emerging concepts of VMT mitigation exchanges or banks, subject to policy action by the agencies authorized to implement and operate express lanes. Such commitments would require confidence in financial forecasts of express lane revenue and expenses, a thorough understanding of the risks and liabilities of committing future revenues to fund mitigation commitments and the ability to do this effectively given the statutory requirements associated with use of express lane revenues.

4.4.1 Legal Context

The following laws and legal precedents form the basis of the requirements governing VMT mitigation.

- The California Environmental Quality Act (CEQA): CEQA (1970) arose from the national environmental movement in the 1960's, expanding upon the National Environmental Policy Act (NEPA, 1970). CEQA requires all major infrastructure projects to undergo environmental analysis and public disclosure to determine if a significant environmental impact will result from its implementation (Lead Agencies have discretion to determine thresholds of significance³⁴). If a significant impact is found, the government requires a developer to mitigate that impact.³⁵ According to CEQA, mitigations may be avoided in limited circumstances. Public Resources Code Section 21081 and CEQA Guidelines Section 15093A state that a Statement of Overriding Considerations may be approved under CEQA which exempts projects from mitigating impacts if (a) region-wide or state-wide benefits of a project outweigh unavoidable adverse environmental effects and (b) findings demonstrate that the required mitigation measures or alternatives are infeasible. This procedure has not been tested as it relates to new requirements under SB-743.

³⁴ https://ceqaportal.org/tp/Thresholds_of_Significance%2003-23-20161.pdf

³⁵ <https://www.opr.ca.gov/ceqa/>

- California Senate Bill 743 (SB-743): SB-743 (2013) required the Governor’s Office of Planning and Research (OPR) to develop an alternative mechanism to study the environmental impacts of traffic under CEQA. OPR subsequently revised CEQA guidelines to provide a framework for transportation impact analysis that focuses on reduction of VMT, instead of automobile delay. This effectively eliminated LOS and other delay measures as impact indicators, which previously led projects to be developed that emphasized highway capacity expansion and greenfield development.³⁶ Measuring VMT impact instead requires that total miles traveled per vehicle be assessed, and mitigations must also be implemented using VMT as their point of measurement.
- Nollan v. California Coastal Commission (1987): The Nollan case established that there must be a significant nexus between a legitimate government interest and the mitigation they demand of a developer. For example, if reducing GHG emissions serves the public good as a legitimate government interest, the exaction imposed on the developer must relate to the increased GHG emissions that are produced by the project, for example by requiring VMT to be reduced.³⁷
- Dolan v. City of Tigard (1994): The Dolan case took the nexus concept further by establishing that there must be a rough proportionality between the adverse impact and the mitigation. The government cannot exact a mitigation that has a significantly greater positive effect than the negative effect of the project impact.³⁸
- California Government Code Section 66000-66001 (Mitigation Fee Act): The Mitigation Fee Act (1987) and subsequent amendments codify the legal concepts determined in the Nollan and Dolan cases for projects in California, and describe in detail how government exactions may be collected in terms of a fee. Development projects may pay for all or a portion of the cost to implement public facilities necessary to support the projects. This requires:
 - A reasonable relationship between fee’s use and the type of project on which the fee is imposed;
 - A reasonable relationship between the need for public facility and the type of project on which the fee is imposed; and
 - A reasonable relationship between amount of fee and the cost of the public facility.³⁹
- California Native Plant Society v. County of El Dorado (2009): The results of this case found that payment of fee does not presumptively establish full mitigation of a discretionary project – a separate CEQA review of the program is necessary to satisfy a “duty to mitigate.”⁴⁰

The concept of additionality is also a key requirement for some forms of VMT mitigation. This legal concept requires that any mitigation exacted from a developer be distinctly additional to a baseline of existing GHG reduction projects. Therefore, any GHG reduction projects that have already been planned are not eligible for consideration as a VMT mitigation. Mitigations must be new.

4.4.2 On-Site Mitigations

Mitigation measures for infrastructure projects are traditionally applied on-site or in the immediate area of the project. For express lane projects, these types of mitigations can include many of those previously described as being useful strategies to pair with general purpose lane conversion, such as transit and carpool improvement programs. Pairing new lane projects with more aggressive demand management

³⁶ <https://www.fehrandpeers.com/wp-content/uploads/2020/01/ImplementingSB743Berkeley.pdf>

³⁷ <https://www.law.cornell.edu/supremecourt/text/483/825>

³⁸ <https://www.law.cornell.edu/supct/html/93-518.ZD.html>

³⁹ https://escholarship.org/content/qt4gj3n2n3/qt4gj3n2n3_noSplash_142dad3649e123b29a9af940e5f40811.pdf

⁴⁰ https://www.fehrandpeers.com/wp-content/uploads/2020/04/VMT-Fees_Exchanges_Banks-White-Paper_Apr2020.pdf

strategies could also serve to mitigate VMT impacts. For example, implementing an occupancy requirement that only permits qualified vanpools and buses to travel toll-free, paired with a pricing regime that effectively manages demand from toll-paying vehicles, could be more effective at mitigating VMT impacts than a HOV-2+ occupancy policy.

However, it may not always be possible for a project sponsor to demonstrate that the impacts of an on-site mitigation are enough to counter the projected VMT impacts of the project. For example, if a new transit service was proposed as a mitigation for an express lane project that involved new lane construction, it would have to be shown that enough drivers would switch to riding transit to outweigh the impacts of the induced demand caused by the new lane. This could be difficult if the transit service is localized or if the project is in an area not well-served by transit or where transit is not cost effective. An added complication arises if the transit service would best be implemented at a regional level, preventing a locally based mitigation from generating maximum effect.

4.4.3 Emerging Mitigation Concepts

Because on-site mitigations may not be feasible depending on the scale and location of a specific project, the concept of VMT mitigation banks and exchanges are being explored to facilitate maximally efficient overall regional VMT reduction. These strategies, explored in detail below, allow governmental bodies to remove the need for projects to have on-site mitigations by coordinating VMT impacts with possible mitigations over different geographies and timeframes.

At the outset, it is important to emphasize that these are new concepts that have predominantly been discussed in the housing and commercial development space thus far. They are discussed here as they may apply to public transportation infrastructure projects, but their application to this sphere may require further CEQA review. At a minimum, a program would need to establish, in coordination with legal precedents described above, the following:

- A formal nexus analysis, which ensures that required mitigations are sufficiently related to the impact and roughly proportional in scale;
- Quantification of need for VMT reduction projects to be funded by the mitigation program; and
- Calculation of mitigation fees expected to be generated by project development.

At the time of publishing, both the Southern California Association of Governments and the Contra Costa Transportation Authority have received Caltrans Sustainable Communities Technical Grants to study the development of such a VMT Mitigation Program.

4.4.3.1 VMT Mitigation Exchange

In a VMT Mitigation Exchange, as currently conceptualized for housing and commercial development, a developer agrees to implement a predetermined VMT-reducing project or proposes a new one,⁴¹ essentially exchanging a VMT increase for an equal VMT decrease. Unlike on-site mitigations, the mitigations in an exchange may be located outside of the immediate project vicinity, so long as mitigations are equal to impacts. There is also flexibility in whether a mitigation is a capital project, maintenance & operations project, or program.

A VMT exchange could prove an attractive option for express lane projects. Implementing agencies could opt to invest in additional strategies within the express lane corridor that serve to offset any VMT

⁴¹ https://www.fehrandpeers.com/wp-content/uploads/2020/04/VMT-Fees_Exchanges_Banks-White-Paper_Apr2020.pdf

impacts of the express lanes. These may additionally be synergistic with existing multi-county efforts that focus on cross-county corridor planning such as those being undertaken in conjunction with the Bay Area Partnership's Connected Mobility Subcommittee. Investments could be complementary to the express lanes, such as investments in transit, and could be wholly or partially subsidized using express lane revenues. Additionally, the concept is applicable to a variety of geographies from corridors to regions.

It is crucial in an exchange program to ensure that mitigations are equal to impacts, showing rough proportionality as in the *Dolan v. City of Tigard* case, described above. This requires:

- A facilitating entity (e.g., joint powers authority) that can review the VMT generated by a project, match that VMT generation with a reducing project that is both equivalent and available, and ensure through evidence that the results of this VMT reduction are valid;
- Possibly a third-party administrator; and
- Determination of timeframe of monitoring mitigation life. This is particularly important since the GHG/VMT effects of strategies like capacity expansion may occur over several years.

The concept proposed for the Contra Costa Transportation Authority's I-680 Innovate project resembles that of a VMT exchange. Although still in development, the concept proposes to offset the VMT effects of the express lane project, which involves adding additional capacity to fill a critical gap, with the VMT-reducing benefits that would be realized by implementing other projects in the corridor.

A potential model of a VMT exchange includes the San Francisco Transportation Demand Management Program, managed by San Francisco Planning. While not necessarily analogous to the concept of an exchange, the method by which impacts are valued and mitigations are traded has potential in an exchange system. Under this program, staff assigns points to new developments based on negative impacts, with each point roughly equivalent to a requirement for 1% reduction in VMT. These points are then traded for demand-management measures such as bicycle parking, car-share parking, or public transportation contributions.

4.4.3.2 VMT Mitigation Bank

A VMT Mitigation Bank is related to the exchange concept in that it allows developers to fund off-site mitigation projects. But instead of the developer directly implementing the mitigation project, a mitigation bank allows a developer to purchase credits that are then applied to VMT reduction projects by the entity in charge of the bank. Compared to exchanges, banks have a more flexible application to facilitate regional transfers but require more robust program administration to collect fees from developers and to fund mitigation projects.

A simplified VMT bank could take the form of traditional development impact fee programs that charge developers a fee in proportion to the extent of the impact, with the fee being used to fund demonstrated VMT mitigation projects. The City of Los Angeles Westside Mobility Plan Transportation Impact Fee Program was the first impact fee program based on VMT reduction. The program used VMT as a measure to exact fees from developers, generating funding for improvements to transit, active transportation, intelligent transportation systems, and auto-trip reduction programs. The program is noted for low administrative costs, limited to construction cost updates and complying with state reviews of funding distribution.⁴²

⁴² https://planning.lacity.org/odocument/f70a7b90-3613-49ce-a65c-2be4a98c6e8c/ordinance_168104_and_168105.pdf

Alternatively, VMT banks could be structured as market-based systems, similar to California's Cap-and-Trade Program. In this way, developers needing to mitigate could buy VMT credits through open trading markets and the funds can be used towards approved mitigation projects. Such a system could be established at a regional level; however, concerns associated with VMT credits being used to fund projects in other jurisdictions would need to be addressed (see Section 4.4.6 Equity Considerations, below). Establishing and operating a market-based VMT banking system would also require a great deal of effort to establish and operate, but once established, could prove beneficial. As compared to VMT mitigation exchanges, banks would require additional administrative resources associated with:

- Regulating prices for VMT fees/credits;
- Demonstrating a strong nexus and substantial evidence that projects receiving credits would achieve expected VMT reductions; and
- Distributing funds for, monitoring, verifying and prioritizing VMT reduction projects.

In the Express Lanes Network, banks could provide the same options as exchanges by generating funding for complementary VMT-reducing benefits like increased transit or carpool services and infrastructure. However, it provides the added benefit of allowing sponsors to help fund a current mitigation, like a regional express bus service, in exchange for future credits against express lane projects yet to be built.

There are no current examples of VMT banks in operation, however there are similar models for how such a system might function. For example, the California Department of Fish and Wildlife (CDFW)'s Conservation and Mitigation Banking Program uses a mitigation bank which allows developers who need to mitigate environmental impacts to purchase credits, either through established mitigation banks or in-lieu fee programs. Mitigation values are identified through the standard CEQA process, and developers or transportation agencies can then acquire credits to provide greater protection for wildlife and ecological process than onsite mitigation. CDFW also has a new advance mitigation mechanism at its use, the Regional Conservation Investment Strategy (RCIS), established by California Assembly Bill 2087 (AB-2087). An RCIS enables local agencies to purchase mitigation in advance of project-level CEQA mitigation requirements for a suite of planned projects. The RCIS allows Mitigation Credit Agreements (MCAs), which establish mitigation ratios for various habitats. Developers and transportation agencies can then purchase these credits to offset environmental impacts as later identified in the project-level CEQA document. RCISs/MCAs differ from the Mitigation Banking Program in that it allows agencies to establish its own advance mitigation credits for a specific set of projects that developers and transportation agencies may purchase to offset the impacts of future development projects. RCISs/MCAs guarantee that credits will be available for a planned project, and can greatly reduce the time, cost, and effort needed to mitigate a projects' environmental impacts. MTC is currently advancing the Regional Advance Mitigation Planning (RAMP) Program pilot phase by completing RCIS's in the East Bay and Santa Clara County.⁴³

4.4.4 Cost

It is important to note that in either the exchange or bank concept, the cost of mitigation is likely to be expensive and may even exceed the cost of the development causing the impact. Initial high-level estimates by MTC for initial planning purposes indicate that for each lane-mile of new capacity, the cost to offset GHG in 2019 dollars would likely be approximately:

- \$50 million if spent on bike improvements

⁴³ <https://www.fehrandpeers.com/wp-content/uploads/2020/01/ImplementingSB743Berkeley.pdf>

- \$80 million if spent on local bus frequency improvements
- \$120 million if spent on express bus frequency improvements

4.4.5 Governance

VMT mitigation exchanges and banks have high required levels of oversight, administration, subject matter expertise, and governmental coordination. In general, the level of oversight and need for nexus analysis increases as the application of funds becomes more flexible and impacts become more separated from mitigations. This raises several questions on how such a system would function:

- Who makes program decisions?
- How are decisions made?
- Who is accountable for decisions?
- How are projects/decision-makers held accountable?
- How is the equitability of impacts and mitigations ensured?
- Specific to express lanes, how/where can express lane revenue be used, and what is the backstop if toll revenue drops and the funds for mitigation are needed for basic express lane operations and maintenance?

These questions are complicated if different levels of government implement different mitigation programs or the same mitigation program with different rules. If a regional authority and a local authority both set up a mitigation bank, consistency of VMT valuation is likely to require coordination, as will the implementation of mitigating projects that result from developers purchasing VMT credits. One opportunity is to support the current RAMP Program framework that could be leveraged to establish a similar VMT Mitigation framework.

4.4.6 Equity Considerations

To expand on the equity concerns introduced in Section 3.2.5, above, we must also consider equity as it pertains to forthcoming strategies around new construction. By design, VMT mitigation exchanges and banks remove the mitigation from the impact. However, whenever these are separated, either in space or time, the possibility of benefiting or causing adverse impacts to one population over another is introduced. Therefore, while equity is not the primary focus of this paper, any VMT mitigation strategy described above should be evaluated for impacts to equity in the region and opportunities to improve it. To combat potential inequity in the distribution of resources, there are some steps that can be taken to regulate the distribution of funds:

- A certain percentage of total mitigation funds can be earmarked for communities of concern, and equity programs using these funds can be determined through meaningful community outreach and participation;
- Priority can be given to mitigations that benefit communities of concern;
- VMT mitigations with co-benefits to communities of concern, such as investment in transit services, can be focused on communities who need them; and
- Mitigation strategies which apply mitigations at the place or time of impact can be prioritized.

5 Other Considerations

5.1 Clean Air Vehicles

When it comes to reducing GHG emissions, promoting the use of clean air vehicles (CAV) may seem like an obvious choice. Feebates (financial rewards for purchasing efficient and alternative fuel vehicles) and policies that permit CAVs to use HOV/express lanes have been used to encourage drivers to switch to

hybrid and electric vehicles in California. Governor Gavin Newsom recently issued an executive order requiring all new passenger cars and trucks sold in California to be zero-emissions vehicles by 2035.⁴⁴ It is unclear at this point how this executive order will translate into laws, policies, and/or programs. However, CAV promotion may have mixed effects across the network when it comes to achieving VMT/GHG goals.

Under the current express lane operating strategy, CAVs with qualifying DMV-issued decals can utilize express lanes for a discounted rate. The CAV decal program will end in 2025, and unless extended, all decals will expire. Some lanes in the Bay Area began charging CAVs a 50% toll in Fall 2020, and remaining lanes will follow suit in 2021. Prior to offering a 50% discount, the volume of CAVs using express lanes was on the rise. As an example, it was observed that CAVs accounted for 30 to 40 percent of the total traffic on the 237 Express Lane prior to charging a 50% discount. Although providing this discounted access creates incentive for greater adoption of CAVs, which has an overall positive impact on GHG emissions, it can also decrease express lanes reliability for transit and carpools if too many CAVs utilize the lanes, decreasing the attractiveness of these modes.

6 Recommendations

6.1 Participate with partners to promote regional mitigation solutions

As an outcome of SB-743, VMT/GHG impacts are becoming very important for the implementation of the Express Lanes Network. A coordinated VMT/GHG mitigation strategy across the Bay Area Express Lanes Network will likely be a great undertaking, requiring collaboration between multiple levels of government and all express lane operators. The necessity to construct certain capacity-increasing projects provides the impetus to establish innovative solutions like VMT exchanges and banks, but these are very new concepts in nascent stages of development. In the near-term, MTC and express lanes partners should closely track the results of VMT impact analysis for upcoming projects, participate in mitigation strategies, and add to the VMT toolbox described above. This work should include consideration of the feasibility, benefits and risks of committing future express lane revenue to mitigations through a mitigation bank or exchange program. A summary of ongoing efforts in the region is included in Appendix Section 7.3

6.2 Advocate for legislation

When it comes to lane conversion, general purpose lane conversion is particularly stymied by unclear statutes. There are also real concerns about the operational feasibility of such a strategy, which may rely on whether certain conditions are or are not met on specific corridors with particular characteristics. It is therefore important that MTC and express lane partners continue to advocate for clear opportunities to test or pilot general purpose lane conversion, keeping in mind the ultimate goal of implementation.

⁴⁴ <https://www.gov.ca.gov/2020/09/23/governor-newsom-announces-california-will-phase-out-gasoline-powered-cars-drastically-reduce-demand-for-fossil-fuel-in-californias-fight-against-climate-change/>

7 Appendix

7.1 HOV Lanes

One of the most well-established and publicly recognizable forms of freeway demand management is the HOV lane, which dedicates a highway capacity to drivers who are carrying more than one passenger in their vehicle. Since a relatively small proportion of highway users typically travel as an HOV, this lane is usually less congested than general purpose lanes and provides a reduction in travel time to users. The Bay Area has made significant investments in building a system of HOV lanes throughout the region. These lanes are intended to incentivize users to carpool, reducing the number of vehicles on the road and therefore reducing overall VMT. However, there are many challenges to HOV lanes operating as intended:

- Underutilization: HOV lanes are underutilized for many reasons. Despite the availability of benefits for HOVs, driving alone continues to be a more popular choice for personal travel. Potential reasons for this may be practical (lack of a connected HOV lane system, location/schedule limitation, travel flexibility, need a vehicle during the day, need to make other stops, no available carpool program) or personal (appreciate alone time, commute preferences e.g. radio, perceived potential traits of carpool partners), making it difficult to influence behavior.⁴⁵
- Overutilization: HOV lanes can become overutilized when the volume of eligible HOVs and/or Clean Air Vehicles in a corridor approaches the capacity of the lane, and/or when too many non-eligible vehicles use the lane illegally. In the former case, increasing the HOV occupancy requirement can address the overutilization problem, although the reverse problem of underutilization can then sometimes occur if the volume of eligible HOVs is too low. The occurrence of HOV violations can only be addressed via manual enforcement by California Highway Patrol, which has limitations given the relatively few violators that can be safely observed and cited at any given time. MTC is currently undertaking two pilots to improve enforcement. One is testing the effectiveness of vehicle occupancy detection cameras, while the other focuses on app-based technology for self-identification.
- Lack of a connected system: The benefits of using HOV lanes can be hindered by gaps in the system. The reliability and time saving benefits of HOV lanes are compromised without seamless connectivity in the system. However, these gaps can be costly to fill.

These challenges, as well as the inability to actively manage HOV lanes, prevents them from being a maximally effective strategy in managing demand and reduce their viability as a strategy to reduce congestion and GHG emissions.

7.2 Express Lanes

Over the past decade, express lanes, also known as High Occupancy Toll lanes, have emerged regionally as a solution to the underutilization, overutilization and the often fragmented nature of HOV lanes. Express lanes maintain the primary function of HOV lanes, preserving time saving and reliability benefits for transit and carpools, while using pricing to manage the remaining capacity in a way that maintains free-flowing conditions. This provides additional benefits above and beyond those of an HOV lane, including:

- Better utilization of extra HOV lane capacity, reducing congestion on general purpose lanes;

⁴⁵ Li, Jianling, et al. "Who chooses to carpool and why? Examination of Texas carpoolers." *Transportation Research Record* 2021.1 (2007): 110-117.

- Provides commuter with more reliability in travel time when needed;
- Better ability to maintain favorable operating conditions to continue encouraging carpools, vanpools, and transit;
- Ability to provide increased enforcement against policy violators; and
- Revenue generation to offset construction costs, better maintain service and functionality of the lane, and fund programs that support other regional goals like equity or GHG reduction.

7.3 Regional Efforts in VMT/GHG Mitigation

	Title	Lead Agency	MTC Staff Contact	Outcome & Implications for MTC Policy	Status / Timeline for Results
Regional	Bay Area Regional Advance Mitigation Planning (RAMP) Program	Leads: MTC, Nature Conservancy, Coastal Conservancy	Kenny Kao	MTC is working to establish a RAMP framework for advance mitigation of habitat impacts. The team is currently developing a strategic plan exploring whether VMT can be incorporated as a mitigation required under CEQA (per SB-743)	Strategic plan to be shared summer 2020.
	CCTA VMT Bank Feasibility Study	Lead: CCTA	Krute Singa / Kenny Kao	CCTA received a Caltrans Planning Grant to explore VMT mitigation strategies, basing the scope on similar studies in Southern California. A Bay Area study could also examine regional involvement for larger/ multi-county projects' VMT impacts and mitigation.	\$400K awarded to CCTA in June 2020
	TDM Programs	Lead: MTC	Cross-Agency	MTC implements programs designed to reduce solo driving. MTC could tie highway capacity projects to enhancements of these programs and express bus. Projects include (note: list not complete): <ul style="list-style-type: none"> • Carpool/vanpool • SHIFT • Climate programs • Forward programs • Commuter Benefits Program 	Ongoing programs
Statewide	Caltrans guidelines for SB-743 Implementation	Lead: Caltrans	Krute Singa / Lisa Zorn	Requirements for CEQA compliance for analysis of and mitigation for VMT impacts for all projects on the state highway system. This would set the standard for methodologies to measure impacts, assesses their significance and identify appropriate mitigations under CEQA Projects now starting CEQA review (including the CC-680 express lane northbound project) must perform VMT analysis and commit to mitigation for impacts.	SB-743 requirements are applicable as of July 1, 2020. MTC submitted comments June 15, 2020. Final guidelines due in September 2020
	Statewide VMT bank/exchange feasibility study	Lead: Caltrans	Krute Singa	A mitigation tool Caltrans may study	TBD
	California VMT Exchange Working Group	Lead: Collaborative	Krute Singa	The group includes city, county and state agency staff as well as consultants from throughout the state	Ongoing discussion group meeting every 2 months

5.3 EXPRESS BUS WHITE PAPER

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1 Executive Summary

1.1 Express Lanes are a natural fit for regional transit service like express bus

The Bay Area Express Lanes Network is a system of managed lanes, currently under construction throughout the region's highway network, which uses pricing to control traffic volume on one or two lanes of a highway. Like an HOV lane, this system provides a free travel time benefit to people traveling in a high-occupancy mode; however, it also generates revenue by allowing drivers not meeting the occupancy requirement to use excess capacity in the lane for a toll (see Appendix Section 6.1, below). As traffic volume grows, the price for low occupancy vehicles does as well, so that good traffic flow is maintained and the incentive for taking high-occupancy modes remains strong. It is important for this network to be extensive and seamless because one of the greatest motivators for drivers to switch to a high-occupancy mode is the presence of a clear travel time benefit over a large portion of their trip.

In addition to incentivizing commuter carpools, the Express Lanes Network also has many potential benefits to transit, especially for express bus service. Transit is essential for urban areas like the San Francisco Bay Area to survive and thrive because it:

- Supports growing populations while mitigating congestion increases,
- Reduces the public health and environmental harms of pervasive auto use, and
- Provides options that ensure all communities have access to a variety of transportation choices.

Regional express bus is a type of transit that is gaining momentum in the Bay Area as regional roadway congestion, the cost of rail transit infrastructure, and crowding on existing transit services like BART⁴⁶ have continued to increase. A typical express bus service route has a single origin stop or cluster of stops, followed by a long travel segment, ending in a single destination stop or cluster of stops. Regional express buses are similar in function to employee shuttle buses. These services are privately operated by major employers, but would similarly stand to benefit from access to a complete express lanes network.

The Metropolitan Transportation Commission (MTC) solicited comments from several regional express lane and express bus operators on what makes express lanes work best for express bus services. Since users may need to account for extra travel time on both ends of their transit journey, an effective express transit service must provide fast travel times, minimal headways, and reliable operations to attract riders. On a highway network, this can only be accomplished under consistent uncongested travel conditions, for example on an express lane, and these benefits must be easily accessible to buses.

1.2 Express Lanes have the potential to provide significant benefits to bus transit

Unlike transportation investments that tend to exclusively favor either transit or roadway improvements, managed lanes improve both the highway network and transit systems by preserving capacity for buses and carpools. Taking this a step further, express lanes allow for greater control in managing traffic than other types of managed lanes since dynamic pricing can be used in conjunction with other policy, enforcement, and programmatic strategies to better prevent lane degradation. The resulting improved travel times and reliability can improve the overall attractiveness of an express bus.

⁴⁶ <https://www.bart.gov/about/projects/corecapacity>

1.3 While some express lanes would work well for express buses, this is not universal in the region. However, the express lanes create opportunities for transit in general

Improving the express lanes to better serve transit would enhance the functionality and benefits of the express lanes as well as both existing and future transit. However, benefits may not be best achieved under current express lane designs. For buses to gain the significant benefits from express lanes, they must first merge across several lanes of frequently congested traffic to gain access. These weaving and merging challenges often lead to travel time delays, inconsistency, and anxiety for bus operators.

Existing express bus transit, which focuses on serving commuters during peak hours, would benefit from improved access between express lanes and walk-up stations or park-and-ride facilities, ranging from dedicated direct-access ramps to transit signal priority improvements on connecting local streets. However, the existing lack of off-peak service neglects transit users who make trips outside of commute purposes or hours. Future express bus transit might focus more on supporting equity by accommodating riders who make trips for all purposes instead of higher income users who ride during peak commute times. This would rely on both placing stations optimally to maintain a user base, while also investing in infrastructure which increases the travel time benefit to buses, station accessibility, and multimodal connectivity. It is crucial to involve transit planners and operators as early as possible in express lane design to help identify which types of investments make sense for transit needs.

No matter the type of bus transit service, major infrastructure improvements are expensive. A sufficient benefit would need to be projected to provide enough public benefits to counter the significant cost of major capital improvements like dedicated access ramps. Since there are diverse transit needs across the region, it is unlikely that the same improvements will make sense for every express lane project, so the infrastructure strategies described below are not intended to be prescriptive for all projects at present. However, this may change as the network is built out and connectivity increases. Express lane and express bus operators should continue to advocate and expand for increased connectivity and collaboration across the region.

In consideration of all these points, express bus service is not appropriate for all express lane projects. Among the Bay Area counties, congestion management agencies, in consultation with transit operators and MTC, are best equipped to determine if the strategy is a good fit. This is not to say that all projects may not be able to support other local or regional transit services in some way – we also describe several possibilities to invest available net toll revenue into general transit improvements on a corridor. Subject to statutory requirements, supporting transit operations using toll revenue is a good way for express lane operators to still have a positive impact on transit in general, even if express bus is not supported.

1.4 Recommendations

Based on these challenges, MTC recommends the following:

1. Seek opportunities to increase ease of access to the express lanes for express buses and other high-occupancy modes;
2. Since express bus will not work everywhere, work with local, regional, and state partners to establish clear criteria and performance metrics to prioritize corridors and guide investments in express bus services;
3. Get transit planners and operators involved in the conversation early when starting planning for the express lanes;

4. Advocate for transit operators and planners to increase transit network connectivity, coordination, and communication to take full advantage of the regional express lanes network by partnering to deliver inter-county express bus services; and
5. Identify opportunities to link transit investments with greenhouse gas (GHG) or VMT mitigation strategies.

2 Background

Regional interest in supporting express bus services with the express lanes is emerging within a greater context. In the Bay Area and California, the seriousness of climate change and socioeconomic inequity is increasingly being emphasized, with express bus eyed as a possible mitigation for both.

2.1 Plan Bay Area 2050

Traffic congestion is reaching a crisis point in the San Francisco Bay Area, threatening the region's economy and environment. However, instead of expanding highways to increase the supply of transportation infrastructure, transportation entities in the Bay Area are focusing on managing the demand to use highways. Strategies are increasingly focused on improving speed and reliability for carpools and transit, so they are attractive compared to driving alone. Getting more people into each vehicle by encouraging them to shift to carpool and transit means that each traveler has a smaller impact on congestion and VMT/GHG emissions, while removing the need for costly highway expansions.

The goals of Plan Bay Area 2050,⁴⁷ the Bay Area's Regional Transportation Plan and Sustainable Communities Strategy (Plan) expected to be adopted in 2021, are all emblematic of this paradigm shift from building capacity to managing it, including:

- Transportation:
 - Maintain and Optimize the Existing System
 - Create Healthy and Safe Streets
 - Build a Next-Generation Transit Network

While not directly addressing transportation, several other aspects of the Plan can also be seen to affect road use and transportation systems through changes in land use and other policy considerations:

- Economic Strategies:
 - Improve economic mobility
 - Shift the location of jobs
- Housing Strategies:
 - Protect and preserve affordable housing
 - Spur housing production at all income levels
 - Create inclusive communities
- Environmental Strategies:
 - Reduce risks from hazards
 - Reduce climate emissions

Additionally, equity and resilience are at the forefront of the Plan and are a focus in all strategies, with the central vision of making the Bay Area affordable, connected, diverse, healthy, and vibrant for all.

Plan Bay Area 2050 also identified three deficiencies in the express lane network, whose topics have become critical express lanes network strategic goals:

⁴⁷ https://www.planbayarea.org/sites/default/files/FinalBlueprintRelease_December2020_Strategies.pdf

- GHG impact: Plan Bay Area 2050 also includes a 19% per capita reduction in GHG emissions for light-duty vehicles by 2035, compared to 2005 levels. The Express Lane Network was found to increase GHG due to several capacity increases, projected to cause long-term increases to VMT and GHG. Transit investment is one of many mitigation strategies under consideration;
- Equity: Express Lanes on their own do not help uplift underserved populations and advance equity. MTC is currently exploring how to improve equity outcomes by piloting a means-based tolling program, and partner agencies in San Francisco and San Mateo are pursuing separate studies on equity in the Express Lanes Network; and
- Cost Effectiveness: Benefit-cost ratios were low in many possible future scenario conditions.

2.2 How Planned Projects Achieve Strategic Goals

Developing an express lane network in conjunction with robust express bus services lanes has varying potential to address the three express lanes network strategic goals:

- GHG impact: A significant mode shift of drivers on express lane corridors to transit services would likely help reduce GHG/VMT.⁴⁸ This is important to meet Plan Bay Area 2050 goals, but also due to the recent implementation of Senate Bill 743, which requires projects to conduct impact analysis and mitigations in terms of VMT. Depending on the feasibility of transit for individual projects, investing in transit may be a primary VMT mitigation strategy. However, estimating the true impact of express bus as a mitigation strategy requires detailed project-level analysis.
- Equity: An express bus system that offers an affordable and accessible mode of transportation for Communities of Concern could be one way to mitigate equity concerns associated with the express lanes. To list a few possible ways express buses could create equity benefits in the Bay Area, transit service may need to focus more on supporting multi-purpose trips throughout the day, commuting during off-peak hours, and building infrastructure like direct access ramps that provide significant and accessible benefits where communities of concern are located. However, detailed equity analysis is outside the scope of this paper. Well-informed determinations of the effects of investing in express bus infrastructure on express lanes would need to ask several key questions. When comparing the benefits to the cost, what does access to express buses mean for disadvantaged populations in terms of change in access to employment, education, and housing opportunities? How do the specific geographies of these populations relate to where express bus routes are currently planned? Do express bus operations provide more benefits than alternatives? These questions must be addressed in separate, targeted studies.
- Cost Effectiveness: Incorporating elements into the Express Lanes Network that enhance transit service can result in greater benefits for with each dollar invested in the network. Improving travel time and reliability for high-occupancy modes incentivizes mode shift, which can also help alleviate crowding in the transit network and increase resiliency by providing redundancy.

2.3 Planned Express Bus Projects

Plan Bay Area 2050 envisions a network of express bus services, shown in Figure 2 including the Regional Express (ReX) Transit Network and other express bus services. ReX is a vision for a connected regional express bus network in the Bay Area which uses the Express Lanes Network to deliver reduced travel times, provide connectivity to existing rapid transit and bus systems, and meet the needs of diverse communities by providing high-frequency bus service all day.⁴⁹ Although such a service could provide

⁴⁸ The simplified term “GHG/VMT,” used throughout, refers to GHG and/or VMT, not a ratio of quantities.

⁴⁹ <https://www.transformca.org/ReX>

regional benefits, many routes on the original ReX network showed low cost effectiveness in modeling because they required a high number of expensive infrastructure features like tunnels, ramps and stations, as well as significant operating costs required to provide all-day, high frequency service. As shown in Figure 2, MTC has since sponsored one of the high-performing routes of the ReX network along I-80 through San Francisco (green route), in addition to two lower-frequency “basic” routes (red and blue routes) for inclusion in Plan Bay Area 2050.



Figure 2: Regional Express Bus Concept for Plan Bay Area 2050

2.4 Transit from the User Perspective

To ensure the success of transit services that use the express lanes, it is important to be aware of the users' needs and experiences, particularly since those that are planning, implementing, and operating express lanes are not always transit providers. Different strategies are needed for different types of transit users:

- Commuters: take transit regularly, but primarily for work. This user may find auto traffic inconvenient, parking too difficult or expensive, or be taking advantage of transit subsidies from their employer;
- All-Purpose Riders: take transit regularly for multiple purposes. These users may live in an area which already has great transit access and quality, be more likely to use transit off-peak and on weekends, be more likely to use non-auto modes even when not using transit, or be transit-dependent. Transit-dependent riders require some additional consideration here. While there is overlap between those who may choose to use transit for multiple purposes and those who are dependent upon it, it still bears pointing out that there are many for whom transit is their only transportation option. These populations are particularly important to consider from an equity perspective; and
- Occasional Riders: take transit occasionally. This user is likely to travel primarily by car or app-based car services, using transit when other options are unavailable.⁵⁰

Strategies for designing and operating express lanes can be geared toward many different aspects of transit operations. These have varied importance to different groups of users, while still being critical to the success of the specific transit service and local expectations of public transit as a mode. This will be further discussed below, but to summarize, these aspects center around:

- Frequency
- Travel Time
- Service Reliability
- Station Conditions
- Real-time Information

2.5 A Note on the COVID-19 Pandemic

This paper recognizes the significant and continuing impact that the COVID-19 pandemic has at the societal level in the United States. From a transportation perspective, the long-term effects of the pandemic on travel behavior are speculative at this point, but may result in long-lasting impacts on travel patterns, particularly as they relate to the willingness to use high-occupancy modes and transit, as well as commuting and work travel.

MTC has convened the Blue Ribbon Transit Recovery Task Force, a group of thirty elected officials; state representatives; CalSTA; transit operators; business and labor groups; and transit and social justice advocates. The task force was formed to help guide the region's response to pandemic impacts on transit operators and riders. The ongoing efforts of the task force reiterate the importance of early collaboration with transit planners and operators. How the pandemic may affect the types of transit infrastructure decisions made by express lane operators and the ability of transit operators to provide service, is also speculative at this point, but it is important to track the ongoing work emerging from this regional group and carry on in its spirit of collaboration.

⁵⁰ <https://transitcenter.org/wp-content/uploads/2016/07/TransitCenter-WOB-2016.pdf>

3 Express Bus and the Bay Area

3.1 Current Bay Area Express Bus Service

Several of the region's bus operators provide services on longer, multi-county routes. Golden Gate Transit, AC Transit, WestCAT and SamTrans have focused on express bus services along specific corridors, primarily to and from San Francisco, with AC Transit also providing some additional connectivity across the Bay by operating across the San Mateo-Hayward and Dumbarton Bridges. Based on the success of these routes, express lanes which lead into high-traffic bottlenecks like bridges may warrant special consideration at the project-level to determine any additional benefits express bus investment may provide and the challenges of providing such benefits. Soltrans and FAST also primarily serve a commuter-focused function by providing connectivity to BART and providing connectivity to the mega-region via Sacramento.⁵¹

However, express bus services in the Bay Area have not been a consistent success story. Santa Clara Valley Transportation Authority, for example, has found that for their population and geography, express buses have not been a good fit for many of their transit goals. Express buses have tended to only work for unidirectional commute-focused services, which often run empty on return routes. Without significant ridership on these return routes, operation cost per passenger is high, without providing significant support for equity goals in communities that need it. These communities may gain more benefit from investment in local transit services.

These examples emphasize the critical point that among the counties of the Bay Area, there are some where express buses have worked and some where they have not. It is essential to learn from these examples to ensure that we are not pursuing strategies which may come at great cost without providing needed progress toward local or regional climate, congestion, and equity goals. As a strategy, express bus sometimes falls within this category, and should be carefully analyzed as an alternative at the project level when being considered along with express lanes. The first step in developing an express bus network should be a comprehensive existing and future travel market analysis to determine which corridors have the greatest ridership potential given existing and planned land use. This should include identifying corridors that have the greatest potential for bi-directional transit travel demand.

3.2 Transit Operations and the Express Lanes

Operational decisions are critical to the performance of any transit service, but also the furthest outside the purview of express lanes operators. For example, one of the most important determinants for riders in taking transit is frequency of service. High frequency takes on additional importance for future services, especially those focused on accommodating non-commuting users by providing high frequency service all day.

There is very little that express lane operators can build in terms of infrastructure to encourage high frequency service – that is an operational decision which must be supported by population density, point of interest density at destinations, and overall demand. However, express lanes operators can coordinate with transit operators early to make sure that infrastructure is in place to support planned high frequency routes. The express lane network can help prioritize bus infrastructure investments in corridors that meet demand that is not otherwise filled by existing transit services like BART and

⁵¹ MLIP Express Bus White Paper

Caltrain. Additionally, by continuing the network buildout, it can also fill critical missing gaps in facilities that would provide a travel time savings along full regional routes that does not currently exist.⁵²

As a national example, Houston Metro reorganized bus routes after noting a 39% decrease in transit ridership from 1999-2013. While the overall number of routes decreased, they have increased ridership by refocusing routes on serving job centers and maximizing the number of people within walking distance of routes.⁵³ By involving transit planners early, express lane infrastructure investments can be made in ways that best support smart route planning. On the other hand, this example also shows that routes are not sustainable when the demand does not exist. This means that not all express lane facilities will support high frequency transit. However, it is still important to incorporate transit planners early even if it is only to confirm that transit options are not viable.

4 Lessons for the Bay Area

While managed lanes present many potential benefits for transit services, transit operators face many challenges when it comes to realizing the full potential of the express lanes network. At a basic level, there must be demand to support a planned route. But even after a route is determined, routes that do choose to use the lanes may experience drawbacks in travel time and reliability in getting to the lane that counteract potential benefits. These include:

- Gaps in the network;
- Difficulties in navigating into and out of the lanes;
- Lack of signal priority or direct-access ramps that connect stations directly to express lanes; and
- Express lane degradation (slow travel speeds and lack of reliability).

MTC solicited comments from regional transit providers⁵⁴ to help determine the kinds of investments they want to see to increase the benefits of the express lanes for their bus services. Considering this feedback, along with regional and national examples, can help inform the types of investments that can be made on the express lane network in the Bay Area. We reference the user perspective here to organize types of investments by transit characteristics that are important to users.

4.1 Travel Time & Reliability

4.1.1 Direct, Connected Routes

The first consideration, even before the types of improvements transit operators would like to see on the express lanes, is whether there is an express lane at all. The lack of a facility that provides time savings over the whole trip is often cited as a primary barrier to getting users to switch to high-occupancy modes.⁵⁵ Completing an integrated express lane network would provide benefits across trips of all types, purposes, and lengths.

⁵² https://www.spur.org/sites/default/files/publications_pdfs/SPUR_Seamless_Transit.pdf

⁵³ Houston METRO, "Ridership Reports."

⁵⁴ Includes representatives from AC Transit, Central Contra Costa Transit Authority, County Connection, Livermore Amador Valley Transit Authority, SamTrans, San Francisco County Transportation Authority, San Francisco Municipal Transportation Agency, SolTrans, Solano Transportation Authority, Eastern Contra Costa Transit Authority, and Santa Clara Valley Transportation Authority

⁵⁵ Giuliano, Genevieve, Douglas W. Levine, and Roger F. Teal. "Impact of high occupancy vehicle lanes on carpooling behavior." *Transportation* 17.2 (1990): 159-177.

Benefits	Challenges
<ul style="list-style-type: none"> • Enables consistent travel time benefits across local, sub-regional, and regional routes • Encourages further coordination and development of regional services • Provides benefits to other modes like carpooling • May generate revenue which could be used for reinvestment 	<ul style="list-style-type: none"> • Building new express lanes to close gaps is expensive and may require VMT mitigation • Converting existing general purpose lanes may be difficult, politically and practically
<p>Learning from National Examples</p> <p>Houston Metro takes full advantage of a complete network to be creative with routing. During peak hours, each park-and-ride lot has its own route; this changes to a multi-station route during off-peak hours.</p> <p>In Miami-Dade, 53% of new express bus riders said the presence of express lanes influenced their decision to start using transit, while 38% of new riders said they used to drive.⁵⁶</p>	

National Example: I-95 (Miami-Dade/Broward)



Summary

Variable toll managed lanes in Florida provide benefits to auto users after registration, but transit, school and intercity buses can use for free without registration.

Four express bus routes in and out of downtown Miami have seen ridership increase by 22% over a year despite a 12% decrease in overall transit ridership.

Source: FDOT

<https://ops.fhwa.dot.gov/congestionpricing/docs/fhwajpo11044/index.htm>

4.1.2 Dedicated Bus-Only Access Points

Among the Bay Area express bus operators interviewed by MTC, the difficulty of getting to the express lane was the number one challenge to deriving maximum benefits from the system. Sixty percent of operators in express lane corridors claimed this as a challenge, with forty percent noting that it was specifically the challenge and safety concerns around merging across multiple lanes of highway traffic to access the express lane on the left.

Successful express bus systems on managed lanes, like Houston Metro, tend to have lanes on different grades, or physically separated from general purpose lanes by a barrier. This is not likely to be feasible in the Bay Area due to limited and expensive right-of-way.

Multiple national examples feature dedicated ramps that connect buses directly from median or off-freeway stations to the express lane. The Bay Area already features such ramps on I-80 in Richmond/El Cerrito which provide access for buses and HOVs at Cutting Boulevard Interchange and Richmond Parkway. Ramps such as these cut down on travel time costs incurred when buses must merge across multiple lanes of traffic to access the facility, increasing bus reliability and benefit to users. This is

⁵⁶ <https://ops.fhwa.dot.gov/congestionpricing/docs/fhwajpo11044/armiami1.pdf>

supported by five of the Bay Area bus operators interviewed who indicated that direct access/exit ramps between stations and express lanes were among their top desired improvements.

Benefits	Challenges
<ul style="list-style-type: none"> • Dedicated ramps reduce congestion and weaving and improve safety • Limited entry and exit points reduce the complexity of merging transit and general traffic • Direct access ramps may also provide benefits to non-transit users like carpools 	<ul style="list-style-type: none"> • Building above-grade facilities, including direct access ramps, is expensive and likely requires acquisition of right-of-way • Gaining community support to add access ramps may be challenging since access ramps can change the look and feel of the neighborhood
Learning from National Examples	
Houston metro has dedicated ramps to park-and-ride stations, so buses do not have to interact with general traffic at transition points.	
Harbor Transitway also notes the difficulties in transit having to interact extensively with general traffic. They indicate decreased speeds due to increased express lane use by private vehicles as one of its main detractors from ridership.	

National Example: Houston Metro



Source: <https://www.ridemetro.org/pages/PR-SouthPoint.aspx>

Summary

Houston Metro operates five reversible barrier-separated express lanes:

1. Northwest Freeway (US 290 W)
2. Eastex Freeway (US 59 N)
3. Gulf Freeway (I-45 S)
4. North Freeway (I-45 N)
5. Southwest Freeway (US 50 S)

Features

- 28 park-and-ride lots and transit centers
- Direct access to ramps for travel time savings and improved safety
- Connectivity to multiple local bus services
- Routes that vary between multi-station and direct routes to each station depending on time of day
- Rideshare programs to match carpools and vanpools

Additionally, while building dedicated right-of-way may prove expensive, it is also possible that dedicated ramps may provide benefits outside of transit services. If ramp access was granted to carpools, this would provide more widespread benefit and go farther toward meeting greenhouse gas reduction goals by providing more incentive for other high-occupancy modes, though enforcement would be challenging without some type of automated charging and/or enforcement system. We also note that targeting direct access ramps in strategic locations, rather than planning a high frequency of such facilities, could provide benefits with a lower intensity of investment.

4.1.3 Bus-Only Shoulders

Bus-only shoulders did not show significant interest among Bay Area transit operators interviewed, however there are successful examples of its use around the country. This strategy allows use of the shoulder when mainline speeds are slow. Use of the left shoulder might prove useful if express lane

conditions deteriorated; however, allowing transit use on left shoulders is likely impossible when considering safety, the need for emergency vehicle access, and the fact that there are limited areas in the Bay Area where left shoulders are already wide enough to allow transit use. Maintenance costs will likely also be increased because of regular use by heavy buses. Allowing use of right shoulders has little to do with the express lanes as planned but may be useful when access to express lanes is prevented by severe degradation in general purpose lanes, and the ability to install direct access ramps is limited.

Benefits	Challenges
<ul style="list-style-type: none"> • Allows buses to maintain speeds while moving past congestion • Less expensive than added lanes • Takes onus off express lane operators 	<ul style="list-style-type: none"> • Requires diligent maintenance of shoulders, including cleanup of debris • Safety and emergency vehicle access • May require expensive shoulder widening • Requires enforcement for bus only

Learning from National Examples

Minneapolis allows shoulder use when mainline speeds are less than 35 mph. Buses are prohibited from exceeding adjacent speeds by more than 15 mph, up to a maximum speed of 35 mph. They also have ramp-meter bypasses so buses can reach shoulders directly.

San Diego is currently undertaking a three-year Transit Only Lane Demonstration Project which allows for South Bay Rapid Buses to perform Bus on Shoulder operations along I-805 and SR 94 during peak travel times. Set to begin operations in early 2021, this project is notable for its use of ITS technologies which will alert drivers to lane conditions, vehicle conflicts, and obstructions.⁵⁷

MTC has also proposed a pilot program to speed up buses on the Dumbarton Corridor, known as Dumbarton Forward. This will allow peak period bus lanes on the shoulder of Highway 84.⁵⁸

4.1.4 Operational Considerations

While bus operations are out of the scope of this paper, it is important to point out several operational considerations that can be made in tandem with the infrastructure strategies above to support travel time and reliability goals. These are a mix of decisions to be made by transit operators and express lane/HOV operators based on local conditions.

Transit Operators

- Optimizing station/stop frequency: Peak and off-peak periods may have widely varying user needs. A combination of strategic station placement and route planning can allow buses to provide more direct routes to major stops during peak and switch to sequential stops during off-peak.
- Bi-directional routes: Routes which must deadhead, or return to their origin empty due to lack of demand for return routes, are more expensive to run for the benefit provided. By working with operators, investments can be prioritized in corridors with the greatest potential for bidirectionality.
- Prepaid fare collection/tap-and-go cards: reducing transaction time allows buses to spend less time at stations and helps maintain consistency with in-station loading times.
- Regional connectivity: the operational considerations of transit services are very much localized in the Bay Area, which somewhat contrasts with the connected regional vision of the Express

⁵⁷ https://www.keepsandiegomoving.com/Rapid-Group/SouthBayRapid_BusOnShoulders.aspx

⁵⁸ <https://mtc.legistar.com/LegislationDetail.aspx?ID=3855890&GUID=40F06297-587A-4734-85B4-79DB16D0E702%EF%BB%BF>

Lanes Network. The operational limits of each transit agency are governed by local funding sources, service areas, and goals. It is therefore difficult to initiate service outside of jurisdictional boundaries, besides origin-destination pairings that are particularly in demand, like service to and from San Francisco. Even so, 29% of Bay Area commuters cross a county boundary on the way to and from work every day,⁵⁹ while only three percent of trips in the Bay Area are currently made on public transit.⁶⁰ Depending upon travel patterns, markets, and local conditions, a vision of a connected transit guideway through a complete Express Lanes Network can introduce greater possibilities for transit services to expand cross-county services. However, to achieve this, transit agencies and express lane partners will likely need to partner to deliver more inter-county express bus services. The operational considerations of such a venture are outside the scope of this white paper, but would likely require significant effort, expense, and coordinated administration. The Blue Ribbon Task Force, previously mentioned for guiding the region's transit response to the COVID-19 pandemic, is looking at the idea of a single network manager to help coordinate transit operations across the region. The express lane operators will need to collectively monitor the network manager effort as future express bus planning and coordination may be with the network manager.

Local Conditions

- **Transit Signal Priority:** By focusing on improving operations on streets which feed into express lane facilities, variability in arrival and travel times can be reduced for buses that partly rely on non-highway roads. Transit and express lane operators can work together with local jurisdictions and/or Caltrans as part of the express lane project to improve transit signal priority.

Express Lane/HOV Operators

- **Managed lane degradation and violation:** The express lane network uses variable tolls and automated enforcement systems to ensure there is enough capacity on express lanes to be able to maintain a specific speed. Tolls can be adjusted to create extra capacity for transit services to function better. The network also works with California Highway Patrol for manual HOV occupancy enforcement practices, for which supplemental automated enforcement strategies are currently being studied. In addition to operational considerations, this also has design implications in the designation of police observation zones and enforcement technology.
- **Cross-service benefits:** Linking services such as FasTrak® with other transit card services creates the opportunity to incentivize travel on both by providing free rides, reduced tolls or other significant financial benefits.

⁵⁹ <https://www.spur.org/publications/urbanist-article/2015-05-11/seamless-transit>

⁶⁰ 2010–2012 California Household Travel Survey Final Report (California Department of Transportation, June 1, 2013), <http://www.dot.ca.gov/hq/tsip/FinalReport.pdf>

National Example: Flatiron Flyer (US 36)



Source: Nathaniel Minor/CPR News
<https://www.cpr.org/2019/07/02/that-1-5b-boulder-longmont-train-transit-advocates-say-maybe-we-should-ask-for-more-buses-instead/>

Summary

The Flatiron Flyer is a bus rapid transit service on the US 36 between Denver and Boulder that opened in 2016. It was developed as part of a public-private partnership between CDOT and Plenary Group, who agreed to guarantee minimum bus speeds as part of their operations contract.

Features

- Bus priority improvements on ramps
- Improvements to intermodal regional transportation stations
- Electronic display signage
- Separated commuter bike paths

4.2 Station/Stop Conditions

Current express bus services in the Bay Area are dominated by commuter buses that stop off-freeway. These may utilize park-and-ride facilities which allow users to drive to a station, park, and transfer to bus. While this type of station is critical to existing services, certain station locations, improvements, and other station types are important to consider for equity purposes. While commuters who currently use express transit may trend to be working professionals with higher incomes, older or lower-income users traveling outside of peak times would likely also benefit from express bus services where there is demand that can be provided cost-effectively.

4.2.1 Accessibility and Multi-modal Connectivity

Accessibility is critically important when considering equity in transit since users may be transferring to transit from non-auto modes, be older, or disabled. Accessible stations have pedestrian access points that are safe, easy, and pleasant. These stations are in walkable areas with a high concentration of residents and destinations, a concept which may be at odds with stations located on the freeway.

An additional consideration for accessibility is multi-modal connectivity. These stations have access points for shared modes, local transit services, and active transportation like bicycles. They may provide additional infrastructure like bike lockers or carpool drop-off points to accommodate this.

There are many station types which may be appropriate for a transit service that utilizes the express lanes. Each has different considerations in accessibility and safety that are critically important to how the service is perceived by users.

4.2.2 Freeway Stations

Stations located on the freeway can be on the median, which allows the bus to easily move left off the express lane to pick up passengers and merge right to return to the freeway. This helps the bus run efficiently, however, it creates a less than ideal environment for the passenger while waiting due to freeway noise, pollution, and safety. Such stations can also only be accessed by pedestrian access paths, which may be intimidating or inaccessible to users. Universally, Bay Area transit operators had little enthusiasm for stations located on the freeway, citing the poor user experience generally associated

with such stations discouraging ridership. For these operators, the operational benefits made possible under such stations did not outweigh the high cost and negative impacts to user experience. This is reinforced by the national example of the Harbor Transitway in Los Angeles, which notes median station conditions as a primary reason for lower than expected ridership.⁶¹

As an alternative to ground-level median stations, providers like Sound Transit in Seattle have buses travel up dedicated ramps that connect perpendicularly to stations on an over- or underpass. This provides better access and comfort compared to median stations in return for higher capital cost. It bears noting there are numerous freeway over- and underpasses which cross planned express lanes.

Benefits	Challenges
<ul style="list-style-type: none"> Increased efficiency for bus operators since they do not have to exit the express lane or merge in general traffic Over-/underpass station ramps also create possible access points for other modes 	<ul style="list-style-type: none"> Isolated, noisy stations Right-of-way constraints make this a costly option (less problematic for over-/underpass stations, but these could have costly seismic challenges) Difficult to access, not multi-modal
Learning from National Examples Harbor Transitway identified the isolated, noisy freeway environment of stations as one of the key reasons for lower than expected ridership.	

National Example: Harbor Transitway (I-110)



Source: Steve Hymon/Metro
<https://thesource.metro.net/2015/12/14/87997/comment-page-2/>

Summary

The Harbor Transitway is an 11-mile shared-use bus corridor and HOT Lane in Los Angeles, converted from HOV lanes in 2012. The Metro Silverline runs between Downtown LA and the El Monte Bus station. Six stations provide connectivity to multiple local bus routes.

Features

- Added modal connectivity to stations (bike stations)
- Safety improvements (sheriff substation, improved lighting, security cameras)
- Bus priority in Downtown LA
- Digital message boards
- Park & ride stations
- LA Metro is currently planning HOV5+ operations to prioritize high-occupancy transportation

Detractors

Lower than expected ridership attributed to:

- Lower cost parallel lines
- Isolated, noisy environment of median stations
- Inconvenience of accessing stations
- Decreased bus speeds due to increased use of express lanes by private vehicles

⁶¹ Schaffer, Alexander. Passenger Exposure to Noise at Transit Platforms in Los Angeles. UCLA Luskin Center for Innovation, 2012. https://www.transitwiki.org/TransitWiki/images/6/69/Noise_Transit_Platforms.pdf

4.2.3 Off-Freeway Stations

Off-freeway stations can be more optimally located for passengers in environments that are more pleasant and accessible. However, this increase in accessibility comes at the expense of operating efficiency. Buses often must enter lower-priority local streets to access stations, reducing time savings and reliability.

The design and placement of off-freeway stations are also squarely outside the purview of express lane operators. That is not to say that express lane operators have no influence in their success. The reduced time savings caused by exiting the freeway can be offset by locating stations as close to the freeway as possible, which may be within existing right-of-way. Building dedicated access ramps to the express lanes can also be optimized for existing and planned station development (see 4.1.2 above).

Benefits	Challenges
<ul style="list-style-type: none">• Greater accessibility and safety for passengers• Allows for multi-modal connectivity• Locates stops within high density of destinations and/or residences	<ul style="list-style-type: none">• Without serious investments in direct access for buses from station to express lane, off-freeway stations introduce lags in travel time and reliability• Possible over-emphasis on commuting user base, particularly for park-and-rides
Learning from National Examples	
Houston Metro's stations are predominantly park-and-rides, which also emphasize connectivity to local transit and providing carpool matching services. The success of this model is likely due to dedicated direct access ramps that connect express lane facilities to stations, combined with a routing strategy that changes depending upon demand throughout the day.	

Likely the most recognizable type of off-freeway station is the shared mobility hub or park-and-ride. Increasingly in the Bay Area, the concept of the park-and-ride, where commuters park their cars in a lot to transfer to another mode such as carpool, vanpool or bus, is transitioning to that of the shared mobility hub. This emphasizes connectivity to other non-auto modes, like local bus, bicycle, walking, or shared rides, and often takes significant operations and maintenance investment to work well. Mobility hubs are currently in development as part of the Innovate 680 project in Contra Costa County (see Section 4.3, below).

There are currently 175 park-and-ride facilities already in the Bay Area (see Figure 3, below). These lots are free, and often provide multi-modal connectivity to transit, vanpool/carpool, and bicycling through the provision of amenities like bike lockers.⁶²

⁶² <https://511.org/>

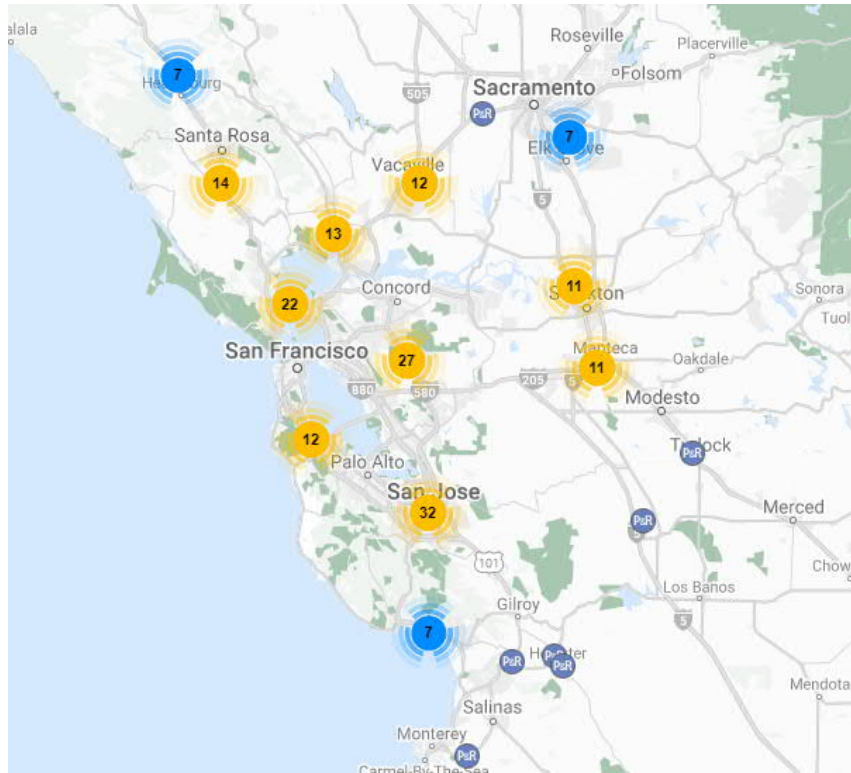


Figure 3: The Bay Area has over 150 park-and-ride facilities, shown above in clusters based on geography (<https://511.org/>)

In addition to constructing new mobility hubs where appropriate, there are many improvements that could be made to improve existing facilities. These include:

- Live updates on parking availability;
- Active management and security;
- First/last-mile services;
- Manage/distribute demand through parking pricing; and
- Shared parking with nearby available lots.⁶³

4.3 Local Innovation

One local example that seeks to integrate the express lanes with a multi-modal transit corridor through shared mobility hubs is Innovate 680 in the I-680 corridor in Contra Costa County.⁶⁴ Innovate 680's concept of shared mobility hubs provides an opportunity to more effectively and efficiently use available resources to meet a range of mobility needs and attract customers to alternatives to single-occupancy vehicles. There are many existing publicly owned and operated parking lots and transit centers along the I-680 corridor served by express bus and BART service; however, the effectiveness of transit service is constrained by a combination of factors such as limited parking supply, incomplete access options, a poor user environment, and overlying land use patterns.

⁶³ MLIP Express Bus White Paper

⁶⁴ <https://ccta.net/projects/innovate-680/>

MTC has also introduced another hub concept by developing Pivot Point Commuter Hubs. These facilities allow users to park in gated, attended parking lots that allow easy transfer to Transbay buses or carpools. Multimodal and seamless connectivity is emphasized through bike lockers, electric vehicle charging, and app-based payment services.⁶⁵

To be successful, shared mobility hubs must be centers of seamless and comfortable connections for the user. By providing a range of fully integrated mobility options, infrastructure, and technologies at shared mobility hubs, more people will be able to utilize those facilities and transit services, redefining mobility and combatting increasing congestion by shifting mode choice. The Innovate 680 shared mobility hub project will assess the feasibility of and plan for the creation of dynamic and technology driven shared mobility hubs along the I-680 corridor.

4.4 Using Toll Revenue

Several national examples of express lane-express bus partnerships included ongoing investment of net toll revenue back into the transit system, up to 11% of Fiscal Year 2019 toll revenues in the case of LA Metro.⁶⁶ However, it should be noted that many of the national examples are dual lane facilities that generate significantly more revenue than Bay Area facilities. In the Bay Area, it is a requirement of authorization that excess revenue be reinvested in the corridor, but as a matter of process, investment of Bay Area express lane net revenues would first require a demonstration that revenues are sufficient to cover operations, maintenance and rehabilitation costs, and debt service, if applicable. The effects of the COVID-19 pandemic also make it difficult to plan for new uses of toll revenue which may detract from other critical uses. That said, a snapshot of what is going on around the country may still prove informative for two reasons:

- The impacts of any infrastructure investments made are strengthened by synergistic operational improvements; and
- Improvements to operations are not as monolithically expensive as capital improvements, so express lane operators may have options to invest in transit if large capital investments are not feasible. These options may also be viable to mitigate VMT impacts discovered through environmental analysis under Senate Bill 743 (SB-743).

Across the board, transit service subsidy is a common way for net toll revenues to be reinvested. Subsidies keep the cost of transit low for users, so in addition to making the mode more attractive in general, it also provides an added benefit for equity goals.

LA Metro's I-10 and I-110 express lanes have a robust re-investment strategy called the Net Toll Revenue Reinvestment Grant Program, which funds varied strategies to promote transit use, including:

- Fleet vehicle purchase
- Increasing frequency
- Expanding days of service
- Station comfort improvements (e.g. sound barriers, heat lamps)
- Multi-modal infrastructure (e.g. bicycle lockers, pedestrian access points)
- Fleet electrification

⁶⁵ <https://511.org/carpool/park-n-ride/pivot-point>

⁶⁶ http://media.metro.net/about_us/finance/images/fy20_adopted_budget.pdf

Congestion in Los Angeles is a powerful motivator to reinvest revenue gained from auto modes into transit. However, the Bay Area is not Los Angeles, so the same areas and levels of reinvestment may not be warranted. Even so, these offer varied options and examples which can be analyzed for suitability and individually adapted depending on what makes sense for a given project. Additionally, Bay Area operators like Alameda County Transportation Commission have already committed to transit investment goals for their adopted Express Lanes Expenditure Plan.

Subject to statutory requirements, revenue reinvestment is also a powerful tool for express lane operators to invest in transit in general when express buses are not a viable option for their area, are not the best way to achieve strategic goals like increasing equity, or planned express bus services would benefit from increases to local services. Investment in local services around the express lane corridor, programs to encourage transit and carpool adoption, and equity programs may be great ways to apply the spirit of these express bus recommendations in areas where express bus services are not expected to work.

5 Recommendations

5.1 Seek opportunities to improve accessibility to the express lanes for express buses and other high-occupancy modes

The key investments identified by transit operators to maximize the benefits of the express lanes are those that provide direct access to the express lanes without having to manage difficult merging across highway lanes. Users also want a service that is fast and reliable with stations that are easy to access. This points to a dual pronged approach to connect accessible off-freeway stations to the express lanes through targeted placement of direct access on- and off-ramps, which can also benefit other transit, carpools, vanpools, and shuttles. These investments can be costly, especially when requiring right-of-way acquisition, so they should not be undertaken lightly. Full project-level alternatives analysis, with robust input from transit planners and operators, will be necessary to determine whether such investments make sense for each project.

5.2 Since express bus will not work everywhere, work with local, regional, and state partners to establish clear criteria and performance metrics to prioritize corridors and guide investments in express bus services

Identifying priority corridors for express bus capital investments and service based on robust analysis of travel markets, demand, potential transit ridership, and land use, as well as the potential for bi-directional, all-day service is critical to establishing a healthy regional transit network. The region may benefit from consistent expectations on what characteristics of a corridor may lead to healthy regional transit routes so that investments can be made which will have the greatest effect on achieving regional goals like GHG reduction and transportation equity. As part of its ongoing dialogue with stakeholders on regional consistency, MTC and regional partners should work together to establish these metrics.

5.3 Get transit planners and operators involved in the conversation early when starting planning for express lanes

Extensive coordination between transit operators and express lane operators is necessary for express lanes to provide maximum value for express buses and transit, in general. In building the express lanes, partners should consider reaching out to express bus operators and transit planners as early as possible and maintaining frequent communication and collaboration throughout the project life cycle.

5.4 Advocate for operators and planners to increase transit network connectivity, coordination and communication so they can take full advantage of the regional express lanes network

For a variety of reasons, the Bay Area has not fully realized the potential for multi-county express bus service, with many current services focused on intra-county routes, or to and from San Francisco. However, as the Express Lanes Network is continually built out into a connected network, with transit in mind, there is likely to be greater benefit to expanding routes availability between counties. The region should continue to promote and explore inter-county efforts to provide seamless bus service that takes advantage of the growing network, while recognizing that express bus strategies will still require analysis to determine viability even if the travel demand is there. There are also several questions that need to be addressed regarding inter-county transit services (e.g., how services would be funded, who would be responsible for providing and maintaining vehicles, how routes would be managed), none of which are addressed in this white paper. Such questions are outside the purview of express lane operators, which reemphasizes the need to incorporate transit planners and operators in planning before deciding on any major investments.

5.5 Identify opportunities to link transit investments with SB-743 mitigation strategies

As the requirements of SB-743 go into effect and projects must mitigate VMT impacts, there may be opportunities to funnel investments into express bus services, among other transit services. This would require a better understanding of the magnitude of VMT mitigation that can be achieved by express bus investments. If express bus investments proved to offer sufficient mitigation, and programs such as VMT exchanges and banks were established in the Bay Area, there would be real opportunities to use mitigation funds to build a more robust express bus service. Regional exchanges and banks could also serve to promote regionally beneficial transit service. This could be in the form of targeted capital investments or the contribution of net toll revenue to subsidize service. If mitigation programs are to fund transit operations, they would ideally be able to offer reliable and consistent sources of funding to facilitate enduring service.

6 Appendix

6.1 Bay Area Express Lanes

The Bay Area Express Lanes are a local network of managed lanes currently being implemented across the Bay Area through close coordination among regional agencies. Although many agencies are involved in the implementation of the express lanes, there are currently five agencies with the authority to operate express lanes, which include Bay Area Infrastructure Financing Authority (BAIFA), Alameda County Transportation Commission (ACTC), Santa Clara Valley Transportation Authority (VTA), San Mateo County Express Lane Joint Powers Authority (SMCELJPA), and the I-680 Sunol Smart Carpool Lane Joint Powers Authority. Express Lanes build on the concept of High Occupancy Vehicle Lanes, which are further described in Appendix Sections 7.1 and 7.2, above. As of Fall 2020, there are approximately 144 lane-miles of operating express lanes in an overall planned regional network of 750 lane-miles

Bay Area Express Lanes generally operate according to the following principles:

- The lanes are largely open access, meaning drivers can enter and exit at will
- Variable tolls change with demand to maintain reliable travel times
- Tolls are paid electronically using FasTrak®. Solo motorists pay tolls with a FasTrak® or FasTrak Flex® toll tag set to 1 person. Carpools, vanpools, buses, and motorcycles use a FasTrak Flex® toll tag set to 2 or 3+ people to pay no toll or half-price toll, depending on the tolling rules
- Clean Air Vehicles (CAV) use a FasTrak® Flex CAV toll tag to pay no toll or half-price toll, depending on local rules⁶⁷

The overall goals of the Express Lane Network include managing traffic, reducing congestion and increasing beneficial travel behaviors like carpooling to reduce GHG emissions and increase throughput.

6.2 HOV Lanes

One of the most well-established and publicly recognizable forms of freeway demand management is the HOV lane, which dedicates a highway capacity to drivers who are carrying more than one passenger in their vehicle, including buses and other transit modes. Since a relatively small proportion of highway users typically travel as an HOV, this lane is usually less congested than general purpose lanes and provides a reduction in travel time to users. The Bay Area has made significant investments in building a system of HOV lanes throughout the region. These lanes are intended to incentivize users to carpool, reducing the number of vehicles on the road and therefore reducing overall VMT. However, there are many challenges to HOV lanes operating as intended:

- Underutilization: HOV lanes are underutilized for many reasons. Despite the availability of benefits for HOVs, driving alone continues to be a more popular choice for personal travel. Potential reasons for this may be practical (lack of a connected HOV lane system, location/schedule limitation, travel flexibility, need a vehicle during the day, need to make other stops, no available carpool program) or personal (appreciate alone time, commute preferences e.g. radio, perceived potential traits of carpool partners), making it difficult to influence behavior.⁶⁸
- Overutilization: HOV lanes can become overutilized when the volume of eligible HOVs and Clean Air Vehicles (CAVs) in a corridor approaches the capacity of the lane, or when too many non-

⁶⁷ https://mtc.ca.gov/sites/default/files/BAIFA_EL_Program_Report_2020_Q1_0.pdf

⁶⁸ Li, Jianling, et al. "Who chooses to carpool and why? Examination of Texas carpoolers." *Transportation Research Record* 2021.1 (2007): 110-117.

eligible vehicles use the lane illegally. In the former case, increasing the HOV occupancy requirement can address the overutilization problem, although the reverse problem of underutilization can then sometimes occur if the volume of eligible HOVs is too low. The occurrence of HOV violations can only be addressed via manual enforcement by California Highway Patrol, which has limitations given the relatively few violators that can be safely observed and cited at any given time. MTC is currently undertaking two pilots to improve enforcement. One is testing the effectiveness of vehicle occupancy detection cameras, while the other focuses on app-based technology for self-identification.

- Lack of a connected system: The benefits of using HOV lanes can be hindered by gaps in the system. The reliability and time saving benefits of HOV lanes are compromised without seamless connectivity in the system. However, these gaps can be costly to fill.

These challenges prevent HOV lanes from being a maximally effective strategy in managing demand and reduce their viability as a strategy to reduce congestion and GHG emissions.

6.3 Express Lanes

Over the past decade, express lanes, also known as High Occupancy Toll lanes, have emerged regionally as a possible solution to the underutilization, overutilization and the often-fragmented nature of HOV lanes. Express lanes maintain the primary function of HOV lanes, preserving time savings and reliability benefits for transit and carpools, while using pricing to manage the remaining capacity in a way that attempts to maintain free-flowing conditions. This provides additional benefits above and beyond those of an HOV lane, including:

- Better utilization of extra HOV lane capacity, reducing congestion on general purpose lanes;
- Provides commuter with more reliability in travel time when needed;
- Better ability to actively manage traffic to maintain favorable operating conditions to continue encouraging carpools, vanpools, and transit;
- Ability to provide increased enforcement against policy violators; and
- Revenue generation to offset construction costs and better maintain service and functionality of the lane.

It is important to note that while Express Lanes attempt to solve the underutilization, overutilization, and fragmentation of the HOV network, they can face the same challenges. This is particularly the case as the express lanes network is built out and as challenges with enforcement continue. The Bay Area Express Lanes Network is continuing to address these challenges, in part through the development of its Strategic Plan for Plan Bay Area 2050.

5.4 STRATEGIC INVESTMENT PRINCIPLES WHITE PAPER

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Executive Summary

The Bay Area Express Lanes Network is a system of managed lanes, currently under construction throughout the region's highway network, which uses pricing to manage traffic and maintain reliable travel conditions. As of Fall 2020, there are approximately 150 lane-miles of operating express lanes in an overall planned regional network (through 2050) of 750 lane-miles.

MTC worked together with express lane operators and Caltrans to identify and articulate six strategic program goals that would guide the continued buildout of the Bay Area Express Lanes Network, and better align it with regional and state priorities for equity, GHG emissions, and cost effectiveness.

Express Lane Program Goals	
1.	Manage congestion and bring reliability to the traveling public
2.	Increase person throughput by creating a seamless network that incentivizes the use of transit, vanpools, and carpools
3.	Deliver Bay Area Express Lanes Network in a timely manner
4.	Be responsible in use of public funds
5.	Minimize greenhouse gas impacts
6.	Focus on equity to improve transportation access and affordability, especially for communities of concern

These program goals informed the interim prioritization principles that MTC used to determine which projects would be nominated in 2020 for funding under Senate Bill 1 competitive programs and under Regional Measure 3. The purpose of this white paper is to more formally adopt Strategic Investment Principles to guide future funding decisions for the buildout of the Bay Area Express Lanes Network.

MTC recommends adopting the strategic investment principles in Figure 1, below, into a framework for the Express Lanes Network Strategic Plan (see Section 2, below) that can incentivize projects to align with regional goals. This framework organizes principles into two groups: project merit and project readiness. As future funding sources become available where MTC has a role in selecting projects for funding, MTC would use this framework to advance projects that perform well against regional goals. The structure of this framework allows the flexibility to change emphasis depending upon the requirements of specific funding sources, while also allowing MTC to emphasize other goals over project readiness when possible to encourage development of projects that meet key regional goals. To this end, MTC would be helping partners advance Plan Bay Area 2050's vision for the Bay Area.

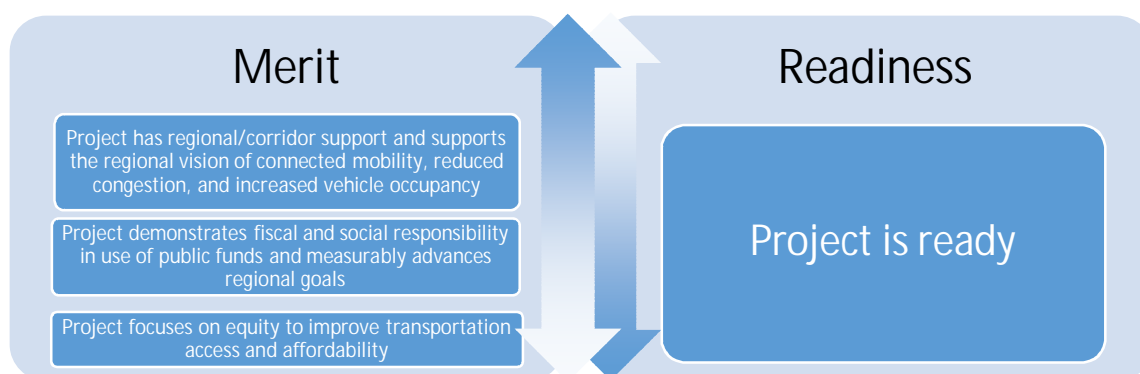


Figure 4: The strategic investment principles framework allows merit-based principles to be more strongly emphasized, while maintaining flexibility if certain funding sources prioritize readiness

1 Background

1.1 Bay Area Express Lanes Strategic Plan

The Bay Area Express Lanes Network is a system of managed lanes, currently under construction throughout the region's highway network, which uses pricing to manage traffic and maintain reliable travel conditions to increase person throughput. The express lanes provide a free travel time benefit to people traveling in a high-occupancy mode, encouraging carpooling and transit usage. Other vehicles can pay a toll to use any extra capacity in the lanes, providing a source of revenue that can be reinvested in the corridors (see Appendix Section 6.1 above for more information on Express Lanes).

The buildout of the Bay Area Express Lanes Network is being carried out by several Bay Area agencies, each with their own authority to implement and operate a portion of the overall network. To ensure a seamless, holistic vision, the express lane operators are collaborating to develop a Strategic Plan for the continued buildout and operation of the Express Lanes Network. Development of the Strategic Plan began in late 2019 and is expected to be finalized in Spring of 2021 with adoption by MTC's Operations Committee. In addition to the subject of this paper, the Strategic Plan will address the following topics:

- Vehicle Miles Traveled (VMT)/Greenhouse Gas (GHG) Impacts and Mitigations
- Express Bus
- Consistent Operating Policies
- Funding and Financing Strategies
- Implications of Future Pricing Strategies

1.2 What are strategic investment principles?

The purpose of this white paper is to define a set of guiding principles that capture the collective goals of the Bay Area Express Lanes to help the region make decisions as funding becomes available. In addition to building and operating express lanes, MTC also has a role in programming funding available to Bay Area express lane operators from certain Regional, State and Federal sources, including:

- Compiling project nominations,
- Nominating projects, and
- Programming funds.

These funds are typically limited and restricted in the kinds of uses for which they may be awarded, so MTC identifies eligible projects through a grant application and approval process. MTC is also often called upon to give input on funds from other sources which may be awarded by other entities.

Strategic investment principles are a way for MTC to incentivize projects that have applied for funding to ensure (1) they achieve the goals required by the grant and (2) they meet other important regional goals. As an example to the first point, if a grant becomes available for projects that reduce congestion, a strategic investment principle would encourage funding applicants to ensure their project reduces congestion in a way that is in alignment with regional strategic goals and meets the grant criteria.

Furthermore, investment principles ensure that all aspects of performance with regards to achieving strategic goals are considered when prioritizing projects, even if a specific funding source does not have such broad requirements. For example, if a limited grant becomes available to reduce congestion, and two projects demonstrate congestion reduction benefits, evaluating projects holistically may help prioritize a project which also achieves a regional strategic goal of focusing on equity. For this reason, it is critical to establish a set of standing strategic investment principles which may not only be applicable

to specific funding sources, but also provide universal guidance on how other benefits should be considered during project evaluation. It is also important that strategic investment principles are living guidelines that can adapt to a policy landscape that may change over the course of the decades-long timeline of long-term planning.

1.3 How has MTC used strategic investment principles in the past?

Throughout 2019, MTC worked together with regional express lane operators and Caltrans to identify and articulate strategic program goals that would guide the continued buildout of the Bay Area Express Lanes Network. These included:

1. Manage congestion and bring reliability to the traveling public;
2. Increase person throughput by creating a seamless network that incentivizes the use of transit, vanpools, and carpools;
3. Deliver Bay Area Express Lanes Network in a timely manner;
4. Be responsible in use of public funds;
5. Minimize greenhouse gas impacts; and
6. Focus on equity to improve transportation access and affordability, especially for communities of concern.

During and after the establishment of these goals, MTC had to nominate projects for 2020 Senate Bill 1 (SB1) competitive programs and for initial programming of Regional Measure 3 (RM3) express lane funds. Since the program goals of the Strategic Plan were still in development, interim prioritization principles were established to help translate these goals into tangible ways to evaluate potential funding recipients. The “short lists” identified under this process were comprised of projects that (1) met the network goals; and (2) conformed to the prioritization principles for each funding source.

SB1, also known as the Road Repair and Accountability Act of 2017, provides over \$5 billion annually in competitive funding, distributed through dedicated programs for specific purposes. MTC used a regional approach to prioritize projects which closely aligned with regional goals.⁶⁹ Prioritization principles for the SB1 Solutions for Congested Corridors Program (SCCP) were adopted under MTC Resolution No. 4130 in November 2019, and prioritized projects that:

- Were listed in SB1 legislation;
- Addressed mobility in congested corridors;
- Reduced GHG emissions;
- Demonstrated deliverability by FY22-23;
- Were fully funded (not including grant award); and
- Showed regional support (Caltrans, CalSTA, CTA support or nomination).

RM3 is a voter-approved measure that provides \$300 million in funding for the Bay Area Express Lanes Network for traffic relief.⁷⁰ RM3 gives MTC authority to program these funds to express lane projects. MTC’s principles for the RM3 Express Lanes Program (under MTC Resolution No. 4411, Revised in May 2020) include:

- Projects should be ready-to-go

⁶⁹ <https://mtc.legistar.com/LegislationDetail.aspx?ID=4217921&GUID=1DD58B8F-B7D0-4E0A-B6E5-867F213060BC&Options=&Search=>

⁷⁰ <https://mtc.legistar.com/LegislationDetail.aspx?ID=4454971&GUID=E77E128D-4EE1-45C7-9ACE-534C92BC285C&Options=&Search=>

- Projects must have strong benefit-cost performance
- Recipients must agree to follow regionally consistent toll policies established by MTC/BAIFA.

In addition, MTC's strategy for the 2020 RM3 program emphasized projects that

- Delivered seamless system to Bay Area commuters sooner;
- Put funds to work and got ready projects fully funded and constructed in each express lane's corridor group;
- Maximized opportunity to secure SB1 funding;
- Met commitments by making regional funds available when needed; and
- Agreed to return RM3 funds to reserve if projects fail to secure funding or meet other requirements to start construction.

These prioritization principles were intended to help evaluate funding recipients in a way that would also help achieve regional goals while the Strategic Plan was under development. As the Strategic Plan matures, MTC is seeking to both, (1) in anticipation of potentially diverse future funding opportunities including the possibility of a robust federal reauthorization, establish Strategic Investment Principles that better align funding prioritization with projects that achieve regional goals; and (2) achieve formal adoption of these principles by MTC as part of the Express Lanes Strategic Plan.

1.4 Why does the Strategic Plan include investment principles?

Plan Bay Area 2050,⁷¹ the Bay Area's Regional Transportation Plan and Sustainable Communities Strategy expected to be adopted in 2021, is focused on creating a future for the Bay Area that is affordable, connected, diverse, healthy, and vibrant. These overarching goals are to be achieved through broad recommendations that have specific applications to the Express Lanes Network, including:

- An emphasis on operating and maintaining the existing transportation system;
- Advancing equity by increasing affordability and connectivity of transportation in high-demand corridors and priority development areas; and
- Reducing our impact on the environment by expanding MTC's Climate Initiatives Program and investing in transportation demand management.

The Express Lanes Network was evaluated through a Project Performance Assessment to see how well it achieved the goals of Plan Bay Area 2050. The results of this assessment revealed challenges in meeting key regional strategic goals. These included:

- Cost Effectiveness: Benefit-cost ratios were low in several possible future conditions, i.e., planning scenarios.
- Equity: As a tolled facility, the benefits of express lanes were not experienced equally by users of all income levels. As one of several possible programmatic strategies, MTC is currently exploring how to improve equity outcomes by piloting a means-based tolling program; and
- Greenhouse gas (GHG) impact: Plan Bay Area 2050 requires a 19% per capita reduction in GHG for light-duty vehicles by 2035, compared to 2005 levels. The Express Lane Network was found to increase GHG due to several capacity increases, despite agencies planning to shift many projects to lane conversion. These are projected to cause long-term increases to VMT and GHG;

As part of MTC's efforts to adopt Strategic Investment Principles, it is necessary to better incorporate these key regional goals to ensure future funds go towards projects that help advance them.

⁷¹ https://www.planbayarea.org/sites/default/files/pdfs_referenced/PBA2050_Draft_BPStrategies_071320_0.pdf

1.5 How will investment principles be used?

As funding sources become available in the future, these investment principles will be used to consider projects for funding if MTC has a role in nominating projects or programming funds. However, particular funding programs may have specific requirements and goals established by state or federal funding agencies or statute. As such, the principles outlined below will need to be integrated and adapted to identify projects well-matched to each particular funding source. There may be diverse opportunities for express lanes projects with different characteristics to be competitive for funding, when available.

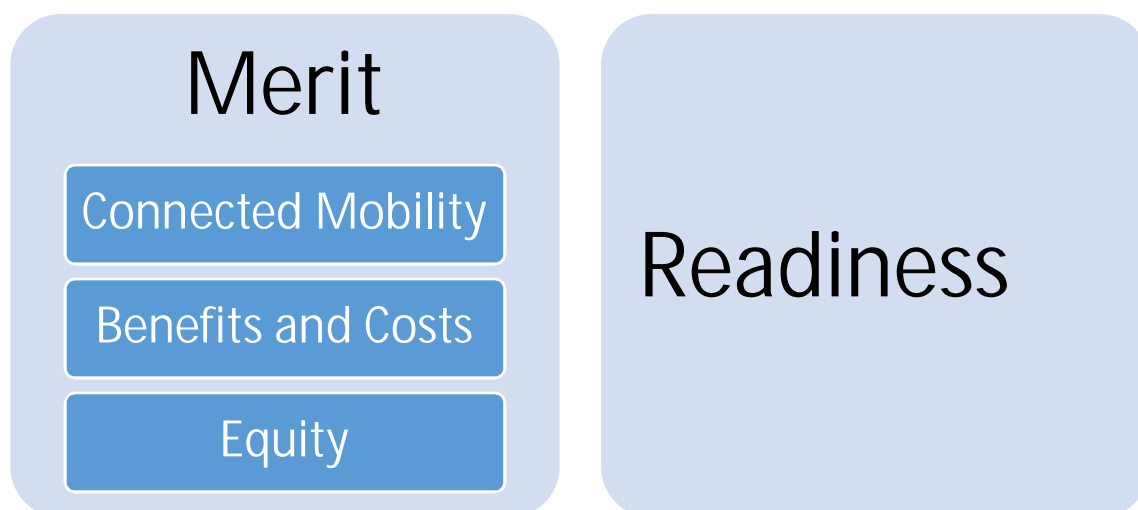
It is important to emphasize that express lane projects are complicated to consider because they are both individual projects and part of a broader project – the full network. We attempt to consider the duality here by emphasizing under each investment principle that each project may have a way to contribute to a strategic goal individually or agree to participate in a regional effort. For example, for a GHG/VMT reduction goal, a project may not feasibly be able to convert an existing lane rather than build new capacity, but may be able to participate in a regional effort like helping to connect and support a regional transit service.

Finally, we recognize that strategic investment principles are not generally considered in strategic plans. In this case, these principles are tied to other white papers being produced in consideration of programmatic components of the Express Lanes Network, listed in Section 1.1, above. Since strategic investment principles have bearing on how topics in these papers may be discussed, we believe it is important to consider them together.

2 How were investment principles developed?

MTC solicited feedback from partners through discussions and in written formats. While considering the region's strategic goals under Plan Bay Area 2050, to the extent possible MTC has incorporated these considerations to create a new baseline of strategic investment principles for incorporation into future funding considerations.

To assist projects to compete for future funds, we present a framework which structures program goals into two simplified groups: project merit and project readiness. Project merit can additionally be broken down into three themes: connected mobility, benefits and costs, and equity.



Each of these major themes relates to and expands upon the original six goals:

Original Six Goals		New Themes
1. Manage congestion and bring reliability to the traveling public	→	Connected Mobility
2. Increase person throughput by creating a seamless network that incentivizes the use of transit, vanpools, and carpools	→	
3. Deliver Bay Area Express Lanes Network in a timely manner	→	Readiness
4. Be responsible in use of public funds	→	Benefits and Costs
5. Minimize greenhouse gas impacts	→	
6. Focus on equity to improve transportation access and affordability, especially for communities of concern	→	Equity

In the sections below, we expand upon each of these themes by:

- Expanding their definitions;
- Providing illustrative examples of possible projects characteristics that fit these themes; and
- Defining and specifying language into a Strategic Investment Principle.

2.1 Assess Project Merit

Project Merit is a primary consideration to ensure projects meet regional goals. It describes what the project does to meet key regional priorities and determines how well the project achieves these goals. The main themes of such principles are:

- Connected Mobility;
- Benefits and Costs; and
- Equity.

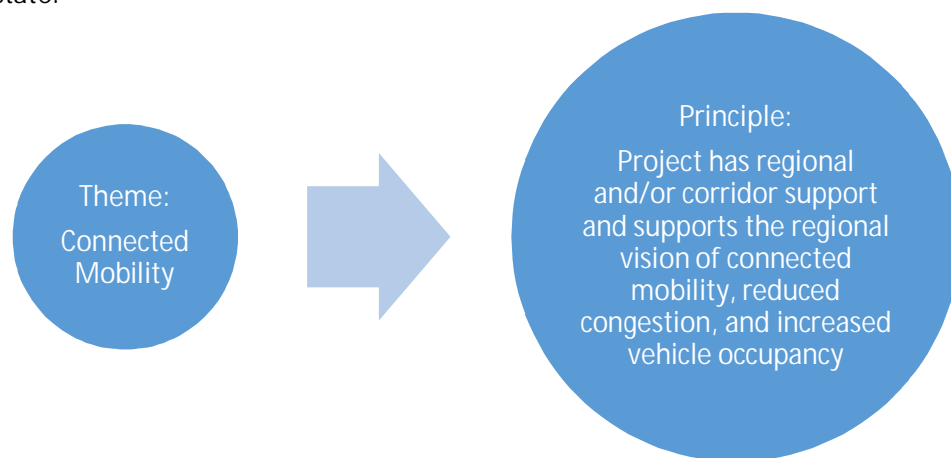
Each of these themes translates into a distinct prioritization principle as described in the following sections.

2.1.1 Connected Mobility

Demonstrating a coalition of support has been an important part of determining project funding eligibility. Support from local, regional and state agencies shows that a project's merits have been proven to stakeholders with oversight of, or connectivity to, a project. However, as important as it is to gain the support of regional stakeholders, it is just as important for a project to support the overall regional vision and strategic goals.

To that end, a core concept of the regional vision is to build a connected, seamless network that follows consistent operating policies, helps reduce per capita GHG emissions compared to 2005 levels, and increases equity outcomes. It is therefore critical that, whenever possible, express lane partners work to close gaps in the regional express lane network and meet the congestion management goals that typify express lanes. Gap closure may occur through lane conversion or new lane construction, which may both increase GHG emissions in the short- or long-term, respectively, depending on existing conditions. Partners may therefore couple gap closure projects with any of a diverse range of robust transportation management strategies to promote high occupancy modes.

MTC recognizes that all corridors are different, and that some may not be able to fully address their congestion problems through these methods alone. It may be necessary to add capacity by building additional lanes to complete the express lane network. However, even if building new capacity is a solution, promoting high-occupancy modes should be considered in tandem to (1) provide consistency with connected facilities across the region and (2) help slow the effects of induced demand, which increases the number of single-occupancy vehicles utilizing the new capacity and returning it to a congested state.



Projects which meet this principle may, for example:

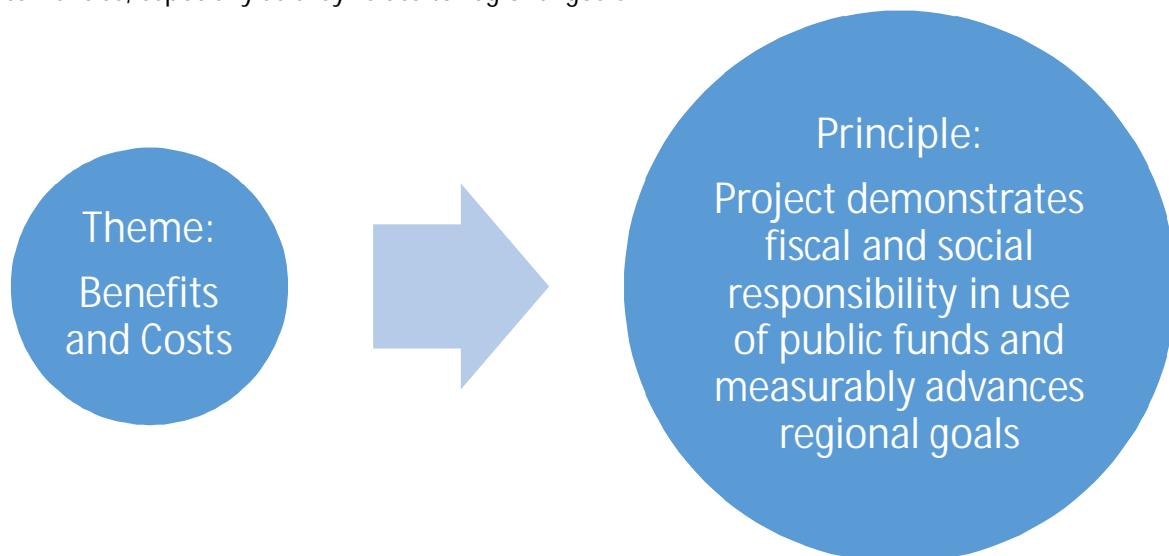
- Provide connectivity, close gaps, or complete corridors at the local, multi-county or interregional scale;
- Integrate multi-modal strategies to increase person throughput, e.g. carpooling, local transit, express bus, and mobility hubs;
- Agree to follow tolling and operating policies that are consistent on the corridor or regional level, depending upon what is appropriate;
- Include design that provides greater access and travel time benefits to transit and HOVs;
- Plan to reinvest revenue in programmatic strategies for congestion relief, including transit, carpool, TDM, and active transport; or
- Incorporate feedback from and/or collaborate with transit operators, local transit operators, and other express lane operators in project design.

2.1.2 Benefits and Costs

It is important that projects demonstrate a strong benefit-cost ratio to be able to justify a good use of public funds. However, some positive or negative externalities provide costs and benefits beyond what can be monetized, like contributing to GHG reduction, equity, or safety strategies. In addition to achieving regional priorities, projects which accomplish these goals provide a clear public benefit.

It bears noting here that future express lane projects may be impacted by the recent implementation of California Senate Bill 743 (SB 743). This bill requires projects to mitigate the impacts to vehicle-miles travelled under the California Environmental Quality Act to the maximum extent possible. It is probable that mitigation requirements will add to project costs. As anticipated requirements for SB 743 solidify over the next few years, staff will likely need to reassess how they fit into investment principles under Benefits and Costs. Until these requirements are tested, the projects that best fulfill GHG goals likely generate no net project-level GHG and contribute to net regional-level reduction.

In general, while cost effectiveness is still important to demonstrate, this principle carves out some room for projects which can demonstrate a clear public benefit that may be difficult to quantify monetarily. On the other hand, it also calls for stronger examination of projects that generate negative externalities, especially as they relate to regional goals.



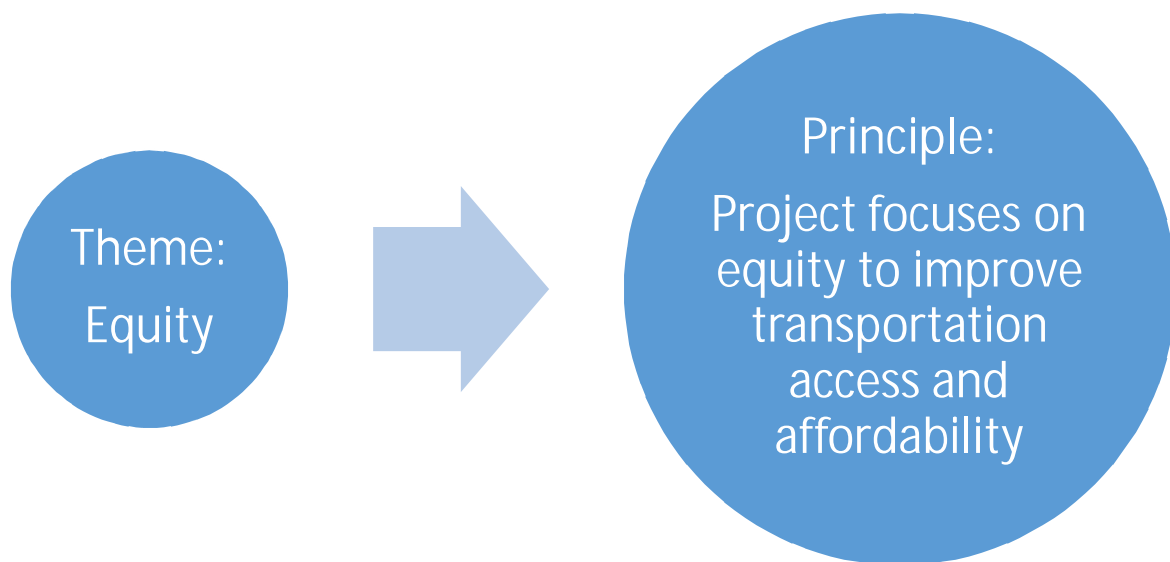
Projects which meet this principle may:

- Have strong benefit-cost performance;
- Demonstrate public benefits like reduced traffic congestion, enhanced equity, or transit;
- Incorporate additional GHG mitigation strategies not otherwise required by law at the project-level to support regional GHG reduction goals;
- Support regional express bus network, transit operations, and other TDM strategies; or
- Not generate negative externalities like GHG emissions, safety issues, or adverse impacts for communities of concern.

2.1.3 Equity

Integrating equity into the development and operation of the express lanes is a critical regional priority. The express lanes have always been available to a diverse user base depending upon need and are meant to better utilize available capacity to free up congestion for all users. However, tolled facilities are more accessible to higher income users, unless measures are taken to increase accessibility to lower income travelers. There are a variety of opportunities to further integrate equity into the express lanes, from implementing reduced toll programs for low-income users, to multi-modal integration, to discount and incentive programs for using non-auto modes, to funding projects with toll revenue.

This investment principle favors express lane project sponsors who take advantage of opportunities to have the express lanes benefit (and not negatively impact) communities of concern, encourage participation in planning, and support equity programs on a regional or local level, depending on what is appropriate.



Projects which meet this principle may:

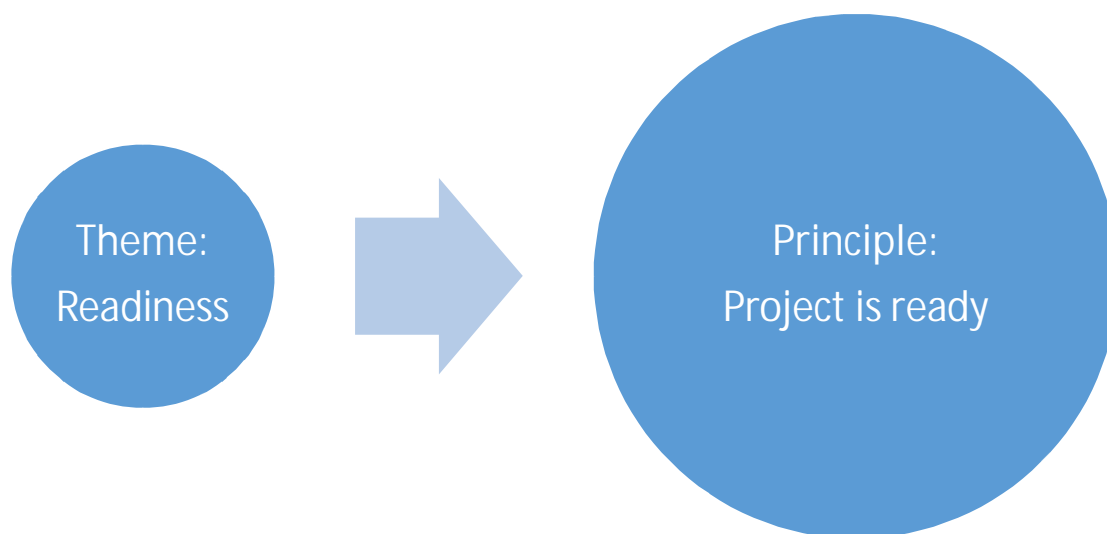
- Demonstrate benefits for and not negatively impact Communities of Concern;
- Increase accessibility by supporting multi-modal connectivity, including non-auto & active modes like bicycling and walking;
- Intend to use net toll revenue to support local or regional equity programs, such as a means-based toll discount or benefits funded from net revenue; or
- Address needs identified through community participation.

2.2 Assess Project Readiness

Previous funding opportunities greatly emphasized project readiness in determining which projects were most eligible for funding. This ran the gamut of characteristics that make projects “ready” including:

- Deliverability within the next few years, e.g. environmental review complete, toll authority granted;
- Full funding (besides the current request); and
- Regional support and consistency.

These aspects are still important for project viability for future funding opportunities and may continue to be emphasized for certain funds that establish readiness as key criteria, such as Senate Bill 1 funding. However, emphasizing readiness alone does not leave much opportunity to advance other promising projects. Therefore, project readiness is now a flexible consideration in how strongly it is emphasized. There may be projects that are not “shovel ready” but still have a positive impact on strategic goals, and MTC is open to considering projects at early stages, including Design Alternative Analysis studies, given sufficient justification from project owners. Evaluating this principle alongside the merit-based principles therefore allows some leeway for deemphasis if a project shows clear merit for other strategic goals.



Projects which meet this principle may be:

- Able to be delivered within the next few years e.g. environmental complete, toll authority granted; or
- Fully funded (besides current request) e.g. through sales tax measures, other grants.

3 Recommendations

MTC recommends adopting the above-listed framework and investment principles into the Express Lanes Network Strategic Plan. As future funding sources become available where MTC has a role in supporting projects in their selection for funding, MTC would use this framework to incentivize projects to meet regional goals and effectively compete for funds. To this end, MTC would help partners advance Plan Bay Area 2050's vision for the Bay Area. At the same time, the structure presented in this framework provides enough flexibility that principles can be emphasized or deemphasized depending upon the requirements of the funding source.

4 Appendix

4.1 Bay Area Express Lanes

The Bay Area Express Lanes are a local network of managed lanes currently being implemented across the Bay Area through close coordination among regional agencies. Although many agencies are involved in the implementation of the express lanes, there are currently five agencies (in addition to Caltrans) with the authority to operate express lanes. These include Bay Area Infrastructure Financing Authority (BAIFA), Alameda County Transportation Commission (ACTC), Santa Clara Valley Transportation Authority (VTA), San Mateo County Express Lane Joint Powers Authority (SMCELJPA), and the I-680 Sunol Smart Carpool Lane Joint Powers Authority. Express Lanes build on the concept of High Occupancy Vehicle Lanes, which are further described in Appendix Sections 4.2 and 4.3, below. As of Fall 2020, there are approximately 150 lane-miles of operating express lanes in an overall planned regional network of 750 lane-miles.

Bay Area Express Lanes generally operate according to the following principles:

- The lanes are largely open access, meaning drivers can enter and exit at will
- Variable tolls change with demand to maintain reliable travel times
- Tolls are paid electronically using FasTrak®. Solo motorists pay tolls with a FasTrak® or FasTrak Flex® toll tag set to 1 person. Carpools, vanpools, buses, and motorcycles use a FasTrak Flex® toll tag set to 2 or 3+ people to pay no toll or half-price toll, depending on local tolling rules
- Clean Air Vehicles (CAV) use a FasTrak® Flex CAV toll tag to pay no toll or half-price toll, depending on local tolling rules⁷²

The overall goals of the Express Lane Network include managing traffic, reducing congestion and increasing beneficial travel behaviors like carpooling to reduce GHG emissions and increase throughput.

4.2 HOV Lanes

One of the most well-established and publicly recognizable forms of freeway demand management is the HOV lane, which dedicates a highway capacity to drivers who are carrying more than one passenger in their vehicle. Since a relatively small proportion of highway users typically travel as an HOV, this lane is usually less congested than general purpose lanes and provides a reduction in travel time to users. The Bay Area has made significant investments in building a system of HOV lanes throughout the region. These lanes are intended to incentivize users to carpool, reducing the number of vehicles on the road and therefore reducing overall VMT. However, there are many challenges to HOV lanes operating as intended:

- Underutilization: HOV lanes are underutilized for many reasons. Despite the availability of benefits for HOVs, driving alone continues to be a more popular choice for personal travel. Potential reasons for this may be practical (lack of a connected HOV lane system, location/schedule limitation, travel flexibility, need a vehicle during the day, need to make other stops, no available carpool program) or personal (appreciate alone time, commute preferences e.g. radio, perceived potential traits of carpool partners), making it difficult to influence behavior.⁷³

⁷² https://mtc.ca.gov/sites/default/files/BAIFA_EL_Program_Report_2020_Q1_0.pdf

⁷³ Li, Jianling, et al. "Who chooses to carpool and why? Examination of Texas carpoolers." *Transportation Research Record* 2021.1 (2007): 110-117.

- Overutilization: HOV lanes can become overutilized when the volume of eligible HOVs, Clean Air Vehicles (CAVs), and non-eligible vehicles in a corridor approaches the capacity of the lane, or when too many non-eligible vehicles use the lane illegally. In the former case, increasing the HOV occupancy requirement can address the overutilization problem, although the reverse problem of underutilization can then sometimes occur if the volume of eligible HOVs is too low. The occurrence of HOV violations can only be addressed via manual enforcement by California Highway Patrol, which has limitations given the relatively few violators that can be safely observed and cited at any given time. MTC is currently undertaking two pilots to improve enforcement. One is testing the effectiveness of vehicle occupancy detection cameras, while the other focuses on app-based technology for self-identification.
- Lack of a connected system: The benefits of using HOV lanes can be hindered by gaps in the system. The reliability and time saving benefits of HOV lanes are compromised without seamless connectivity in the system. However, these gaps can be costly to fill.

These challenges may prevent HOV lanes from being a maximally effective strategy in managing demand and reduce their viability as a strategy to reduce congestion and GHG emissions.

4.3 Express Lanes

Over the past decade, express lanes, also known as High Occupancy Toll lanes, have emerged regionally as a solution to the underutilization, overutilization and the often-fragmented nature of HOV lanes. Express lanes maintain the primary function of HOV lanes, preserving time saving and reliability benefits for transit and carpools, while using pricing to manage the remaining capacity in a way that maintains speeds at the FHWA speed requirement of at least 45mph. This provides additional benefits above and beyond those of an HOV lane, including:

- Better utilization of extra HOV lane capacity, reducing congestion on general purpose lanes;
- Provides commuter with more reliability in travel time when needed;
- Better ability to actively manage traffic to maintain favorable operating conditions to continue encouraging carpools, vanpools, and transit;
- Ability to provide increased enforcement against policy violators; and
- Revenue generation to offset construction costs and better maintain service and functionality of the lane.

5.5 FUNDING AND FINANCING STRATEGIES WHITE PAPER

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Executive Summary

The estimated cost to construct the remaining segments of the Express Lanes Network in Plan Bay Area 2050 is \$3.7 billion. Relying on traditional funding sources alone will not be sufficient to fulfill this remaining need. Seeking alternative funding and financing strategies may be necessary in the future and can help expedite the buildout of the interconnected network.

So far in the Bay Area, express lanes have been delivered relying primarily on state, regional and local funds, and to a lesser extent, federal funds. Most express lane projects in the Bay Area have relied on a combination of funds from these multiple sources. It is likely that the near-term buildout of the Express Lanes Network will continue to rely primarily on these funding sources, although the prospect of a new federal transportation bill or reauthorization could make federal funding a more attractive option. The region has had some success securing state funds made available through the competitive grant programs as part of Senate Bill 1. The ability to obtain capital advances from local sales tax revenues and financial institutions and use express lane revenues to pay back the loans is another mechanism that is being used in the Bay Area.

Beyond obtaining loans from sales tax revenues, other financing models may be challenging to implement in the Bay Area. Introducing bond financing, although it could theoretically allow greater access to capital, may not be achievable given the need to generate sufficient revenues to cover principal and interest payments. Examples of express lanes that have been successful issuing bond debt generally feature two express lanes in each direction and HOV3+ occupancy requirements, which is notably different than express lanes in the Bay Area. Private investment is another option that would be challenging to implement and would require changes to state law, potentially ceding control of operational policies such as toll rate setting.

Given the uncertainty faced in the years following the COVID-19 pandemic, it seems imprudent to chart a course for a change in how Bay Area express lanes have been funded. The decline in tax and toll revenues will undoubtedly put a strain on transportation funding in the Bay Area for years to come. The region should actively pursue state and federal funding opportunities and should advocate to include the Express Lanes Network buildout in any future regional funding measure. While financing could be a part of the solution, it is unlikely to play a major role in the near-term, primarily because the Bay Area's environmentally friendly approach (e.g., minimizing roadway widening and right of way acquisition) is less attractive to the commercial bond market, and other financing opportunities remain limited.

1 Purpose

This white paper explores various options to fund the remaining buildout of the Bay Area Express Lanes Network. The estimated cost to construct the remaining segments of the planned express lanes network in Plan Bay Area 2050 is \$3.7 billion. Relying on traditional funding sources alone will not be sufficient to fulfill this remaining need. Seeking alternative funding and financing strategies may be necessary in the future and can help expedite the buildout of the network. For example, several express lane projects in the region have been delivered using capital advances from local sales tax revenues and financial institutions with the expectation that express lane toll revenues will be used to pay back the loans.

2 Background

So far in the Bay Area, express lanes have been delivered relying primarily on state, regional and local funds, and to a lesser extent, on federal funds. These fund sources are summarized below:

- State Funds
 - State Transportation Improvement Program (STIP)
 - Senate Bill 1 (SB1), also known as the Road Repair and Accountability Act, competitive programs
- Regional Bridge Toll Funds
 - Regional Measure 2
 - Regional Measure 3 (pending outcome of litigation)
 - BATA Express Lane Funds (one-time funding for BAIFA express lane implementation)
- Local Sales Tax Funds
 - Alameda County Measure B
 - Contra Costa County Measure J
 - San Mateo County Measure A

3 Traditional State, Regional and Local Funding

It is likely that the near-term buildout of the express lanes network will continue to rely primarily on federal, state, regional and local funding sources such as those listed above. In general, these sources feature a lower cost of capital and are less complicated to secure than financing. However, these sources of funds must also meet a lot of other competing transportation needs and therefore are not guaranteed. It is therefore in the best interest of the region to ensure that express lane projects incorporate state, regional and local goals to be competitive for these funding sources.

The following sections provide more detail on each of these traditional sources of public funding.

3.1 State Funding

3.1.1 State Transportation Improvement Program (STIP)

The STIP is a statewide 5-year plan that allocates transportation funding under the purview of the California Transportation Commission. Seventy-five percent of the STIP consists of regional spending plans developed by MTC and other Metropolitan Planning Organizations in the state. These regional plans are further subdivided based on a county share formula. STIP funds have been, and will likely continue to be, used for express lane projects in the Bay Area, although they typically make up a relatively small share of a project's overall funding plan.

3.1.2 Senate Bill 1 Competitive Programs

Senate Bill 1, the Road Repair and Accountability Act of 2017, was signed into law on April 28, 2017 and imposed new vehicle registration fees and increased the gasoline excise tax. This increased funding

allows investment of more than \$5 billion annually in California's transportation infrastructure, allocated by formula and through competitive grant programs. Three of the competitive grant programs provide funding opportunities for express lanes as described below.⁷⁴

3.1.2.1 Solutions for Congested Corridors Program (SCCP): \$250 million annually

SB1 created the Solutions for Congested Corridors Program (SCCP), providing \$250 million annually to multimodal corridor projects that make performance improvements along the state's busiest and most congested highway and transit corridors. SCCP funds cannot be used for general purpose lane construction; instead, capacity increasing projects are restricted to HOV and managed lanes and other non-general purpose lane improvements that improve safety or operations (e.g., auxiliary lanes, truck climbing lanes). MTC and Caltrans are the eligible nominating agencies in the Bay Area for this program. Selected congestion relief projects involving HOV and express lanes include:

- US-101 in San Mateo and Santa Clara Counties: \$233.2 million was awarded to build 22 miles of new, managed lanes on US-101 in San Mateo County and convert approximately nine miles of carpool lanes to express lanes in Santa Clara County.
- US-50 in Sacramento County: \$110.3 million was awarded to build seven miles of carpool lanes on US-50 from I-5 to just east of Watt Avenue and expand light rail service from Sunrise Blvd. to Downtown Folsom.
- I-105 in Los Angeles County: \$150 million was awarded to convert existing HOV lanes and build an express lane in each direction on I-105 between I-405 and I-605.

3.1.2.2 State-Local Partnership Program (LPP): \$200 million annually

The LPP supports the investment that local communities have made in their region through voter-approved transportation measures by matching funds. Projects include road maintenance and rehabilitation purposes and other transportation infrastructure improvements. Funds are allocated by the California Transportation Commission (CTC) with funding split between formula and competitive programs. Example express lane projects that have received LPP funds include:

- US-101 in San Mateo and Santa Clara Counties received \$20 million of State LPP competitive funds in 2019.
- I-680 SB Gap Closure Project in Alameda County received \$25 million of State LPP competitive funds, leveraging Alameda County's LPP formula funds.

3.1.2.3 Trade Corridor Enhancement Program (TCEP): \$300 million annually

The TCEP provides funding for projects that seek to improve corridors that have a high volume of freight traffic. Demonstration of 30% matching funds is a requirement of this program. Preference is given for projects that can be completed in a timely manner and that are jointly nominated.

The Solano Transportation Authority, MTC, and Caltrans District 4 submitted a joint application for construction funding for the I-80 Express Lanes in Solano County through the TCEP and SCCP programs in the Summer of 2020. The project was ultimately successful in receiving \$123.4M as part of the adopted 2020 TCEP Program.

3.2 Regional Funding

BATA made a funding commitment of \$345.2M to deliver the first set of express lanes projects in BAIFA's authorized network. These funds were used to construct the I-680 express lanes in Contra Costa County and the I-880 express lanes in Alameda County and are being used to complete the design for

⁷⁴ <https://catc.ca.gov/programs/sb1>

the I-80 express lanes in Solano County. This was a one-time commitment and there is no expectation that BATA will supply any additional funding for express lanes.

To help address the Bay Area's growing congestion problems, Regional Measure 3 was put on the ballot in 2018 to finance a comprehensive suite of highway and transit improvements through an increase in tolls on the region's seven state-owned toll bridges. The ballot measure passed in 2018 with overall 55% voter approval in the nine counties in the Bay Area. Toll revenues will be used to finance a \$4.45 billion slate of highway and transit improvements in the toll bridge corridors and their approach routes, including \$300M for express lanes. Initial programming of \$240 million for the express lanes was adopted by MTC in May 2020.⁷⁵ As of January 2021, RM3 is under active litigation, pending resolution. Until that occurs, the revenues associated with the toll increase are being held in an escrow account.

A regional sales tax measure to provide funding for transportation in the Bay Area has been under consideration. In 2019, the concept of a regional 1-cent sales tax measure to fund \$100 billion for transportation improvements over 40 years (referred to as the "mega measure") received serious consideration. Early conversations about the mega measure contemplated a robust network of dedicated toll lanes that could be leveraged to serve enhanced regional bus service. Ultimately, the campaign backing the measure was put on hold amid the disruption caused by the COVID-19 pandemic. It is not known if or when such a measure may resurface.

3.3 Local Funding

Eight of the nine Bay Area counties have approved dedicated transportation sales tax measures. At least three counties have used their sales tax revenues to fund express lanes, including:

- Alameda County Measure B half-cent sales tax – The I-580 express lanes were funded, in part, from Measure B capital advance loans up to \$38.5 million.⁷⁶ Toll revenue from I-580 will be used to repay this loan. Measure B is also being used to fund \$128.2 million for Phase 1 of the I-680 Sunol Express Lanes.⁷⁷
- Alameda County Measure BB half-cent sales tax – The 2014 Transportation Expenditure Plan developed for Measure BB includes \$60 million for express lanes on the I-680 corridor in Alameda County.⁷⁸
- San Mateo County Measure A half-cent sales tax – A loan of up to \$100 million was approved for the US-101 Express Lanes Project. The loan is to be repaid with future toll revenues once the express lanes are operational.⁷⁹
- Contra Costa County Measure J half-percent sales tax – \$40 million from Measure J has gone towards the southbound I-680 gap closure project.⁸⁰

Sales tax funds can be used to provide capital loans for express lane implementation with the expectation that they are to be repaid with future toll revenues. This arrangement helps to preserve county sales tax measure capacity by requiring that any funds used towards express lanes

⁷⁵ <https://mtc.legistar.com/View.ashx?M=F&ID=8447864&GUID=1CF71018-0856-4D60-89C5-42C4401268BD>

⁷⁶ https://www.alamedactc.org/wp-content/uploads/2018/12/I-580_Express_Lanes_20_Year_Expenditure_Plan_201800426.pdf

⁷⁷ https://www.alamedactc.org/wp-content/uploads/2020/10/1369000_I680-Sunol-EL_FS_20201028.pdf

⁷⁸ https://www.alamedactc.org/wp-content/uploads/2018/11/2014_Transportation_Expenditure_Plan-2.pdf

⁷⁹ https://www.smcta.com/about/MediaRelations/News/Transportation_Authority_and_San_Mateo_County_Express_Lanes_Joint_Powers_Authority_Approve_up_to_100_million_in_Financing_for_101_Express_Lanes.html

⁸⁰ <https://ccta.net/wp-content/uploads/2019/10/2019-Measure-J-Strategic-Plan.pdf>

implementation be repaid at a future date. And since in many cases the entity providing the loan is often the same entity implementing express lanes, the terms of the loan agreement and repayment may be more flexible than if the loan had been offered from a private entity.

4 Federal Funding

This section explores federal funding opportunities. The U.S. Department of Transportation (USDOT) offers several discretionary grant programs and financing options that Bay Area agencies can pursue to fund express lane projects. Grant funding and financing provided by the federal government involves adhering to very specific federal requirements as set forth in the various application processes, and may include reporting and Buy America considerations that could affect project costs and contracting options. The combined incremental cost to adhere to federal requirements should be included in any consideration of federal grant or financing programs. Grant programs are generally highly competitive with success rates of less than 10 percent of applicants while federal financing programs often require a lengthy review and authorization process.

4.1 BUILD Grants

The Better Utilizing Investments to Leverage Development (BUILD) grant program (formerly known as TIGER) is a highly competitive USDOT discretionary grant program which supports the capital costs of road, rail, transit, and port projects that have a significant impact on the nation, a region, or a metropolitan area. The funds are awarded on a competitive basis for projects that demonstrate significant local or regional impact. The program was first created in the 2009 Recovery Act.⁸¹ The USDOT routinely provides technical assistance to prospective applicants, via a series of webinars and guidance.⁸²

Broad support and local consensus, including support from the business community, various interest groups (e.g., environmental, labor, economic development) and elected officials at the federal, state, and local levels are key requirements to being competitively positioned for BUILD funding. USDOT also prefers projects that have completed considerable project development (e.g., finalized environmental clearance) and secured commitments of matching non-federal funding. In situations where a project cannot meet USDOT's preparedness criteria, but the project sponsor anticipates they will in one to two years, they may submit an application to make USDOT aware of the project and better position the project for future rounds of BUILD grants based on initial feedback.

BUILD grant applications must demonstrate:

- The benefits for expected users of the project, a description of the challenges that the project aims to address, and how the project will address these challenges;
- Project stakeholders are engaged and supportive of the project;
- Grant funds and sources / uses of project funds are available and commitment funding sources;
- The project will improve the condition of existing transportation facilities and systems, with a particular emphasis on minimizing lifecycle costs and improving resiliency;
- The project will contribute to regional economic competitiveness over the medium- to long-term by improving the transportation system while creating and preserving jobs;
- The project will increase transportation choices and access to transportation services for local residents;

⁸¹ <https://ops.fhwa.dot.gov/Freight/infrastructure/tiger/>

⁸² <http://www.transportation.gov/BUILDgrants/outreach>

- The project will improve energy efficiency, reduce dependence on oil, reduce greenhouse gas emissions and benefit the environment;
- The project will improve the safety of U.S. transportation facilities and systems; and
- The project uses innovative strategies, such as innovative technology, innovative funding and financing mechanisms, or innovative project delivery and management techniques.

In FY 2020, \$1 billion was made available through the BUILD program; with the most recent cycle closing on May 18th, 2020. The program is subject to annual appropriations by Congress and the next BUILD notice of funding availability is anticipated in early 2021 with a submittal deadline in May or June. Express lane projects in Atlanta and Denver have been successful securing TIGER/BUILD grant funding.

4.2 INFRA Grants

The Infrastructure for Rebuilding America (INFRA) discretionary grant program was established by the 2015 Fixing America's Surface Transportation (FAST) Act. The program promotes the incorporation of innovative technology that will improve the national transportation system.⁸³ INFRA grants can be used for up to 60 percent of eligible costs for highway projects on the National Highway System

INFRA grant applications must demonstrate that:

- The project will generate national or regional economic, mobility, or safety benefits;
- The project will be cost effective;
- The project will contribute to the accomplishment of 1 or more of the national goals described under 23 U.S.C. 150;
- The project is based on the results of preliminary engineering;
- Additional stable and dependable source(s) of funding and financing are available to construct, maintain, and operate the project;
- Contingency amounts are available to cover the unanticipated cost increases;
- The project cannot be easily and efficiently completed without other Federal funding or financial assistance available to the project sponsor; and
- The project is reasonably expected to begin construction not later than 18 months after the date of obligation of funds. [23 U.S.C. 117(g)]

In FY 2020, \$906 million was made available through the INFRA program; with the most recent cycle closing on February 25, 2020. The program is subject to annual appropriations by Congress. The next INFRA notice of funding opportunity is anticipated in February 2021.

There have been at least two express lane projects in the country that have been recipients of an INFRA grant:

- \$184 million for express lanes on State Route (SR) 400 in Atlanta, Georgia (awarded in 2018)
- \$90 million for express lanes on I-25 and I-70 in Colorado (awarded in 2018)

4.3 Grant Reporting Requirements

Each applicant selected for an INFRA/BUILD grant must submit the Federal Financial Report (SF-425) on the financial condition of the project and the project's progress, as well as an Annual Budget Review and Program Plan to monitor the use of federal funds and ensure accountability and financial transparency

⁸³ <https://www.transportation.gov/buildamerica/financing/infra-grants/infrastructure-rebuilding-america>

in the INFRA/BUILD programs. The USDOT requires reporting on project performance, including observed measures under baseline (pre-project) conditions as well as post-implementation outcomes. This information is used to evaluate and compare projects and monitor the results.

4.4 New Federal Authorization/Reauthorization

The current federal surface transportation authorization is set to expire on September 30, 2021. With a new administration just taking office, ever growing demands for more investment in the nation's transportation infrastructure, and the ability for transportation funding to serve as an economic stimulus post pandemic, there is reason to believe that a robust federal authorization could be in the near future. However, it is too early to speculate what kinds of funding opportunities could be available for express lane projects in a future authorization.

5 Financing Options

Financing options rely on obtaining funds from financial institutions or capital markets. It is common for lenders/investors to require some amount of public funds to be pledged to the project in order to secure financing in the first place. Any borrowed funds must be repaid with interest. Express lanes can use toll revenue to secure and repay these loans. As a general rule of thumb, every \$100 million of project cost requires about \$6 million in toll revenue per year to service the debt over 30-40 years. The amount of toll revenue available for debt service needs to account for the need to cover annual operations and maintenance costs as well as rehabilitation and replacement costs.

The following sections further describe individual financing options along with a discussion of feasibility for financing the Bay Area's express lanes.

5.1 Bond Financing

Several publicly owned express lanes facilities have sought financing in the form of issuing debt through toll revenue bonds, which are paid back using toll revenues. In general, the advantage of toll revenue bond financing is access to a greater amount of capital, which would allow faster buildout of the express lanes network. However, bond financing requires sufficient toll revenues to cover principal and interest payments, and associated bond covenants place requirements on the issuer of the bond. These requirements often include the establishment of reserve accounts that can be used to pay debt if annual toll revenues fall below the necessary amount to cover debt service. Requirements can even include limitations on bond issuer's ability to make additional capital investments.

An investment-grade traffic and revenue study is typically prepared to provide confidence to investors prior to bond issuance, with exceptions made for facilities that have a robust track record of toll revenue generation. The traffic and revenue study includes detailed assumptions and results of traffic demand modelling and forecasting, and usually includes sensitivity tests to demonstrate impacts as a result of different economic projections. Detailed estimates of toll revenue, operations and maintenance costs and rehabilitation costs for the tolled facility are estimated as well to illustrate a project's potential to contribute to debt repayment and financial capacity. A Debt Service Coverage Ratio (DSCR) is assumed when calculating the maximum debt capacity, which is the ratio of annual revenues available for debt service to required repayments for any given year. The DSCR is typically set between 1.3 to 2; the higher the DSCR, the more conservative the borrower or riskier the revenue stream, and the more toll revenue available for debt service is required.

In general, the advantage of toll revenue bond financing is access to a greater amount of capital, allowing for faster buildout of the express lanes network. However, compared to other financing options, specifically those using a larger pool of funding, such as a general state tax or fee, the cost of capital in terms of debt service is likely to be higher. Investment-grade financing also tends to require additional financial disclosures and reserve account requirements. Nearly all examples of express lanes that have been successful obtaining bond financing feature two express lanes in each direction, with access restrictions and HOV3+ occupancy requirements in place, which is notably different than the Bay Area Express Lanes Network. Such designs are geared to maximize toll revenue and reduce revenue leakage; however, they also tend to require more road widening and right of way acquisition than the “skinnier”, lower-impact approach (i.e., predominantly single lanes with continuous access) pursued in the Bay Area. From an investor’s perspective, this would most likely dampen toll revenue potential, increase revenue volatility, and ultimately affect the financial capacity and/or potential credit ratings.

Since the vision for the Bay Area Express Lanes Network is not what bond markets typically favor, options to improve the prospect of bond financing include offering up another source of revenue as backing for debt, or a mechanism to pool toll revenues. Both of these options come with challenges. Backing toll revenue bond debt with sales tax revenues would require tying up some portion of sales tax funds to service express lanes debt. Pooling express lane revenues may require statutory changes to allow revenues to more easily flow across jurisdictional boundaries.

5.2 Individual Facility Compared to System

Bay Area Express Lanes are largely single lane facilities, many operating with HOV2+ occupancy requirements, and it is unlikely that most individual projects will generate sufficient initial toll revenue to support financing. Since the operational structure of the Bay Area Express Lanes Network is not what bond markets typically favor, options to improve the prospect of bond financing include pledging other sources of revenue as backing for debt or pledging revenue from multiple toll facilities. Both options come with challenges. Backing debt with sales tax or other revenues would limit funding available for other uses. Pooling express lane revenues may require statutory changes to allow revenues to more easily flow across jurisdictional boundaries.

Consolidating projected system revenues and costs into a centralized financing strategy is a frequently used option. One option is to establish a regional infrastructure bank that could be backed by various sources of transportation revenues (e.g., sales tax revenue, toll revenue, future state and federal funds). A regional infrastructure bank set up in this way could offer loans to fund project development with the expectation that the loans would be paid back. This concept could help advance project delivery by closing the gaps in project funding plans and offer lower borrowing costs than other financing options. However, establishing a regional infrastructure bank would be challenging for many reasons. Previous attempts to establish a regional bank in the Bay Area⁸⁴ did not prove successful due to disparate goals and requests from different jurisdictions. Being able to pledge revenues towards a regional bank in the first place would require changes to statutory restrictions on the use of revenues across jurisdictional boundaries, favorable economic conditions, and broad consensus among regional participants on how the bank would be governed. However, a regional infrastructure bank may be an important strategy to consider since financing opportunities are limited.

⁸⁴ <https://mtc.legistar.com/MeetingDetail.aspx?ID=644512&GUID=6529D007-DA04-4C30-B509-57C59D6DA4E6&Search>

5.3 Commercial Loans

Although commercial bank loans could be an option to secure a share of express lanes capital funding needs, the amounts that banks can be expected to offer at competitive terms may initially be limited until there are proven revenue streams. Opposed to securing debt from the bond market, where risk is spread out among investors, a bank that issues a loan is taking on all the risk and is therefore not likely to lend large amounts of capital. Furthermore, a larger bank loan can often require higher debt service payments and thus a greater amount of toll revenue required to repay the loan.

VTA was able to finance a portion of its Phase 2 extension of SR-237 Express Lanes via a commercial loan. Of the \$33.9 million total project cost, \$24 million was provided by Western Alliance Bank. The terms of the loan include a 20-year payback period with a fixed annual rate of 5.15%⁸⁵

5.4 TIFIA Loans

The Transportation Infrastructure Finance and Innovation Act (TIFIA) of 1998 provides credit assistance in the form of direct loans, loan guarantees, and standby lines of credit (rather than grants) to projects of national or regional significance.⁸⁶ TIFIA loans tend to be more flexible with repayment terms for both interest and principal and offer lower competitive interest rates. As of February 15, 2021, the interest rate for a 35-year loan stands at 1.93%, which is lower than can be expected with toll revenue bonds or commercial loans. For new toll facilities without proven revenue streams, TIFIA offers a lower cost and flexible financing solution that also helps to reduce perceived program risk and secure additional debt at more competitive terms from other sources. TIFIA tends to be junior, or subordinate to other debt obligations, in terms of future cash flow. In the event of liquidation or bankruptcy, US DOT is required to have a parity lien with senior creditors. If TIFIA is used as subordinate debt, the senior debt must also obtain two investment grade ratings prior to execution of the loan.

Obtaining a TIFIA loan requires a detailed federal application process and the credit assistance has some key major requirements as follows:

- Minimum anticipated project costs:
 - \$10 million for Transit-Oriented Development, Local, and Rural Projects
 - \$15 million for Intelligent Transportation System Projects
 - \$50 million for all other eligible Surface Transportation Projects
- TIFIA credit assistance limit – Credit assistance limited to 33 percent of reasonably anticipated eligible project costs (unless the sponsor provides a compelling justification for up to 49 percent).
- Investment grade rating – Senior debt and TIFIA loan must receive investment grade ratings from at least two nationally recognized credit rating agencies (only one rating required if less than \$75 million).
- Dedicated repayment source – The project must have a dedicated revenue source pledged to secure both the TIFIA and senior debt financing.
- Applicable federal requirements – Including, but not limited to: Civil Rights, NEPA, Uniform Relocation, Buy America, Titles 23 and 49.

⁸⁵ <http://santaclaravta.igm2.com/Citizens/FileOpen.aspx?Type=4&ID=7933>

⁸⁶ <https://www.transportation.gov/buildamerica/financing/tifia>

- Reimbursement – Project sponsors must reimburse USDOT for the costs of the outside advisors who advise TIFIA on the transaction. This transaction fee generally ranges between \$400,000 and \$700,000. The fee may vary significantly depending on the complexity of the project.⁸⁷
- Reporting requirements - Ongoing, periodic reporting is required to provide USDOT with an oversight tool for ensuring the borrower's compliance with the provisions of the credit agreement; monitor the overall status of the project; and assist USDOT and the Office of Management and Budget (OMB) in identifying any changes to the credit risk posed to the federal government under individual credit agreements. This includes providing ongoing financial and project information until the loan is fully repaid at the cost of the project sponsor, including audited financial statements, annual credit evaluations of the project, budget and cash flow projections, sources and use of funds, project schedules, and operating statistics.

TIFIA is often combined with other bond measures including toll revenue and sales tax revenue bonds. TIFIA accounted for 41 percent of total debt obligations on the I-405 Express Lanes in Orange County and for 38 percent of debt obligations on the SR-91 Express Lanes in Riverside County. The two agencies offer examples of how TIFIA has been used on projects in California:

- Orange County Transportation Authority (OCTA) I-405 Express Lanes – OCTA in cooperation with Caltrans is widening I-405 16 miles of I-405 between the SR-73 freeway in Costa Mesa and I-605 near the L.A. County line. The project will incorporate the existing carpool lanes and add a new lane in each direction between SR-73 and I-605.⁸⁸ The credit agreement was executed in 2017 and provides a \$561 million direct loan for the \$1.7 billion project.⁸⁹
- Riverside County Transportation Commission (RCTC) SR-91 Express Lanes – RCTC extended the existing express lanes on SR-91 into Riverside County, from the Orange County Line to the I-15. The project constructed two express lanes in each direction with no intermediate access points. The credit agreement was executed in 2013 and provided \$421 million for the \$1.79 billion project.⁹⁰

6 Private Investment

Private investment in express lane implementation is typically achieved through a Public-Private Partnership (P3), where a private company enters into a contractual relationship with a public agency to deliver a project. P3s for express lanes and other tolled facilities often involve a long-term concession agreement where the private entity agrees to deliver, operate and maintain the facility in exchange for the right to collect the toll revenue generated. These agreements can have terms that range from 30 years to as long as 99 years. At the end of the term, the facility reverts to the public owner.

Some of the biggest advantage of P3s include the ability to accelerate project construction and the ability to transfer risks to the private sector. P3s can bring private investment to the table that would otherwise take years or decades to obtain through traditional funding approaches, although many P3 models do include an investment of public funds towards the project. In addition, P3 can stipulate regimented operations and maintenance regimes and provisions for rehab and replacement to ensure that the facility is kept in optimal condition throughout the life of the agreement. These regimes and

⁸⁷ <https://www.transportation.gov/buildamerica/financing/tif/tif-credit-program-overview>

⁸⁸ <http://www.octa.net/Projects-and-Programs/Under-Construction/I-405-Improvement-Project/?frm=7135>

⁸⁹ <https://www.transportation.gov/buildamerica/projects/octa-i-405>

⁹⁰ <https://www.transportation.gov/buildamerica/projects/sr-91-corridor-improvement>

provisions would need to be adhered to regardless of the amount of revenue that is being collected, thereby transferring risk to the private partner.

Express lanes that have utilized a P3 model tend to be megaprojects requiring significant highway reconstruction in heavily traveled corridors. And the facilities themselves tend to consist of two express lanes in each direction with HOV3+ occupancy requirements, some of them with no cap on toll rates. A few example express lane projects that were delivered via P3 agreements are summarized below:⁹¹

- Washington, D.C. metropolitan area – The I-95, I-395 and I-495 Express Lanes outside of Washington, D.C. have all been delivered through P3 concession agreements. Each facility was constructed in the median, with some portions including two express lanes in each direction and other portions including two to three reversible express lanes. The total project cost for all three facilities was over \$3.5 billion, which included replacement of aging bridges and overpasses in the corridors. The express lanes operate 24/7 and require three or more occupants for toll-free travel. The lanes essentially serve as a separate freeway within a freeway, with direct access ramps provided from the express lanes to major interchanges. The terms of the concession agreements range from 70 to 75 years.
- Dallas-Fort Worth Metroplex, Texas – The North Tarrant Express project is being delivered in two phases through separate P3 agreements. The entire project comprises 31 miles on three separate freeways, including direct connectors. Two express lanes are provided in each direction, which required reconstruction and widening of the freeway, and in some areas, new frontage roads were added. The total project cost is \$3.8 billion. The lanes provide a 50% discount for vehicles with two or more occupants during weekday peak periods only; all vehicles pay the full toll at all other times.
- Denver Metro Area, Colorado – A 5-mile extension of the US 36 express lanes that connect the City of Boulder to Denver was delivered as a P3. The terms of the 50-year concession agreement included improvements to the entire US 36 corridor as well as routine maintenance and lifecycle replacement on the entirety of the US 36 express lanes as well as the I-25 express lanes. The total cost of the project was \$208.4 million. Unlike other express lanes delivered via P3, the US 36 express lanes consist of a single lane in each direction. Vehicles with three or more occupants travel toll-free and tolls are capped.

Significant changes would be required for P3 to be a feasible option for continued buildout of Bay Area express lanes. First, a change to state law would be required to even allow public private partnerships for tolled facilities. In addition, the following would need to be considered by Bay Area express lane agencies:

- Control of operational policies, include toll setting – Policies that seek to maximize toll revenues tend to attract greater private interest. Private investors would prefer to have a say in toll-setting policies to guarantee a return. A compromise could be to include provisions in the concession agreement that allow for changes to operational policies only when certain triggers/thresholds are reached. Toll caps can also be included as part of the agreement.
- Bundling of facilities – It is not likely that any single express lane facility in the Bay Area would attract sufficient private interest. Instead, it may be necessary to bundle facilities that are to be delivered and operated via a P3. Like the US 36 example, it could be possible to structure an agreement that involves some portion of the buildout and includes operations and maintenance of multiple facilities.

⁹¹ https://www.fhwa.dot.gov/ipd/project_profiles/

- Project delivery and operations – Express lanes project delivery and operations have become integrated functions of the County Transportation Authorities and MTC. Ceding control of these functions to a private entity would still require some agency oversight, but probably not as much as is currently invested in the buildout and operation of the express lanes.
- Revenue sharing – It can be difficult to give up 30 to 50 years of toll revenues, creating a desire to include revenue sharing provisions into concession agreements. Although such provisions can ensure that the public receive a share of net revenues, they can also serve to dissuade would-be private investors.

7 COVID-19 Impacts

The COVID-19 pandemic has taken its toll on the transportation sector and its impacts are likely to last for several years after the pandemic ends.

Fitch Ratings released a series of reports over the summer of 2020 that project potential credit rating scenarios for various toll projects with debt financing. One such report focuses on managed lanes exclusively, owing to their unique demand profile and generally distinct debt structure.⁹² The report notes that, while managed lanes have seen incredibly sharp year-on-year drops in traffic and revenue (approaching 75 percent for Q2 2020), they have somewhat counterintuitively demonstrated strong financial performance, in terms of liquidity and debt service coverage. Several factors have contributed to this. Most debt-financed managed lanes projects are relatively new, and therefore the debt required to be paid back is relatively less now than it will be in later years. The relative novelty of managed lanes has also discouraged the pre-COVID assignment of the highest investment-grade credit rating to their debt.

Another interesting aspect of managed lanes' performance throughout the COVID-19 pandemic has been the fact that users are paying to use them at all. Managed lanes' value proposition typically centers around the time savings they provide; with free-flow traffic being the current norm, users appear to be paying (albeit generally lower tolls) for the perceived reliability, safety, and perhaps still greater speed benefits of using the lanes. Variation among express lane corridors during the pandemic has been observed and may be attributable to different trip types being served; for example, express lanes on corridors that primarily serve peak period commute trips have been observed to experience sharper declines in traffic than express lanes on corridors where there is substantial recreational use.

With that being said, Fitch Ratings' updated baseline has some critical assumptions on the timeline of economic, and by proxy, traffic recovery. Fitch's rating case assumes year-over-year managed lanes traffic losses peaking in the second quarter of 2020. Traffic losses are then assumed to ease through the remainder of the year with a gradual recovery through 2022 when traffic is estimated to return to 2019 levels.

8 Conclusions and Recommendations

Given the uncertainty faced in the years following the COVID-19 pandemic, it seems imprudent to chart a course for a change in how Bay Area express lanes have been funded. The decline in tax and toll revenues will undoubtedly put a strain on transportation funding in the Bay Area for years to come. The

⁹² <https://www.fitchratings.com/research/us-public-finance/coronavirus-stress-tests-us-toll-roads-managed-lanes-structural-protections-offset-steep-traffic-losses-rating-pressure-in-severe-downside-case-06-07-2020>

region should actively pursue state and federal funding opportunities and should advocate to include the Express Lanes Network buildout in any future regional funding measure. While financing could be a part of the solution, it is unlikely to play a major role in the near-term, primarily because the Bay Area's environmentally friendly approach (e.g., minimizing roadway widening and right of way acquisition) is less attractive to the commercial bond market, and other financing opportunities remain limited. Specifically, the following are recommended.

Actively pursue state and federal funding opportunities	<p>Senate Bill 1 introduced a new source of much needed transportation funding. Express lane projects in the Bay Area have been successful obtaining funds from each of the three competitive programs under Senate Bill 1. With continued emphasis on building a pipeline of projects that achieve state and regional goals, the region can hopefully continue to rely on state funds for express lanes buildout.</p> <p>Existing discretionary federal grant programs offer opportunities for express lanes funding, and there is potential that a new authorization could provide sustained or enhanced funding for these types of programs. The region should advocate for funding opportunities that could apply to express lane projects, and as funding becomes available, seek opportunities to put forth competitive projects.</p>
Advocate to include the Express Lanes Network buildout in any future regional funding measure	<p>There continues to be talk of a potential regional measure to generate funds for transportation. The previous measure contemplated for 2020 included consideration of funding for a robust managed lanes network to support regional express bus service. The region should continue to stay engaged in discussions that may reemerge and advocate for the buildout of the Express Lanes Network.</p>
Explore regional infrastructure bank concept when economic conditions are favorable	<p>The concept of a regional bank backed by various forms of transportation revenues (e.g., sales tax revenues, toll revenues, or future state and federal funds) could help the region leverage more attractive financing options by pooling resources. However, such a venture requires favorable economic conditions, broad consensus among regional participants, and possible changes to statutory restrictions on the use of net revenue across jurisdictional boundaries.</p>