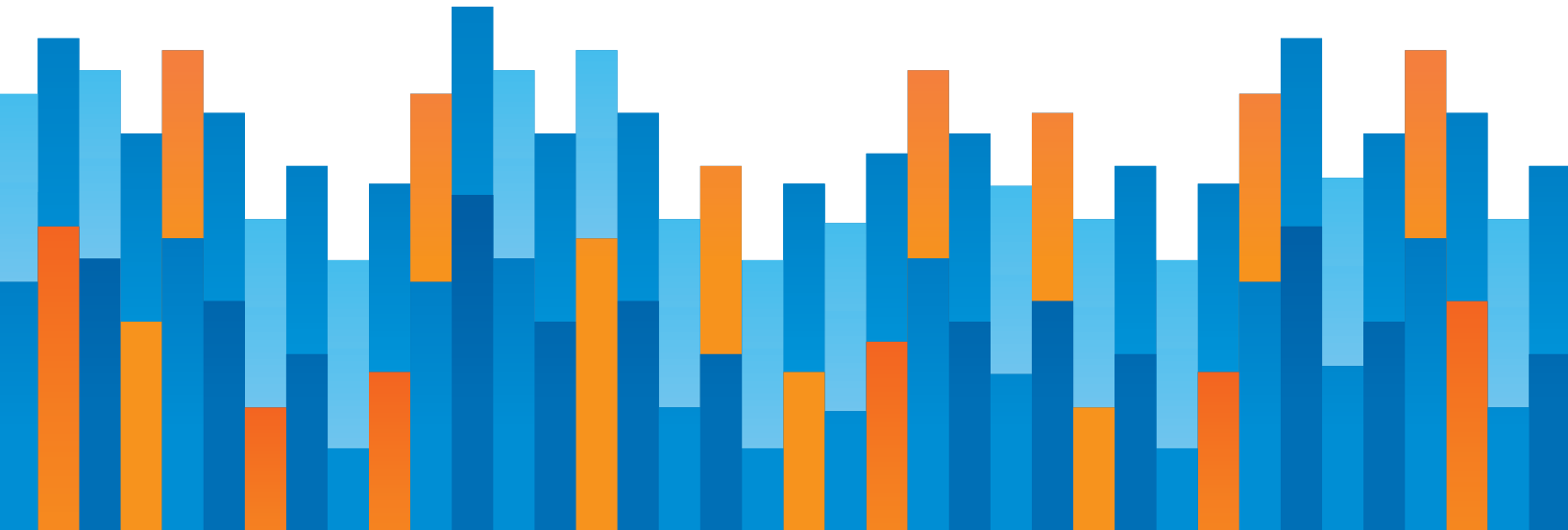
reason FOUNDATION

EXPRESS BUS AND EXPRESS LANES SYSTEM FOR THE SAN FRANCISCO BAY AREA

by Thomas Rubin
Project Director: Robert W. Poole, Jr.

February 2021



Reason Foundation's mission is to advance a free society by developing, applying, and promoting libertarian principles, including individual liberty, free markets, and the rule of law. We use journalism and public policy research to influence the frameworks and actions of policymakers, journalists, and opinion leaders.

Reason Foundation's nonpartisan public policy research promotes choice, competition, and a dynamic market economy as the foundation for human dignity and progress. Reason produces rigorous, peer-reviewed research and directly engages the policy process, seeking strategies that emphasize cooperation, flexibility, local knowledge, and results. Through practical and innovative approaches to complex problems, Reason seeks to change the way people think about issues, and promote policies that allow and encourage individuals and voluntary institutions to flourish.

Reason Foundation is a tax-exempt research and education organization as defined under IRS code 501(c)(3). Reason Foundation is supported by voluntary contributions from individuals, foundations, and corporations. The views are those of the author, not necessarily those of Reason Foundation or its trustees.

EXECUTIVE SUMMARY

Traffic congestion in the San Francisco Bay Area is generally ranked near the worst in the United States. The region has one of the nation's best transit systems and has long-standing smart growth and transit-first policies, but surface transportation mobility has continued to worsen even as government and private transportation costs have increased markedly—and transit use continues to decline.

This study examines how a new approach to bus transit could assist in improving mobility in the region. The primary focus is on long-haul commuter express bus service on what are known in the Bay Area as "Express Lanes," particularly on the San Francisco-Oakland Bay Bridge (Bay Bridge). Depending on the specifics for each lane, Express Lanes can be used by buses, high-occupancy vehicles (HOV), and/or by single-occupancy vehicles that are charged a toll (high-occupancy toll, or HOT). The Metropolitan Transportation Commission (MTC), the nine-county metropolitan planning organization (MPO) that coordinates planning and funding, has been planning an expanding Bay Area Express Lane system for many years.

IMPORTANT QUALIFICATIONS

This study was finalized as the COVID-19 public health emergency is still dominating both public and private life. Post-shelter-in-place transportation impacts, both short- and long-term, are impossible to know at this time, other than that they will likely be profound and require years to fully play out.

This study does not attempt to make predictions or projections of what surface transportation in the Bay Area will look like in a few months or years; instead, it makes a generalized assumption that transportation conditions will return to something approaching the *status quo ante* within a few years. All transportation data used in this study is for pre-pandemic operations unless specifically stated otherwise.

Similarly, there is an assumption that the state of California, Bay Area, and local government policies and practices for land use and housing—some of the most important influences for transportation—will continue largely as before. These policies include continued efforts to densify existing central cities; support transit-oriented and mixed-used development; implement "complete streets" to shift some roadway width and capacity from auto/truck usage to transit, pedestrian, and non-motorized transportation; and discourage more single-family detached housing and suburban development. This study assumes that Bay Area past decades' governmental action patterns are likely to continue.

BAY AREA TRANSPORTATION AND LAND USE STATUS QUO

As in common throughout the U.S., land use planning in the Bay Area has a long-standing emphasis on the core city center—originally, the San Francisco (SF) central business district (CBD). As the name clearly states, the SF CBD is the center, with transportation systems designed to bring workers to and from jobs downtown, as can best be seen through the original five-county design for the San Francisco Bay Area Rapid Transit District (BART) rail plan. It was clearly to serve the SF CBD with three lines from the East Bay, one from the north, and one from San Mateo County in the south.

As Silicon Valley grew into one of the major economic engines of the nation and the world, and San José became the Bay Area's largest city and Santa Clara County its most populous county, some degree of power-sharing has developed, along with transportation planning and funding. Oakland, the third and smallest of the three largest cities, never had the power or the influence to gain as much as its two rivals, but is still getting a significant, but lesser, share of the resources.

These land use plans and practices have continued even as jobs have primarily increased outside of the CBDs. While there has been growth in jobs in absolute terms in the major

Bay Area CBDs, the *share* of CBD jobs has declined locally as it has nationally—and transit does not work well for suburb-to-suburb commutes.

Transit has been a major component of the region's efforts to deemphasize the importance of the automobile and work toward what is believed to be a superior urban form. As in the rest of the U.S., Bay Area transit has had difficulty responding to the transportation needs of increasingly suburban Bay Area residents. Other than the continued robustness, and even growth, of single-passenger auto trips, the only major modal shift appears to be the continued increase in the work-at-home cohort, which nationally now exceeds transit in home-to-work commute share nationally. It appears safe to count on an increased share of work-at-home post-COVID-19 recovery.

For many decades, the region's primary emphasis in transit has been on major capital expansion projects, particularly passenger rail projects such as BART extensions, initiating and expanding the Santa Clara Valley Transportation Authority (VTA) light rail system, new ferry boat service and terminals, the Altamont Corridor Express (ACE) from Stockton in the Central Valley to San José, Capital Corridor intercity rail from Auburn and Sacramento to Oakland and San José, Sonoma-Marin Area Rail Transit (SMART), and Caltrain service improvements into the SF CBD from Gilroy, south of San José, through San Mateo County. While these have had some successes in increasing transit passenger-miles, they have not had much success in replacing former drive-alone trips overall.

The emphasis on new rail and ferry projects has come at the expense of improved transit service to the transportation-disadvantaged. While some higher-income suburbanites have been able to reduce their commute driving, the bus service that has traditionally been an important component of mobility for many urban dwellers has been reduced. Fare reduction, one of the few well-proven (although little utilized) ways of increasing transit use, has not been tried; indeed, transit fares have continually increased, which tends to hasten the move away from transit to auto ownership, particularly for those who are looking for work and finding that transit can't get them to the jobs they prefer.

The Bay Area planning community recently initiated the second step of a plan to increase transit access to the SF CBD from the East Bay. While this study is still in its earliest phase, the two main alternatives are a second BART tube and/or a commuter/regional/intercity rail tube, which would likely require well over a decade to go into service.

RECOMMENDATIONS:

#1 IMPLEMENT LONG-HAUL HIGH-SPEED COMMUTER EXPRESS BUS SERVICE ON EXPRESS LANES

This study proposes another option, a network of long-haul commuter express bus service from multiple East Bay and further distant origins into San Francisco, both to the CBD and other major trip generators, operating predominantly on high-speed Express Lanes, used for buses, high-occupancy vehicles, and single-occupancy vehicles paying a toll. The bus service would be designed to minimize door-to-door travel time and to minimize the number of transfers. This study includes potentially converting an existing Bay Bridge general purpose lane in each direction to an Express Lane.

The Metropolitan Transportation Commission (MTC) has created and expanded a priced Express Lane network throughout much of the nine-county area, with an eventual target of 600 lane-miles. The Bay Area Express Lanes (known nationally as managed lanes) allow both high-occupancy vehicles (generally, two or three occupants) and single-occupant vehicles that pay a variable toll. Since the purpose of the Express Lanes is to provide faster and more-reliable trips, they are ideal for buses. But, to date, the planning for express bus service has generally been only a minor component of the Express Lanes network planning. There is little or no express bus service on most of the new Express Lanes thus far, with the notable exception of AC Transit service on the I-80 Express Lanes to and from the Bay Bridge.

Express bus services have a long record of providing higher-speed transit that can be competitive with both passenger rail service and driving. In addition, some such services have very low taxpayer subsidies. The long-standing express bus service operated between New Jersey's suburbs and Manhattan actually covers its operating costs from fares, advertising, and other operating revenues.

Currently, most Bay Area transit planning is developed on the "transit center" concept. For example, a long-haul transit passenger will start with a local bus route in the morning, taking her to a bus, rail, or ferry transfer center for the next vehicle for the higher-speed portion of the trip, and then a transfer to a local bus or other transit vehicle for the last leg to the job or other destination. While the transit center concept is useful and should be part of the Bay Area transit route network, this study also discusses methods to reduce the number of transfers, which are known disincentives to transit use.

Specifically, as an initial step toward regionwide express bus service on the Express Lanes network, this study proposes bus routes across the Bay Bridge that begin with local service through residential areas or park-and-ride lots, with the "local" bus then proceeding onto a freeway, preferably an Express Lane, directly to its destinations. Since it is impractical to serve all origin-destination sets with direct bus lines, this proposal includes a pair of Bay Bridge Transfer Centers between the toll plaza and the incline section where riders will be able to quickly transfer from their "collector" bus route to an array of "distributor" routes with higher probability of seated rides from beginning to end of their travel. These routes would serve either the Salesforce Transit Center or other major SF destinations.

#2 FOSTER SUPPORT THROUGH COMMUNITY OUTREACH, INFORMATION, AND POLITICS

Implementation of the proposal summarized in #1 will require a project sponsor and a serious effort to explain the rationale for the project and answer many concerns and objections that may be raised. Elected officials in affected communities and state legislators from the Bay Area will be critically important in this effort, along with various community and stakeholder groups. The region's MPO—the MTC—will play a key role in such a project, and it is unlikely to move forward unless the MTC becomes convinced that it would be a worthwhile improvement. Also critically important is Caltrans, which owns the Bay Bridge and is responsible for its operations.

#3 TAKE INTO ACCOUNT THE LIKELY INCREASE IN TELECOMMUTING

The future of commuting post-COVID-19 is still very uncertain. Predictions of what fraction of the workforce will become full-time or frequent telecommuters after the pandemic vary greatly, and even modest increases from the Bay Area's current 6% could have significant impact on all forms of commuting. If that fraction doubles, triples, or quadruples within the next year or two, it will call into question current proposals for multi-billion-dollar capital improvements, such as an additional BART tube or an under-Bay commuter rail line.

The proposal set forth in this study can be implemented incrementally, at modest cost and risk, while the post-pandemic situation evolves and larger-scale capital projects can be re-analyzed in light of changed commuting behavior.

TABLE OF CONTENTS

TABLES

FIGURES

PART 1

SURFACE TRANSPORTATION IN THE BAY AREA IS INADEQUATE

1.1 BAY AREA GEOGRAPHIC, ECONOMIC, AND POLITICAL CONDITIONS

The nine-county San Francisco Bay Area has been one of the greatest growth engines in the U.S. and the world for many decades, first as a transportation and financial center, more recently as the home of Silicon Valley. However, the same geography that makes the Bay Area so attractive severely limits real estate development possibilities, even as population, jobs, and residential, commercial, and other facility needs increase. With the Pacific Ocean on the west and the Bay in the middle, and with much of the land area either mountainous or wetlands, most of the available relatively flat land is in long and narrow corridors that have already been developed. Active ecological, conservationist, and smart-growth organizations and movements, set-asides, and land-use regulation have made construction difficult, expensive, slow, and risky for developers. Proposals to reduce vehicle-miles traveled (VMT) and transportation sector emissions have gained significant and increasing impact. Public transit has become, along with denser and more-compact urban land use,

the favored political response. Unfortunately, transit has been losing market share for decades despite continually increasing expenditures.

The combination of limited developable land and increasing regulation of construction has drastically increased housing prices, leading to more residents taking longer to access the jobs they want or can get from the homes they want or can afford. With road capacity expansion mostly a non-starter, public transit has often proved unable to respond to the vast majority of non-CBD jobs and other trip destinations that cannot be reached by transit in an acceptable amount of time. Despite massive investments in public transit, actual transit trips have been falling in absolute terms for decades, even as population and trips have grown, leading to more cars taking longer and longer trips on only slowly growing road capacity.

The politics of the Bay Area have also contributed to this situation. Besides the nine counties, there are 101 incorporated cities, but there is no New York City or Los Angeles dominating the region. Instead, San Francisco, San José, and Oakland share the regional core city role, but combined have barely 30% of the nine-county population,[1] each with its own objectives to pursue.

Governmental surface transportation is even more fractured, with 27 individual transit operators, nine county transportation commissions, and Caltrans, not to mention other players such as the Air Quality Management District, the private sector, and many non-profits. Even more than in most U.S. metropolitan areas, there is no one organization that can say "yes" to a project, but many that can say "no."

The Metropolitan Transportation Commission (MTC) is perhaps the nation's most powerful metropolitan planning organization (MPO) and is one of the few MPOs that directly receives and allocates its own major taxes, as well as controlling the distribution of funds from the federal government and the state of California. Over the years, via a large professional staff and a succession of long-term, influential executive directors, MTC has prioritized major investments in mega-projects, but gaining acceptance of truly regional programs has been challenging. MTC recently gained a new executive director, Therese McMillan, with both substantial local and national experience. It will be interesting to follow her influence on MTC, which perhaps could include a higher emphasis on bus solutions.

[1] "E-1 Population Estimates for Cities, Counties, and the State — January 1, 2019 and 2020" (for 1/1/19), State of California, Department of Finance, Demographic Research Unit, May 2020, http://www.dof.ca.gov/Forecasting/Demographics/Estimates/e-1/ (12 June 2020).

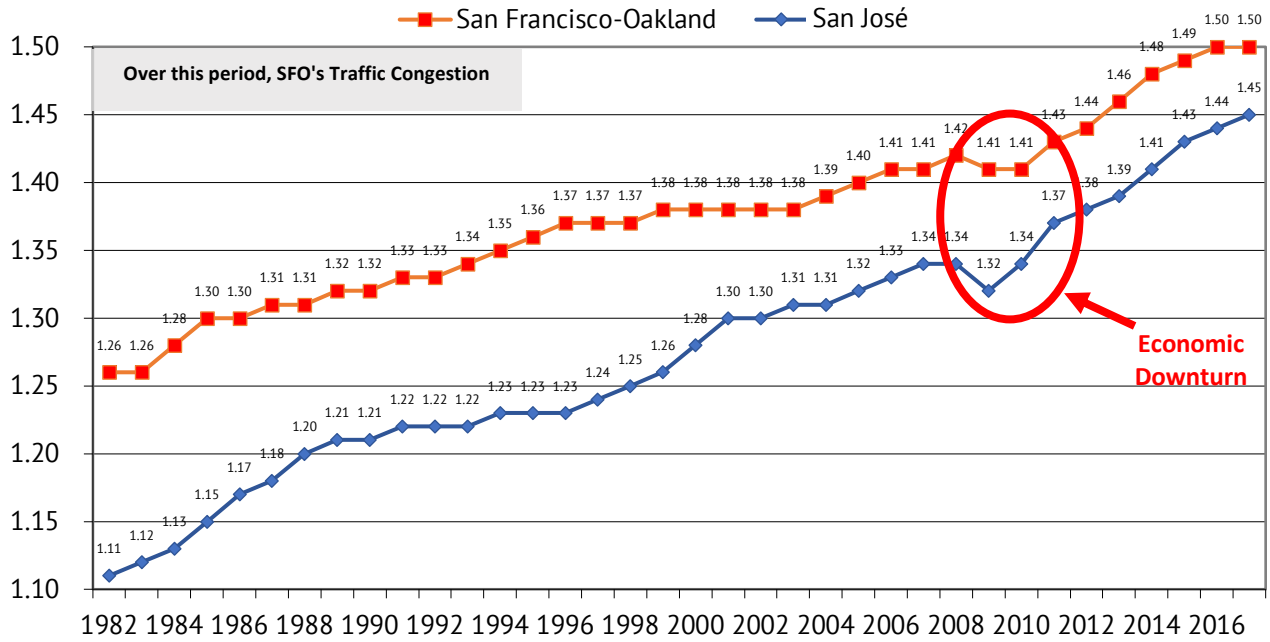
1.2

BAY AREA TRANSPORTATION SYSTEM PERFORMANCE

The following figures illustrate disappointing results. Figure 1 shows that traffic congestion has been increasing for decades, with the exception of during the Great Recession.

Even as measured by a generous metric, transit ridership has not increased over the last several decades, as shown in Figure 2. That figure reports the number of unlinked passenger trips (UPT). (To define by example, if a rider catches a bus from her residence in Oakland to a BART station, takes BART to San Francisco, then takes a Cable Car to Fisherman's Wharf, that's three *unlinked* passenger trips but just one *linked* passenger trip.) Thus, the now-standard UPT metric exaggerates the number of person trips. Moreover, as the region has added new rail systems, more people use buses to get to and from rail and ferry stations, leading to more unlinked trips for each actual person trips.

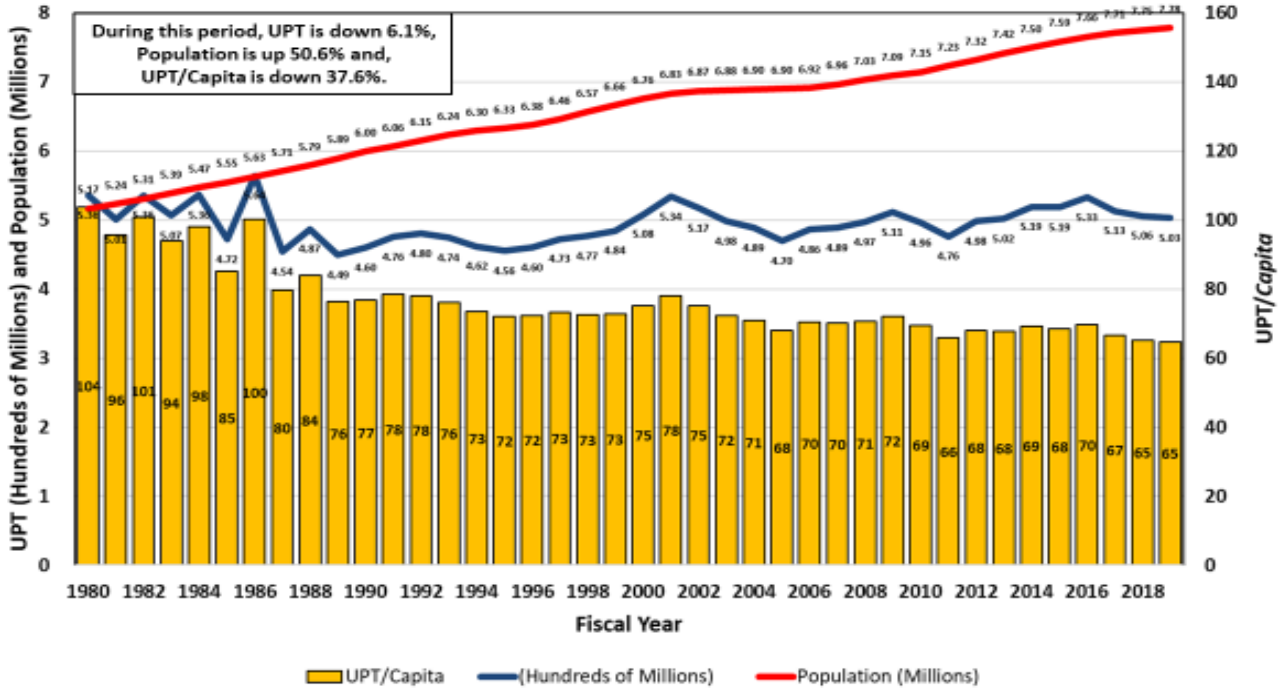
FIGURE 1: LONG-TERM INCREASE IN BAY AREA TRAFFIC CONGESTION
San Francisco-Oakland and San José Urbanized Areas Texas A&M Transportation Institute Travel Time Index 1982-2017



Note: TTI is the longest standing and most recognized measure of traffic congestion. It is basically a measure of the travel time during peak periods to that mid-day. If the same trip takes 30 minutes during peak and 20 minutes off-peak, the TTI is 1.50 (30/20).

Source: David Schrank, Bill Eisele, and Tim Lomax, *2019 Urban Mobility Report*, Texas A&M Transportation Institute, August 2019. https://static.tti.tamu.edu/tti.tamu.edu/documents/mobility-report-2019.pdf (6 July 2020) and https://ops.fhwa.dot.gov/perf_measurement/ucr/index.htm (17 October 2019).

FIGURE 2: BAY AREA TRANSIT USE HAS BEEN SHRINKING
San Francisco Bay Area Fiscal Years (1980-2019) Unlinked Passenger Trips, Population and UPT/Capita



Sources: UPT from Annual Print (1996 and earlier) and Website reports from U.S. Department of Transportation/Federal Transit Administration, National Transit Database (NTD), various dates, https://www.transit.dot.gov/ntd/ntd-data Various dates. Bay Area population from "E-1 Population Estimates for Cities, Counties, and the State—January 1, 2019 and 2020."

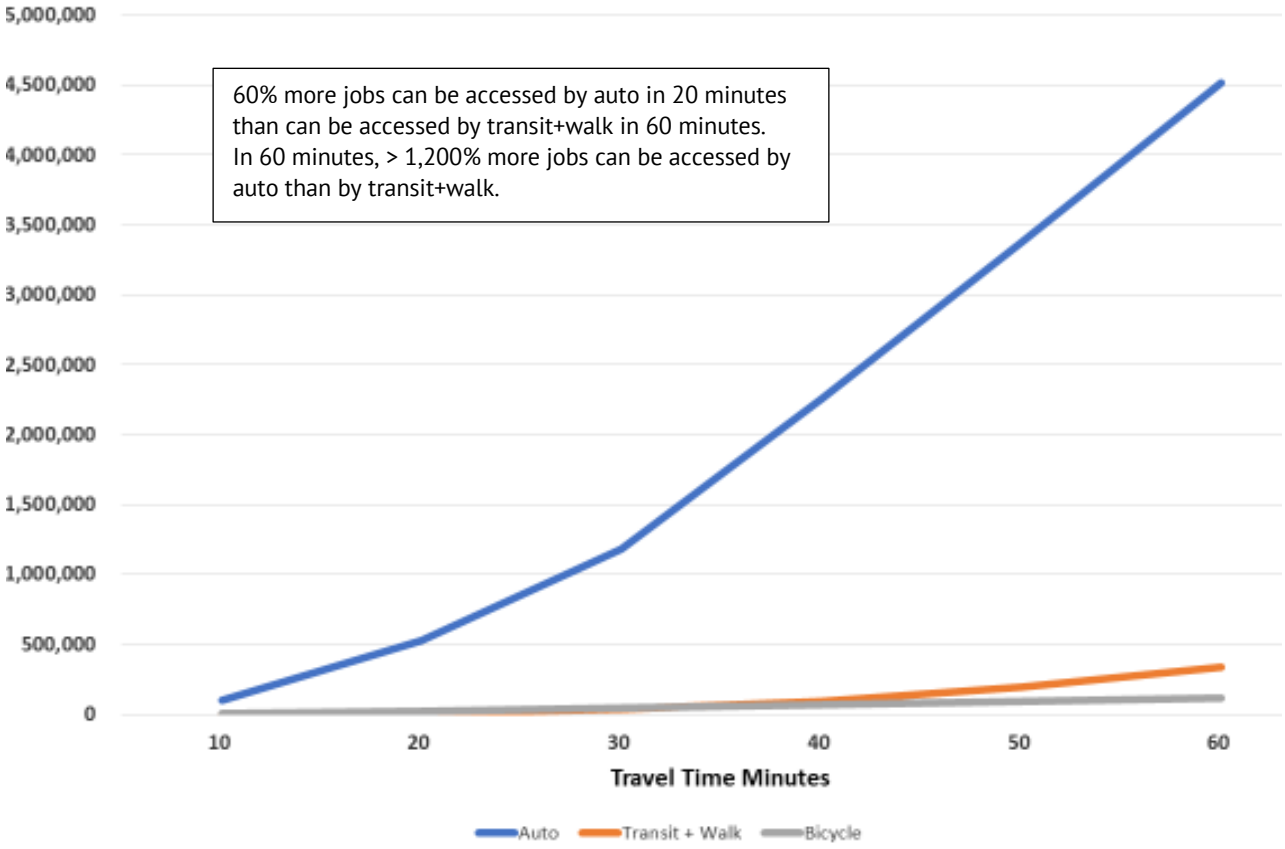
Lack of funding for transportation does not appear to be a major issue. For fiscal year 2020, Bay Area taxpayers and travelers will pay over $10.8 billion in taxes, user fees, tolls, fares, etc. for roads and transit. Adding new taxes and fees is generally not difficult; of 41 total new ones implemented in the 63 years between 1956 and 2018, 31 were added since 2000 and 20 of them—yielding over $2.7 billion for 2020—were added since 2010.[2]

The greatest limiting factor to transit use has been the same as in all other U.S. metropolitan areas—the "you-can't-get-there-from-here" factor. Figure 3 shows that the Bay Area is typical of all U.S. urbanized areas, with a far greater number of jobs accessible in any reasonable time period by driving than by transit or non-motorized options. Note that

[2] Thomas Rubin, "Nine-County San Francisco Bay Area Transportation Taxes and Fees," 31 January 2020, available on request from the author: tarubin@earthlink.net

"Transit + Walk" includes walk-only access. To a large degree, Figure 3 reflects the continued move of jobs from traditional city centers to suburbs, even as the Bay Area city centers have actually continued to show more absolute job growth than city centers in other parts of the nation. Transit can best serve trips in and to-and-from city centers; it does poorly in serving the suburb-to-suburb commutes that have been growing significantly for decades.

FIGURE 3: BAY AREA JOB ACCESS TIME BY TRANSPORTATION MODE
Job Access by Transportation Mode 2017 University of Minnesota Accessibility Laboratory San Francisco-Oakland and San José Urbanized Areas



Source: Andrew Owen and Brendan Murphy, "Access Across America" reports for 2017 for Auto, Transit, and Biking, University of Minnesota Accessibility Observatory, 2018, access.umn.edu (27 June 2019).

The compact and dense region encompassing the city and county of San Francisco is one of the nation's best transit cities, as well as one of most walkable. It has had a strong "transit

first" policy dating back to 1973, and has formally adopted Vision Zero (the movement to reduce road fatalities to zero).[3]

Even though San Francisco has long attempted to minimize driving, including encouraging non-motorized and shared-use transportation (such as short-interval rental bikes and scooters), and converting general purpose lanes and parking to non-automotive uses, such as the recent banning of private automobiles from Market Street,[4] the shift away from what San Francisco defines as "Non-Sustainable" (defined as Transportation Networking Companies [TNC] such as Uber and Lyft, carpool/drive with others, and drive alone) to "Sustainable" transportation (including transit, walk, bike, and taxi/carshare) has hit the wall.[5] Not only has the sustainable share of travel failed to achieve the 80% target, it has actually fallen from 50% in 2013 and 54% in 2017 to 47% in 2019 (interestingly, there is no mention of work-at-home).

While TNCs were first welcomed as a possible method to reduce VMT, recent research appears to show that San Franciscans are leaders in TNCs usage,[6] and that TNC usage actually increases VMT in San Francisco and elsewhere.[7]

The major positive impact of the overall Bay Area transit network has been to better serve the long-distance home-to-work trips that are becoming more and more common. The BART heavy rail system, which is the backbone of Bay Area transit, had an average trip

3 "Transit-First Policy," San Francisco County Transportation Authority, undated, https://www.sfcta.org/policies/transit-first-policy (3 April 2020).

4 Adam Brinktow, "Starting January 29 (2020), Market Street will ban (most) cars downtown," Curbed San Francisco, 2 January 2020, https://sf.curbed.com/2020/1/2/21046844/market-street-cars-free-better-market-date-time (3 April 2020).

5 San Francisco Metropolitan Transportation Authority, Board Workshop Presentation, "2019 Travel Decision Survey," 29 January 2020, https://www.sfmta.com/sites/default/files/reports-and-documents/2020/01/board_workshop_tds_2019.pdf Slide 5. (3 April 2020).

6 Fehr & Peers for Lyft and Uber, Memorandum, "Estimated TNC Share of VMT in Six US Metropolitan Regions," 1 August 2019, https://1y4yclbm79aqghpm1xoezrdw-wpengine.netdna-ssl.com/wp-content/uploads/2019/08/TNC-VMT-Findings.pdf (3 April 2020).

Figure 1, "Estimated TNC VMT Percentage by Metropolitan Region," page 3, San Francisco's TNC VMT 12.8% exceeded the core counties of Seattle (1.9%), Chicago (3.3%), Boston (7.7%), Los Angeles (2.6%), and Washington, DC (6.9%). For the entire Metropolitan regions, the Bay Area was also the largest.

7 Gregory D. Ehrhart *et al*, "Do transportation network companies increase or decrease congestion?," *Science Advances*, May 2019, https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6506243/ (3 April 2020).

length of 14.0 miles in the 2018 reporting year,[8] more than double that of any of its heavy rail counterparts, such as New York City (3.8), Los Angeles (4.8), Chicago (6.2), or Washington, D.C. (5.7). BART ridership had been increasing fairly steadily for years—47% from 2003 to the 2016 peak—although, like most U.S. and Bay Area transit operators, ridership has fallen (5%) from 2016 to 2018.[9]

Since BART first started operations in 1972, the Bay Area has substantially improved its three legacy rail systems (Caltrain and San Francisco Muni Metro light rail/streetcar and Cable Car) and started new rail systems for Altamont Commuter Express commuter rail from Stockton to San José, Capital Corridor intercity rail from Auburn (north of Sacramento) to San José, San José light rail, Sonoma-Marin Area Rail Transit hybrid rail, plus extensions to some of the above. Ferry service operates to San Francisco from three locations in Marin, one in Sonoma, one in Contra Costa, and three in Alameda counties.

Yet, despite all of these major capital expansions, and all the land use and other actions to emphasize transit over driving, total Bay Area transit ridership continues to decline, according to a UCLA transportation study.

> *… regional population and employment increased during the 2010s, carrying overall ridership up with it; yet per capita ridership edged downward ten percent, from 72 annual trips per Bay Area residents in 2008 to 65 annual trips per capita in 2018. The recent decline in ridership should be cause for concern, so too should the preceding decade of gradually falling transit use per capita, which was largely masked by rising population.*[10]

8 National Transportation Database "Profiles" for 2018 Reporting Year, U.S. Department of Transportation/Federal Transit Administration, 2019, https://www.transit.dot.gov/ntd/transit-agency-profiles (3 February 2020).

9 Bay Area Rapid Transit, "Average Weekday Station Exits by Station," various dates, https://www.bart.gov/about/reports/ridership (3 February 2020).

10 Evelyn Blumenberg, et al., "What's Behind Recent Transit Ridership Trends in the Bay Area," UCLA Institute of Transportation Studies, February 2020, http://www.its.ucla.edu/publication/bay-area-transit-ridership-trends, iii, (24 September 2020).

PART 2

PRIOR BAY AREA BUS PLANS

There have been several Bay Area bus plans, plus multi-modal transportation plans with major bus components, in recent years. This section briefly reviews several of those, emphasizing the differences between them and discusses useful elements of each.[11] These include:

- MTC Express Lanes
- AC Transit
- Regional Express Transit Network (ReX)
- FASTER Bay Area (FBA)
- Bay Area Core Capacity Transit Study (CCTS)

[11] Detailed reviews of the last three revealed major concerns; while these reviews are not pertinent to this study and not included herein, they are available from the author on request: tarubin@earthlink.net.

2.1

METROPOLITAN TRANSPORTATION COMMISSION (MTC) EXPRESS LANES

MTC has been developing a network of "Express Lanes" for many years, as shown in Figure 4. The system will be 600 lane-miles when fully built out in 2035.[12] The Bay Area Infrastructure Finance Authority (part of MTC) is implementing many of the projects, while others are managed through joint powers agreements and a county transportation commission.

MTC has been developing a network of "Express Lanes" for many years, as shown in Figure 4. The system will be 600 lane-miles when fully built out in 2035.

The concept of bus service on these lanes has been discussed, but the planning, design, construction, and funding plans have little, if any, detail as to how regional bus service will change, who will operate the service, what the fares might be, or how bus service will be funded. Plans mention speed and other advantages of express bus service on the Express Lanes network, but there is no mention of any of these detail topics, not even in the plan for these lanes submitted to the California Transportation Commission.[13]

Even the currently operating network provides some excellent opportunities for bus service and, when the full system is built out, these opportunities will expand significantly. However, the fully built-out map has several gaps. The most important for this study are the Bay Bridge, California State Route 24/I-980 from Walnut Creek to I-880, and I-880 from the Oakland Airport to the Bay Bridge.

12 "MTC Express Lanes," MTC, undated, https://mtc.ca.gov/our-work/plans-projects/major-regional-projects/mtc-express-lanes (20 June 2020).

13 "Bay Area Express Lanes Public Partnership Application for High Occupancy Toll Lanes Submitted to the California Transportation Commission,"28 September 2011, https://mtc.ca.gov/sites/default/files/FINAL_CTC_Application_092811b.pdf (20 June 2020).

FIGURE 4: MTC FULL BUILD-OUT EXPRESS LANE PLAN

Map of Authorized Bay Area Express Lanes Network

Source: "MTC Express Lanes Quarterly Report, 4th Quarter, October-December 2019," MTC/Bay Area Infrastructure Finance Authority, March 2020, https://mtc.ca.gov/sites/default/files/BAIFA%20EL%202019%20Q4%20Report.pdf (20 June 2020).

2.2 ALAMEDA-CONTRA COSTA TRANSIT DISTRICT (AC TRANSIT)

While prior proposals have suggested a system of Bay Area express bus lines,[14] the AC Transit Service Development and Planning Department developed an express bus proposal that includes routes in its own service area of western Alameda and Contra Costa Counties, with service across the bridges to San Francisco and San Mateo County. This plan also goes much further to include services in the entire nine-county Bay Area, as well as a line to Santa Cruz.

FIGURE 5: AC TRANSIT BAY AREA EXPRESS BUS PLAN

[14] Elizabeth Deakin, et al., "System Plan for California's Bay Area Regional Express Bus Service," *Transportation Research Record – Journal of the Transportation Research Board*, January 2006, https://journals.sagepub.com/doi/10.1177/0361198106198600123 (20 June 2020).

Source: Alan Hoffman, "ReX—Connecting the Bay Area with a Regional Express Transit Network," TransForm, October 17, 2019. https://drive.google.com/file/d/1gUwA9hBqsl5HkhlnPxv2ngdy4Y9f2OHb/view (20 June 2020)

This proposal is notable, perhaps in part because a transit operating agency is preparing it. For example, it includes off-freeway routes, particularly in the AC Transit service area, including last-mile circulator bus services.

It includes express bus operations in the California State Route 24 and I-580 corridors. This plan also includes recommended headways (the intervals between vehicles) for 10-minute peak, 30-minute all-day, and for times of service from 6:00 a.m.–8:00 p.m. The plan also has proposed costs, including $850 million for new capital—exclusive of buses and primarily for freeway hubs and conversion of freeway lanes to express lanes—for 400 miles at $1 million/mile. While the proposed new capital cost is not insignificant, it is a small fraction of the ReX or FBA proposed costs discussed in sections 2.3 and 2.4, perhaps because bus transit planners are conditioned to try to do more with less and not be too aggressive in their asks.

2.3 REGIONAL EXPRESS TRANSIT NETWORK (REX)

ReX is the most recent detailed bus plan included in this section and builds on many of the previous plans, and certain key players in previous plans had major roles in the ReX report.[15] ReX is also the most comprehensive and the most detailed of these bus plans.

MTC funded a Bay Area transit advocacy non-profit—TransForm—to produce ReX, including the 200-page document, "ReX – Connecting the Bay Area with a Regional Express Transit Network—a report to the Metropolitan Transportation Commission and the San Francisco Bay Region."[16] The ReX service map is Figure 6.

ReX is a plan for a comprehensive long-distance bus transit system for the Bay Area, including (numbers in parentheses are ReX page numbers):

- 17 high-frequency ReX Express Routes operating on freeways and the MTC Express Lane Network, with minimum speeds of 45 mph (Executive Summary 3 [hereinafter XS3]).

15 Alan Hoffman, "ReX—Connecting the Bay Area with a Regional Express Transit Network," TransForm, 17 October 2019, https://drive.google.com/file/d/1gUwA9hBqsl5HkhlnPxv2ngdy4Y9f2OHb/view (20 June 2020).

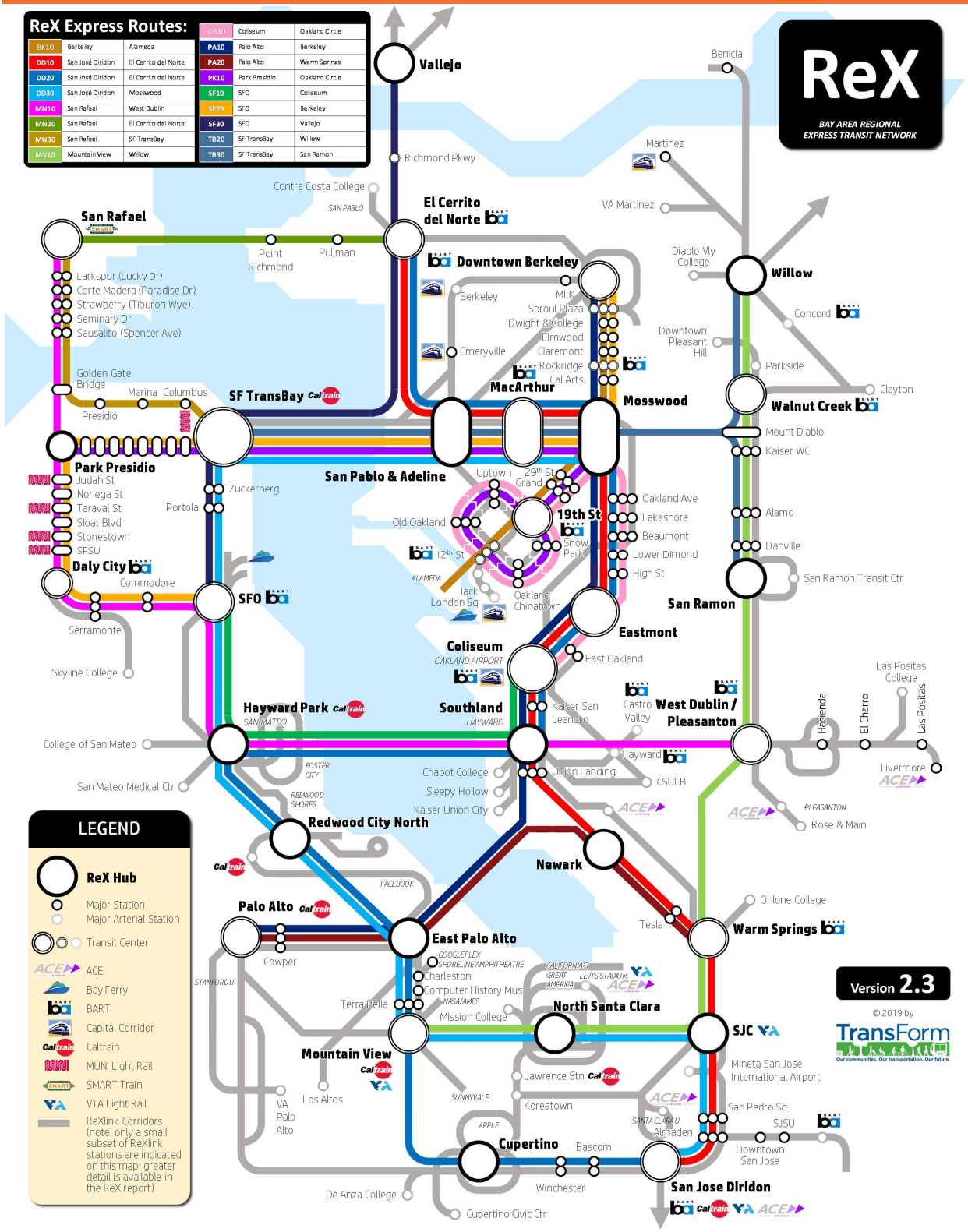
16 Ibid.

- 62 ReXLink routes, including direct shuttles, one-way loops, and hybrid express/bus rapid transit routes, all connecting with the ReX Express Routes (XS3).
- 10 major "Destination" (33) and 20 minor hubs (XS5), many co-located with hubs for other transit modes (such as BART and Caltrain stations and the Salesforce Transit Center) and 662 other stations (5).
- ReX on-freeway side and centerline stations to minimize use of on- and off-ramps (11).
- 994 buses (XS5); including high-capacity articulated 60-footers, double-deckers, and potentially 80-foot double-articulated buses, emphasizing battery electric power (57).

ReX specifically excludes several topics covered in this study, and includes some components that, at a minimum, appear to require considerable further explanation—for example, the 45 mph minimum operating speed appears to refer to the minimum operating speed on Express Lanes and *not* end-to-end operating speeds. There are also internal inconsistencies on operating costs, ridership, and operating revenues.

ReX does not discuss capacity trade-offs between buses, HOV, and HOT vehicles, and hardly mentions either HOV or HOT at all. There is no discussion of Express or managed lanes on bridges (indeed, the term, "Bay Bridge,"—which is proposed to have five Express Routes crossing it—does not appear in the document). The Express lines are mostly limited to the inner Bay Area and the I-680 corridor in the East Bay.

FIGURE 6: REGIONAL EXPRESS TRANSIT NETWORK (REX)



Source: Alan Hoffman, "ReX – Connecting the Bay Area with a Regional Express Transit Network," TransForm, 17 October 2019, https://drive.google.com/file/d/1gUwA9hBqsl5HkhInPxv2ngdy4Y9f2OHb/view F-4 to F-6. (20 June 2020).

The basic design is ReX Express lines running between transit centers. Many transit center pairs have no intermediate stops, some have one to three, and a few have many. This works for many trips, but means additional transfers for many other trips.

ReX is a serious document with great intentions and large amounts of excellent data, but the findings and recommendations appear to require substantial revaluation prior to being acted on.

2.4 FASTER BAY AREA

FASTER Bay Area (FBA) is the name of an organization[17] and of a plan[18] with the original central purpose of getting the voters of the nine-county Bay Area to approve a region-wide 1% sales tax to generate $100 billion over 40 years for massive unspecified transit improvements. "The FASTER Bay Area coalition is led by the Bay Area Council,[19] Silicon Valley Leadership Group[20] and SPUR[21] in partnership with local environmental, equity, and labor communities."[22]

17 "FASTER Bay Area," FBA, undated, https://fasterbayarea.org/ (21 June 2020).

18 "A FASTER Bay Area," FBA, 2020, https://static1.squarespace.com/static/5d6ff5240d873f0001bcea5d/t/5e4d6fd1a5eeda76f6f9383e/1582133208021/FASTER_Framework.pdf (21 June 2020). This is the most recent version of an oft-updated 29-page PowerPoint™ presentation—and, in the absence of a traditional narrative study, is the most detailed explanation of FBA concepts.

19 "Shape the Future with Us – Top CEOs and executives from more than 325 of the region's largest employers work with the Bay Area Council to solve our toughest challenges, grow business and improve the quality of life for everyone who lives and works here," Bay Area Council, undated, https://www.bayareacouncil.org/ (21 June 2020).

20 "About," Silicon Valley Leadership Group," undated, https://www.svlg.org/about-us/ (21 June 2020). "The Silicon Valley Leadership Group, founded by David Packard of Hewlett Packard, is a diverse public policy association of more than 360 dynamic companies shaping the future innovation economy of Silicon Valley, the Bay Area, and the nation. "For more than four decades, the Leadership Group has effectively implemented our members' vision by championing public policies, measures, and initiatives at the local, state, and federal level. Through policy expertise and an outcome driven philosophy, the organization strives to advance proactive solutions in the areas of education, environment, energy, government, health care, housing, tax policies, technology and innovation, and transportation."

21 "We are SPUR," SPUR, *Website*, undated, https://www.spur.org/ (21 June 2020). "We are SPUR, the San Francisco Bay Area Planning and Urban Research Association. We bring people together from across the political spectrum to develop solutions to the big problems our cities face. With offices in San Francisco, San José and Oakland, we are recognized as a leading civic planning organization and respected for our independent and holistic approach to urban issues."

22 "Who We are," FBA, (21 June 2020).

The process to get this type of tax approved is quite complex and requires authorization by the California Legislature and a two-thirds vote majority of the nine-county Bay Area electorate. In the 2019-20 session of the California Legislature, State Senator Jim Beall (D-15, Santa Clara County), Chair of the Senate Transportation Committee, introduced SB278,[23] a "placeholder" bill that was intended to be populated with the details of the FBA proposals and taxes. However, FBA, despite working very hard for years, failed to achieve its desired broad-based coalition, and FBA was put on hold.[24]

The actual FBA plan has been released only as a PowerPoint™ to date, often-revised, ranging from approximately 25 to 40 slides. It avoids specifying projects to be funded, but includes a slightly modified version of the ReX map (mainly adding Express bus routes in the North Bay Counties that had none in ReX) in the presentation.

The PowerPoint™ is generous in its promises. Slide 24 (10 October 2020 version) states, "This FASTER Transit Network would attract hundreds of thousands more riders onto transit, and significant[ly] reduce congestion for drivers." (Emphasis in the original.) What this means and how it would be achieved is not currently known.

In summary, ReX is a key component of FBA. As discussed previously, there are many questionable aspects of ReX—and FBA has compounded these further. This is not a plan or proposal to build on.

2.5 BAY AREA CORE CAPACITY TRANSIT STUDY (CCTS)

The most important study is the official report from MTC, carried out with all the major transit agencies that provide service in the East Bay to SF CBD corridor. It sets out the main opportunities to be studied for adding transit capacity. The main report is *Bay Area Core Capacity Transit Study – Final Report* (hereinafter "CCTS").[25]

The central problem—common to almost every thriving urbanized area in the world—is that commercial development in the traditional San Francisco CBD (a.k.a. the "Financial

[23] Jim Beall, "SB-287 Metropolitan Transportation Commission (2019-2020)," California Legislative Information, 28 March 2019, http://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201920200SB278 (21 June 2020).

[24] "Bay Area transit measure delayed as business sector focuses on COVID-19," FASTER Bay Area, 18 March 2020, https://fasterbayarea.org/in-the-news (8 October 2020).

[25] CCTS, MTC, September 2017, https://mtc.ca.gov/sites/default/files/CCTS_Final_Report.pdf (22 June 2020).

District") and nearby areas has expanded significantly while residential capacity of the city and county, particularly in the city's "Core," has not kept pace, creating a large and growing requirement for more passenger capacity to, from, and around the Core. The San Francisco Core is at the end of a long peninsula, and expansion of road capacity using freeway lanes (let alone new freeways) is a non-starter for various built-environment, political, environmental, equity, and other reasons—which leaves transit as the default means of adding personal mobility capacity. However, BART, by far the largest transit system to the Core, particularly from the East Bay, is near or at its capacity, as CCTS discusses in detail.

The Core and the main access corridors and modes to get to it are shown in Figure 7.

FIGURE 7: BAY AREA CORE AND TRANSIT ACCESS CORRIDORS

Source: MTC, "Core Capacity Transit Study," https://mtc.ca.gov/our-work/plans-projects/other-plans/core-capacity-transit-study (22 June 2020)

AC Transit is the sole bus transit operator considered in the Transbay Corridor in CCTS. For short- and medium-term improvements (p. 29) the recommendation is for $445 million of capital for 110 buses, maintenance facilities, and bus priority infrastructure, which is 9.2% of the total capital recommendation, and $33 million ($300,000 per bus per year) in annual operating needs, which is 39% of the total operating assistance.

San Francisco Muni bus service addresses CCTS, including the Geary Corridor Bus Rapid Transit Project, but the Muni emphasis in the "Improve: SF Metro short- and medium-term analysis and evaluation" chapter is on improvements to Muni light rail service (pp. 30-39). In fact, Muni does not appear in the "Improve: Transbay long-term options" chapter (pp. 40-52). No other bus operators—not even the Golden Gate Bridge, Highway and Transportation District or the San Mateo County Transit District, which both operate significant bus service into the San Francisco Core—were members of the study team coalition.

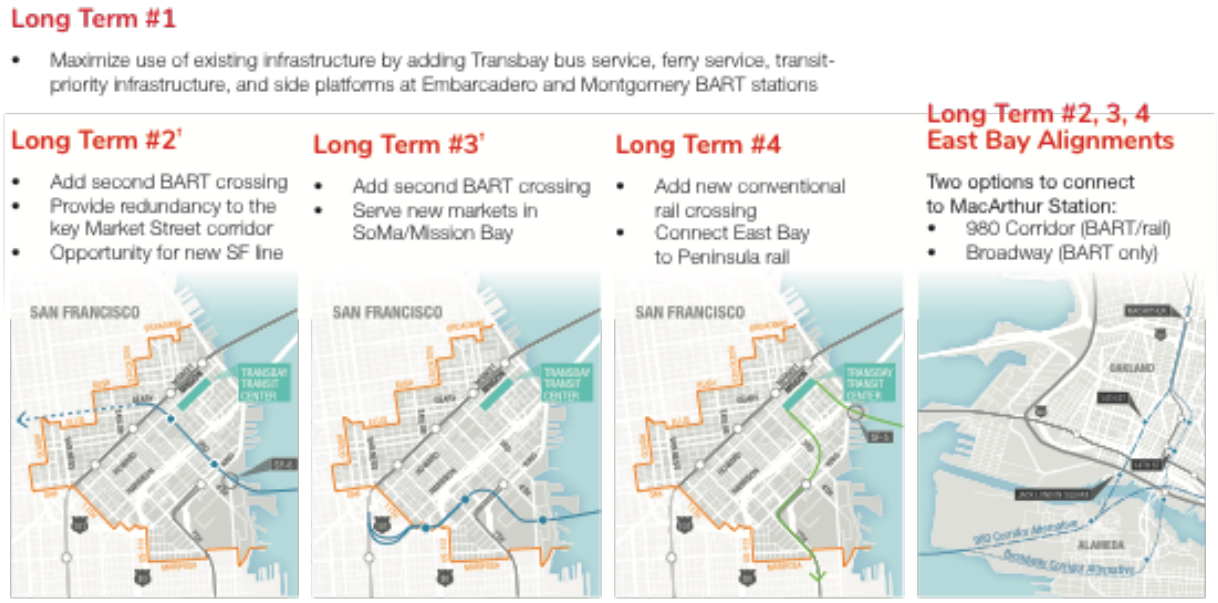
CCTS presents short-, medium-, and long-term options. The short and medium ones include relatively minor increases in bus capacity. On the long-term options, five are listed.[26] Option 1 is "Maximize use of existing infrastructure by adding Transbay bus service, ferry service, transit-priority infrastructure, and side platforms at Embarcadero and Montgomery BART stations." Bus is a portion of Option 1; there is no mention of bus in the other four options. Figure 8 is from the CCTS Study Overview.[27]

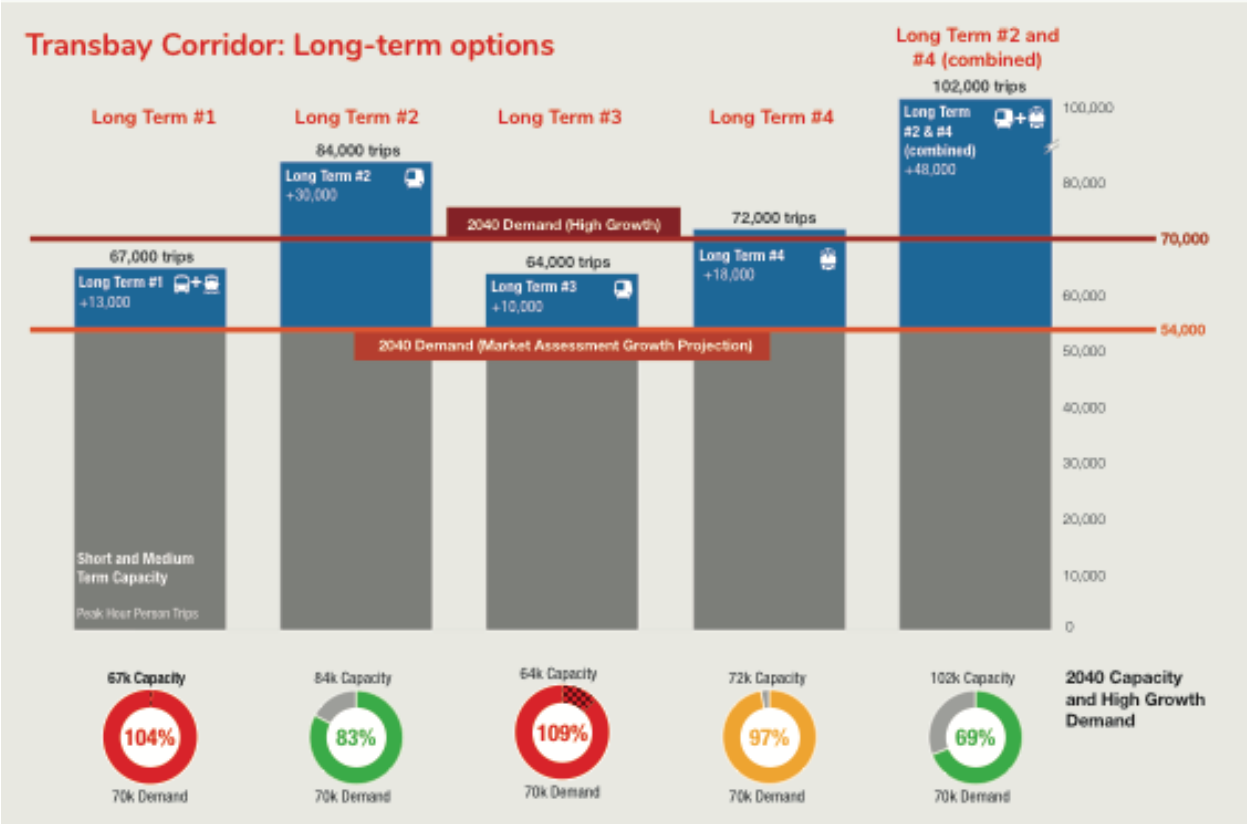
Based on past Bay Area transit experience, the rail emphasis of the five long-term options presented above is not surprising, with all but Option 1 concentrating on new rail connections under the Bay. Not studying passenger rail transportation in this context would border on incompetency, but without a proper and unbiased evaluation of other options, specifically including bus, potentially valuable solutions that may be far faster to implement and far less technically challenging, as well as require far less taxpayer subsidies and serve more origins and destinations, will never come to light.

[26] "Bay Area Core Capacity Transit Study – Study Overview," MTC, September 2017 https://mtc.ca.gov/sites/default/files/CCTS_Takeaway.pdf (22 June 2020).

[27] Ibid.

FIGURE 8: BAY AREA CORE CAPACITY TRANSIT STUDY LONG-TERM OPTIONS





Source: "Bay Area Core Capacity Transit Study—Study Overview," MTC, September 2017 https://mtc.ca.gov/sites/default/files/CCTS_Takeaway.pdf (22 June 2020).

Since the completion of CCTS in 2017, the Transbay rail options—BART and regional/intercity rail—have been studied jointly.[28] While the major decisions are still far away, there are obvious significant benefits from a single, combined planning effort, which is being led by BART, with the assistance of consultant HNTB under a five-year, $50 million contract.

The timetable for actual operation of a new Transbay tube (or tubes) is still very sketchy, but a November 2018 BART press release stated, "Looking ahead, BART hopes to begin construction on the second crossing in about ten years."[29] Based on the known and anticipated timetable of what has been the largest Bay Area rail transportation project of recent decades, BART to San José, it is probably fair to state that starting construction in 2028 is an optimistic projection. BART to San José was listed in the 2001 MTC project list.[30] The extension to Berryessa with the first two stations actually opened in June 2020.[31] The final phase of the project still has major technical and financial difficulties to overcome before the plan is approved.[32] The project sponsor is now projecting operations to begin in 2028[33]—which may prove optimistic. The obvious conclusion is that passenger rail capacity expansion under San Francisco Bay is exceedingly unlikely within a decade, and even two decades to operation is far from a certainty.

In terms of volume of words and graphics, CCTS appears to focus the Transbay portion towards rail, as shown in Table 1:

28 "Second Transbay Rail Crossing, BART, 14 November 2018, https://www.bart.gov/about/projects/transbay (22 June 2020).

29 "Planning for a Second Transbay Tube," BART, 14 November 2020, https://www.bart.gov/news/articles/2018/news20181114-0 (22 June 2020).

30 "Resolution 3434, "Regional Transit Expansion Program of Projects," MTC, 19 December 2001, https://mtc.ca.gov/sites/default/files/RES-3434.pdf (2 October 2020).

31 "BART to San José," MTC, 15 June 2020, https://mtc.ca.gov/whats-happening/news/video-gallery/bart-san-jose, (2 October 2020).

32 Jody Meacham, "San José's BART Tunnel has a problem. How can riders cross the street?" *Silicon Valley Business Journal*, 24 August 2020, https://www.bizjournals.com/sanjose/news/2020/08/24/san-jose-bart-tunnel-santa-clara-street-crossing.html (2 October 2020).

33 "VTA First Agency to Submit Expedited Federal Funding Request for BART Phase II," Santa Clara Valley Transportation Authority, 24 June 2020, https://www.vta.org/blog/vta-first-agency-submit-expedited-federal-funding-request-bart-phase-ii (2 October 2020).

TABLE 1: LONG-TERM OPTIONS SERVICE, CAPACITY, AND CAPITAL COST ESTIMATES

#	Option	Assumed Frequency	Estimated New Capacity (peak hour)	Estimated Capital Cost ($USD Billions)
1	Maximize existing assets	300 buses/hr; 24 ferries/hr	13,000	$1.5
2	BART Market Street Redundancy	28-30 trains/hr	30,000	$5–12
3	BART new markets (merge/breakout)	12 trains/hr	10,000	$5–12
4	Greater regional rail connection	10-12 trains/hr	12,000–18,000	$5–11

Source: CCTS, Table 11, page 47, (22 June 2020)

Notably, this table shows "Estimated new *capacity*," which is not the same as ridership; CCTS does not address how much of that capacity will be used. Detailed analysis raises questions on both capacities and costs. For example, Option 1 shows estimated new peak capacity of 13,000/hour. If all buses were the smallest now in Transbay service, 40-footers with 40 seats, the seated capacity—no standees, which are now common on AC Transit buses, as well as BART trains—is 12,000. Using 60-foot buses with 60 seats or double-deckers with 78, even without standees, pushes the capacity far beyond 13,000. Capacity of ferries varies, but, since these would be new vehicles to be purchased, we can use the specified passenger capacity for the ferries now being procured for service in San Francisco Bay—which is 320.[34] Thus, 24 ferries an hour, each with a capacity for 320 passengers, would be added capacity of 7,680. Therefore, it appears that the Option 1 capacity of 13,000/hour could easily be doubled.

As to cost, if the entire Option 1 $1.5 billion was used for the 300 buses, the cost per bus would be $500,000. That could be sufficient to buy the smaller 40-foot buses, but not the larger buses—and, even with the smaller buses, the funding wouldn't be adequate to acquire 24 ferries, let alone the fixed facilities for both vehicle types.

Without going into detail for the three passenger rail options, the "Estimated new capacities" shown appear reasonable; the costs, less so.

[34] "Bay Breeze and Solano Replacement Vehicles, 19-013, Vehicle Technical Specifications, 20 April 2020 Revision," San Francisco Bay Area Water Emergency Transportation Authority, https://weta.sanfranciscobayferry.com/sites/weta/files/weta-public/opportunities/RFP19-013/19-013PartBTechSpecs.pdf Table 081-1 Principle Operating Characteristics," page 15, (22 June 2020).

Using the capacities shown in Table 1, we can estimate the cost for an additional unit of capacity for each Option.

TABLE 2: CAPITAL COST/UNIT OF NEW PEAK-HOUR CAPACITY BY LONG-TERM OPTION

Option	Capital Cost/Unit of New Peak-Hour Capacity
1	$115,000
2	$166,000-400,000
3	$500,000-1,200,000
4	$417,000-611,000

Source: author calculations, using CCTS data

Assuming, for purposes of this analysis, that the values above have useful validity, the bus and ferry Option 1, "Maximize Existing Assets," has, by far, the lowest cost per unit of added capacity. Going by the mid-points of the ranges for Options 2, 3, and 4, the cost for Option 2 is 2.68 times, Option 3 is 7.39 times, and Option 4 is 5.20 times the cost per unit of added capacity of Option 1—and, again, that is without adjusting what appears to be a major undercount of the Option 1 bus/ferry capacity.

Because the Option 2 Estimated New Capacity is higher than that of Option 3, 30,000 vs. 10,000, at the same range of initial capital cost, $5 billion–12 billion (Table 1), Option 2 has superior cost-effectiveness to Option 3 on this single-criterion comparison. Therefore, logically, a combination of 2 and 4 to produce Option 5 appears superior to a combination of 3 and 4.

Overall, this analysis of CCTS raises two questions:

1. Would it be possible to increase the initial capital cost for Option 1 somewhat and generate some additional peak-hour bus capacity that would actually be well utilized, at far lower cost, than the several rail options, and have it implemented much sooner?
2. Also, what about an Option 6, combining Option 1 (Bus/Ferry) and 2 (BART Market Street Redundancy?

Increasing bus service presents an important challenge: The Salesforce Transit Center has a limit on the number of buses it can handle at peak; therefore, if more buses are operated, where can they go? The obvious answer, one discussed in detail in Part 3, is to remove the assumption that all buses in the Transbay Corridor can only terminate at Salesforce Transit Center.

PART 3

LONG-HAUL HIGH-SPEED COMMUTER BUS SYSTEM

3.1 CURRENT ROAD AND TRANSIT ACCESS TO SAN FRANCISCO

Although the entire Bay Area surface transportation network has been severely overloaded for decades—and is getting worse—accessing the SF CBD has been one of the most acute problems. Yet, a new way of operating long-haul high-speed commuter express bus service on Express Lanes has the greatest opportunity to improve it.

FIGURE 9: ROAD ACCESS TO SAN FRANCISCO

Source: "San Francisco Map," *Bing.com*, Microsoft Corporation, undated, (June 26, 2020).

San Francisco is approximately three-quarters surrounded by water, with limited highway access (Figure 9). The most important road access route is the San Francisco-Oakland Bay Bridge from the East Bay.[35] The Golden Gate Bridge is the only surface access from the north.[36] There are two major freeways, US101 and I-280, into San Francisco from San Mateo County to the south, which merge into a single freeway approximately four road-miles south of the CBD. Other than a few arterial and a variety of local streets between SF and San Mateo County, that's it for auto and freight access to San Francisco by road.

The most important transit connection, by far, is the BART tube from the East Bay, which, at peak hours, carries more passengers and at a far higher speed of travel than the Bay Bridge.

The most important transit connection, by far, is the BART tube from the East Bay, which, at peak hours, carries more passengers and at a far higher speed of travel than the Bay Bridge.[37] Caltrain provides commuter rail service from the south.[38] Bus transit on the Bay Bridge (and, before bus, the Key System rail service through 1958) was the main form of transit from the East Bay to SF, but was reduced significantly after BART Transbay service began in 1974.[39] The San Mateo County Transit District (samTrans) operates bus service from the south along the US101 corridor, primarily to the SF CBD.[40]

35 "The San Francisco-Oakland Bay Bridge," MTC, undated, https://mtc.ca.gov/about-mtc/what-mtc/bay-area-toll-authority/san-francisco-oakland-bay-bridge (1 July, 2020).

36 "Golden Gate Bridge, Highway and Transportation District," undated, https://www.goldengate.org/ (1 July 2020).

37 "System Facts," BART, https://www.bart.gov/about/history/facts (1 July 2020).

38 Caltrain "System Map," Peninsula Corridor Joint Powers Authority (dba Caltrans), undated, https://www.caltrain.com/stations/systemmap.html (1 July 2020).

39 "About Us," "Facts and Figures," Alameda-Contra Costa Transit District (dba AC Transit), undated, http://www.actransit.org/about-us/facts-and-figures/ (1 July 2020).

"History of AC Transit," and "History of East Bay Public Transportation," AC Transit, undated, http://www.actransit.org/about-us/celebrating-ac-transits-50th-anniversary/ (1 July 2020).

40 "samTrans" (San Mateo County Transit District), undated, https://www.samtrans.com/home.html (1 July 2020).

The Golden Gate Bridge, Highway and Transportation District (GG), besides operating the bridge, operates bus service from Marin and Sonoma counties north of San Francisco to the SF CBD and Civic Center and ferry service from Sausalito, Larkspur, and Tiburon in Marin County to the Ferry Terminal at the foot of Market Street in the CBD.[41]

San Francisco Bay Ferry (SFBF) operates ferry service from the East Bay, from (north to south), Vallejo/Mare Island, Richmond, Oakland/Alameda, and Alameda Harbor Bay to the Ferry Terminal, with lesser service to Pier 41 near Fisherman's Wharf and the South San Francisco Ferry Terminal in northern San Mateo County, and event service to Oracle Park (San Francisco Giants, etc.) and the Chase Center (Golden State Warriors, etc.).[42]

3.2 WHAT COULD BUS TRANSIT IMPROVEMENT AND EXPRESS LANES CONTRIBUTE?

As discussed in Part 2, there are many plans for major upgrades to bus systems in the Bay Area, including several that cover topics included in this study. But many of the prior proposals, most specifically the previously discussed ReX plan and FASTER Bay Area, are based largely on the "transit center" concept, which includes a number of centralized transfer points, some at major rail and other transportation stations, others at major trip generators such as employment centers, civic centers, universities, and major health care facilities. Some now include or are proposed to include mid- or high-rise real estate development, potentially including residential, commercial, retail, and other uses. Many of the proposed ReX Express Lines make no or only a limited number of stops other than at major transit centers. While transit centers are certainly justified in many cases, they are often major real estate developments that require years to plan, gain approval, design, and build, and require major investment, often including significant taxpayer funding. As a result, very little action has been taken to implement any of these proposals.

41 "Riding the Bus," GG, undated, https://www.goldengate.org/bus/riding-the-bus/ (1 July 2020).
"Golden Gate Ferry Schedules," GG, undated, https://www.goldengate.org/bus/riding-the-bus/ (1 July 2020).

42 "San Francisco Bay Ferry," San Francisco Bay Area Water Emergency Transportation Authority, undated, https://sanfranciscobayferry.com/ (1 July 2020).

> *While transit centers are certainly justified in many cases, they are often major real estate developments that require years to plan, gain approval, design, and build, and require major investment, often including significant taxpayer funding. As a result, very little action has been taken to implement any of these proposals.*

This study takes a different approach. A key component of this proposal is bus service that will minimize transfers, which have long been recognized as a major negative to transit users.[43] Transfers take time, require mid-trip interruptions to move from vehicle to vehicle, add the risk of not making the connection, and often require that a passenger give up a seat on the first transit vehicle and have to stand on the next one, and the one after that. Focusing on reducing transfers at both ends of the origin-to-destination trip, this study proposes a combination of expanded long-haul bus service operating largely on the existing and emerging Express Lanes network, particularly including a proposed pair of Express Lanes on each of the major Bay bridges, beginning with the San Francisco-Oakland Bay Bridge.

Many major destinations justify direct service by long-haul commuter express buses. For a morning trip in-bound from, for example, East Bay to San Francisco, the same bus that provides local collector service (going through neighborhood streets in a more-or-less conventional manner, and/or a park-and-ride lot) would then proceed to, preferably, an Express Lane, or to a standard freeway where Express Lanes do not exist.

At the other end, local street bus service with the same buses that were used for express service can often be viable. In the case of San Francisco, service should not be limited to forced transfers at, or long walks from, the Salesforce Transit Center, which has limited capacity to handle a major increase in bus dockings anyway. Rather, those buses should operate on the streets in the CBD, serve the SF Civic Center, major health care destinations such as Zuckerberg San Francisco General Hospital and Trauma Center and the University

[43] Tara Bartee, "Transit Ridership, Reliability, and Retention—Final Report," Center for Urban Transportation Research, University of South Florida, October 2008 (https://www.nctr.usf.edu/pdf/77607.pdf, 40 and 104, (22 October 2020)

of California San Francisco, and special-event locations such as Oracle Park and Chase Center. Atlanta's relatively recent—beginning with a pilot in 2014—GRTA Xpress bus service from the outlying counties to central Atlanta is a good example of this type of service.[44]

Perhaps this study's most important new proposal, besides the Bay Bridge Express Lanes, is a pair of transfer stations on the Oakland side of the Bay Bridge between the toll plaza and the incline section, known collectively as the Bay Bridge Transfer Center (BBTC).

Perhaps this study's most important new proposal, besides the Bay Bridge Express Lanes, is a pair of transfer stations on the Oakland side of the Bay Bridge between the toll plaza and the incline section, known collectively as the Bay Bridge Transfer Center (BBTC). Using the BBTC, buses can serve multiple destinations in San Francisco efficiently.

This study also explores incorporating and even expanding transit service at existing transit centers, and building new ones where appropriate, to take advantage of low-hanging fruit—methods of improving transit service that can be done quickly, generally with only minor fixed facility capital funding requirements, and often without time-consuming environmental clearance reviews.

It is obviously not feasible to have dedicated bus routes from every origin in the East Bay to every destination in SF, so the question becomes how to handle this origin-destination link with minimum transfers.

The first step is to use standard transportation methods to identify the most common origin-destination pairs and begin by joining origins and destinations on the basis of the greatest good for the greatest number. Very likely, most origin-end route-pairs will have at

[44] "GRTA (Georgia Regional Transit Authority) Xpress," undated, https://www.atltransit.org/about/agencies/grta/ (20 October 2020)

least two SF destinations, one being Salesforce Transit Center and the other a different location, most commonly along the city streets in the CBD, the Civic Center, or the growing South of Market area.

Next, using well-established transportation route planning and scheduling methods, and professional judgment, establish a comprehensive set of express routes, including all origins and destinations, joined in the best available combinations of origins and destinations. This will not include every destination in San Francisco, just the ones that can attract the most ridership.

Then, for all (or at least most) routes, in both directions, schedule stops at the BBTC. This will be the opportunity for all travelers to destinations not directly served by the bus they are on to transfer to the bus that will take them to their final destination. Because the majority of all buses over the bridge will stop at the BBTC, the frequency of service will be high and the wait times for transfers low.

Because the majority of all buses over the bridge will stop at the BBTC, the frequency of service will be high and the wait times for transfers low.

On average, this methodology will reduce the number of transfers per origin-to-destination trip by approximately one. Best case, under the transit center concept, a transit rider that would have had to first board a collector route bus near his/her home, then transfer to an express bus at a transit center, and then to another bus or other transit mode at/near Salesforce, will be able to do a one-vehicle trip without any transfers. But where this isn't possible, for those that do change buses at BBTC, most will have one fast transfer rather than two that could likely require longer routes, changes in elevation between vehicle deboarding and boarding, and longer waits for the next vehicle.

In an ideal situation, the proper design and scheduling of service through the BBTC should result in few standees on the second bus. The number of buses coming in and going out will obviously be identical, so the total capacity in must be identical to the total capacity going out. The number of vehicles going to each destination will be based on actual travel

demand to each; therefore, the number of trips, and the carrying capacity, to each destination will be fine-tuned to match needs. This can never be done totally perfectly, of course, but the simplicity of the what-comes-in-must-match-what-goes-out design means that it is far easier to match capacity in this system than in the transit center system, particularly when the latter requires transfers between modes, or between different transit agencies that may not be fully motivated, or able, to operate the "proper" level of service.

This approach is very scalable. It can begin with relatively minor increases to existing bus service and then increase as demand increases and funds become available. Because this service will have lower costs than the rail and transit center plans, it will be easier to make additions. While it is best to start with a minimum viable network, focusing on service from specific East Bay communities, it is very easy to add additional community networks where and when appropriate, assuming funding is available. As service is added and the number of buses through the BBTC increases, transfer wait times will decrease.

Compared to the cross-Bay rail and transit center bus options, this would be very low risk, low cost, and quick to implement. Rather than devoting over $10 billion over a decade to ready a new rail line for revenue service, the initial capital investment for bus services is primarily the cost of the vehicles, plus the costs of the added operating and maintenance facilities. Routes can come on line as vehicles are purchased. In contrast, if the rail project goes over budget or over schedule, there is no real alternative to continually putting in more taxpayer dollars to complete it, or, if federal funding were used, to repay those funds. If there is borrowing against local taxes to finance construction, the debt service would still have to be paid.

This type of bus network is also flexible and customizable. It can be started with little more capital cost than the buses. If one bus line doesn't prove worthwhile, even after route, service, fare, marketing, and other modifications attempt to make it successful, it can be reduced. In the worst case, the route can be canceled and the buses and staff used on other routes. It is even possible to operate some or all of the initial routes with leased buses operated by contracted transit service providers with minimal governmental employees and investments in assets.

Such flexibility also allows for incremental adoption based on documented use. Investments in major fixed assets, such as the BBTC, can be delayed until there is proof of concept. The first bus lines can commence service and the users, decision-makers, taxpayers, and voters can see how well they are working before deciding to make more investments. In contrast, planning, designing, and constructing a rail tunnel under San

Francisco Bay would have to be done as a leap of faith, as there would be no ridership data until construction of the first usable component is completed, which, in this case, would be billions of dollars later.

The ability to add transit service quickly is one of the greatest reasons to make investigation of express bus service a priority for Transbay service, along with the ability to quickly apply lessons learned from implementing prior lines. It should be possible to operate the first new bus lines within two years of the "go" decision and a substantial amount of service within three years, with procuring and receiving new buses driving the timeline. Environmental clearance requirements under NEPA and CEQA would be minimal to non-existent until the fixed facility stage is reached, and the work and time required would likely be a fraction of that for a Transbay tube.

3.3 THE BAY BRIDGE ENHANCED BUS/EXPRESS LANES OPTION

3.3.1 THE SERVICES TO BE OPERATED

> *Highly-utilized bus lanes have a well-proven record of carrying more passengers past a point per hour than the approximately 21,000 (peak hour, peak direction) that BART now carries through the Transbay Tube.*

Highly-utilized bus lanes have a well-proven record of carrying more passengers past a point per hour than the approximately 21,000 (peak hour, peak direction) that BART now carries through the Transbay Tube. The exclusive bus lane from New Jersey to the Port Authority Bus Terminal in Manhattan has, for decades, handled well over 700 buses per hour, with average peak-hour/peak-direction passenger loads of approximately 40 riders, approaching 30,000 passengers/hour.[45]

[45] All data are from the National Transit Database, "Profile" for each reporter, for the 2018 reporting year, Federal Transit Administration at https://cms7.fla.dot.gov/ntd/transit-agency-profiles, 2 July 2020.

Similar loads, of course, will not be achieved on the day Bay Bridge Express Lanes are placed into operation or perhaps ever. But, the applicable question to begin with is, can a Bay Bridge Express Lane show a *passenger throughput* improvement over the capacity of a general-purpose lane, resulting in an increase in the total capacity of all five Bridge lanes? Peak-hour, peak-direction, the five Bay Bridge lanes handle ~9,300 vehicles,[46] or approximately 1,860 vehicles/lane/hour. CCTS reports that there were 10,000 people in those cars plus 2,700 in AC Transit and Westcat buses in 2015.[47]

The next step is to calculate the break-even point, the number of passengers, and the buses to carry them, that must be exceeded to make it worthwhile to convert a general-purpose lane on the Bay Bridge to an Express Lane to produce increased mobility. This will be done first on the basis of passengers past a point, peak-hour, peak-direction. This deliberately tilts the assumptions and calculations to set the bar higher, requiring higher bus ridership to justify the conversion to an Express Lane.

The next calculation is the number of buses now on the Bay Bridge, peak-hour, peak-direction, to carry the 2,700 passengers using this 2015 value from CCTS, even though AC Transit transbay ridership increased 30% from 2015 to 2018.[48] A CCTS component paper reported 66 peak-hour buses with a carrying capacity of 2,901 passengers[49] operating at

Commuter Bus data are for eight transit operators: Academy Lines, Inc.; Community Transit Inc.; DeCamp Bus Lines, Hudson Transit Lines, Inc.; Lakeland Bus Lines, Inc.; Olympia Trails Bus Company, Inc.; Rockland Coaches, Inc.; and Suburban Transit Corporation. Community Transit and Olympia Trails, which together carry 6.4% of unlinked passenger trips, do not report passenger-miles to the National Transit Database; they are omitted from the cost/fare/subsidy per passenger-mile and average trip length statistics.

46 "2017 Traffic Volumes: Route 71-80," peak hour at Route 80 at San Francisco/Alameda County Line (which is in the Bay Bridge East Span), California Department of Transportation (Caltrans), undated, https://dot.ca.gov/programs/traffic-operations/census/traffic-volumes/2017/route-71-80 (28 June 2020).

47 "Bay Area Core Capacity Transit Study," MTC, September 2017, https://mtc.ca.gov/sites/default/files/CCTS_Final_Report.pdf, (28 June 2020).

48 Report to the Board of Directors, "Transbay Ridership," AC Transit, 14 October 2015, http://www.actransit.org/wp-content/uploads/board_memos/15-191%20Transbay%20Ridership.pdf, (2 October 2020); Report to Board of Directors, "2018 Annual Ridership and Route Performance Report," 24 October 2018, http://www.actransit.org/wp-content/uploads/board_memos/18-241%20Annual%20Ridership%20Report%202018%20-%20WEB.pdf, (2 October 2020).

49 Aidan Hughes *et al*, Arup, for MTC, "Core Capacity Transit Study Memorandum, 23 May 2016, Table B2, "Transbay Peak Direction Screenline Core Capacity – Existing Conditions (2015)," MTC, https://mtc.ca.gov/sites/default/files/CCTS_TransbayCapacityandDemandSummary_FINAL.pdf (28 June 2020).

94% seated capacity utilization to carry 2,711 passengers,[50] for an average occupancy per bus of 41 riders.

Next, the number of cars and buses must be allocated to the proposed Express and general-purpose lanes. A standard assumption is that a bus operating on the Bay Bridge during peak hour will have a personal car equivalent (PCE) factor of 1.5 (one bus requires the dynamic space of one-and-one-half personal cars).[51] Multiplying the 66 buses by the 1.5 factor, that's 99 PCE. Assuming no trucks during peak hour (another simplifying assumption), that leaves 9,201 autos, carrying 10,000 passengers, for an average passenger load of 1.086. Assuming all the buses use the same lane, that means that the 1,860 PCE in that lane will be 66 buses carrying 2,711 passengers and 1,761 automobiles carrying 1,914 passengers.

So, to exceed the break-even point, to convert this lane to an Express Lane, how many buses must be added to exceed the 1,914 passengers carried in the cars? To make the calculation more difficult for this proposal to meet, the starting average load factor will be only 20 passengers/bus, which would require 96 additional buses, for a total of 162 buses.

However, 162 buses per hour is only one bus every 22 seconds. No matter how definitive the mathematical transportation engineering proof that the Express Lane is generating more transportation work than the former general-purpose lane, drivers in the other four lanes will likely not be very pleased seeing big gaps between buses while they themselves are traveling at well under the 50-mph speed limit, which is one reason why this proposal is for *Express Lanes*, not dedicated bus-only lanes, because Express Lanes will have users besides buses.

The authorized users of the Express Lanes will include, in the following order of priority:

- First Priority: full-sized bus (as it is almost impossible to conceive of total bus transit service exceeding the capacity of the Bay Bridge Express Lane, there is no real importance to the order of presentation for "First Priority" vehicles):
    - Transit buses, including those operated by purchased transportation service providers and unsubsidized private transit operators

[50] Ibid, 10, Table 8, "Peak Hour, Peak Direction by Mode and Year," (28 June 2020).

[51] Transportation Research Board, Special Report 209, *Highway Capacity Manual, Third Edition, Updated 1997*, Washington, D.C., National Research Council, 1998, Table 7-7, "Passenger-Car Equivalents on Extended General Multilane Highway Segments," 7-12.

  - New transit lines by these transit operators.
  - Intercity bus service operated by private bus companies, such as Greyhound.
  - Other bus service, such as school buses and club buses operated by employers and authorized charter and tour bus services (the latter perhaps charged a fee).
- Second Priority: SuperHOV (HOV-4 or greater) vehicles, including smaller transit buses and vanpools.
- Third Priority: HOV-3s paying a discount toll (in the same manner as such vehicles now get a discount on the basic Bay Bridge toll),
- Fourth Priority: All others, including single-occupancy vehicle drivers who need a faster and more reliable trip, will be able to use the Express Lane by paying the market rate, which will vary with demand as on the other Bay Area Express Lanes, and as indicated on variable message signs in advance of the entry points on the bridge Express Lanes.

The ideal would be to continually increase the number of buses using the Express Lane during peak hours until capacity is reached, which is likely somewhere close to or over 1,000 buses/hour (which is very unlikely to ever be approached).

The ideal would be to continually increase the number of buses using the Express Lane during peak hours until capacity is reached, which is likely somewhere close to or over 1,000 buses/hour (which is very unlikely to ever be approached). While the number of buses is increasing from the low initial base as demand and service increase, the Express Lane capacity that is not required for buses (after a fudge factor to absorb delays) will be offered to other users, in the priority order listed previously.

Use of the Express Lanes will be tracked via the existing California FasTrak system to ensure that vehicles using the Express Lane are allowed to be there and, as appropriate, properly charged. For vehicles not equipped with FasTrak, the more costly back-up will be video enforcement to record license plate numbers and identify the vehicle owners to be

charged the higher non-FasTrak fee. The data will also be used to record usage data in real time and to dynamically alter the Express Lane toll based on capacity and usage.

There will be little change to the current responsibilities for managing the Bridge and transit services on and coordinating with it. Caltrans, which owns the Bridge, will continue to operate it, coordinating with the Bay Area Toll Authority (BATA) and Bay Area FasTrak for toll setting and collection. Each transit agency will operate its own transit service, preferably in close coordination with the other transit agencies, Caltrans, and MTC/BATA.

> *To the extent that excess capacity exists after transit and HOV-3s, single-occupancy vehicle drivers who have a need for speed will be able to use the Express Lane by paying the market rate.*

To the extent that excess capacity exists after transit and HOV-3s, single-occupancy vehicle drivers who have a need for speed will be able to use the Express Lane by paying the market rate. This rate, depending upon demand, might range from a minimum of a few dollars on top of the basic bridge toll to significantly higher as demand approaches capacity, as will be clearly indicated on signs on the Bay Bridge approaches and at the entrances to the Express Lanes. These fees, along with the revenues for citations for violators, will go first to the costs of operating and enforcing the Express Lane, including the capital costs, and then to subsidize the costs of the long-haul commuter express bus services.

In justifying conversion of a general-purpose to an Express Lane, the first calculation was based on passengers past a point. It showed that converting a general-purpose lane on the Bay Bridge to an Express Lane could be justified if passengers carried in buses (and other higher occupancy vehicles) exceeded those formerly carried in autos, which appears eminently possible.

However, there is a second standard calculation methodology—that of "transportation work," calculated as units past a point per hour times speed.[52] The metric for human transportation is passenger-miles per hour. By operating the busway as an Express Lane, accessible to other higher-occupancy vehicles and those willing to pay a premium price to use it as single/low occupancy vehicle, and specifically targeting higher speeds of travel, the passenger-miles of the Express Lane will far exceed that of the general-purpose lanes, first through the number of passengers past a point, and second through higher speed of travel.

This service will be designed and marketed as premium service, combining fast and convenient travel with creature comforts and special features. For example, AC Transit's double decker buses are equipped with upholstered seats, reclining upper deck seats, footrests, and Wi-Fi, and the panoramic views are worthy of a sightseeing tour.[53] The Express Lanes not only reduce the travel time, but their resistance to congestion produces more consistent time of travel, as well.

Caltrans has opined that a dedicated bus lane on the Bay Bridge would not be worthwhile because it would save only approximately five minutes of travel time for the buses.[54] While the exact derivation of the five-minute savings is not available, this conclusion appears reasonable for average conditions, based on the author's own observations and calculations. Caltrans also stated, quite correctly, that buses save far more time than five minutes from being able to use the Busway/HOV lanes at the sides of the toll plaza, bypassing the back-ups to pay tolls and going around the lane-metering lights.[55] (Obviously, this only applies to westbound trips into San Francisco; not trips going eastbound.)

However, what can be at least as important as the absolute value of the time saved is the consistency (reliability) of travel time: Small, Winston, and Yan found in 2005, "… motorists exhibit high values of travel time and reliability, and substantial heterogeneity in those

52 Vukan Vuchic, *Urban Public Transportation – Systems and Technology*, Englewood Cliffs, New Jersey, Prentice-Hall, 1981, Chapter 7, "Transit System Performance: Capacity, Productivity, Efficiency, and Utilization," 516-591.

53 "Double Deckers are Rolling," AC Transit, http://www.actransit.org/doubledecker/ (26 April 2020).

54 Nico Savidge, "Bay Bridge bus lane: A lot of traffic pain for little rider gain?" *San José Mercury-News*, 27 January 2020, https://www.mercurynews.com/2020/01/27/bay-bridge-bus-lane-a-lot-of-traffic-pain-for-little-rider-gain/ (1 July 2020).

55 Ibid.

values."[56] In their evaluation of the I-405 Express Toll Lanes in the Puget Sound area, Leung et al. concluded: "Reliability is as valuable as time savings in the morning, while time savings are much more valuable than reliability in the afternoon."[57]

> *Caltrans is correct that most delay in crossing the Bay Bridge, particularly in the weekday morning peak periods, occurs in the approaches to the toll plaza and going through the metering lights.*

Caltrans is correct that most delay in crossing the Bay Bridge, particularly in the weekday morning peak periods, occurs in the approaches to the toll plaza and going through the metering lights. Once the bridge proper is reached, congestion is reduced (although certainly not eliminated) and travel speeds increase.

Unfortunately, many California and Bay Area HOV lanes, including the I-80 HOV lane in Southern Contra Costa and all of Alameda County approaching the Bay Bridge lanes in both directions, are already "extremely degraded," the worst ranking.[58] In a 2017 Caltrans report, the I-80 specific "Recommended Strategies" for improvement focus on enforcement actions against violators and mention future conversion to express lanes,[59] and the introduction mentions "consider(ation) of increasing minimum occupancy for certain HOV facilities to mitigate degradation."[60]

56 Kenneth Small, Clifford Winston, and Jia Yan, "Uncovering the Distribution of Motorists Preferences for Travel Time and Reliability," *Econometrica*, 2005, 73 (4), 1367-1382, https://onlinelibrary.wiley.com/doi/abs/10.1111/j.1468-0262.2005.00619.x (20 September 2020).

57 Mark Hallenbeck, et al., "I-405 Express Toll Lanes: Usage, Benefits, and Equity, University of Washington eScience Institute, 2020 (https://www.depts.washington.edu/trac/bulkdisk/pdf/I-405ExpressTollLanesDSSGEquityFinal.pdf, (20 September 2020)

58 Jasvinderjit Bhullar, Chief, Divisions of Traffic Operations, Caltrans, "2017 California High-Occupancy Vehicle (HOV) Facilities Degradation Report and Action Plan," Caltrans, 8 November 2018, https://dot.ca.gov/-/media/dot-media/programs/traffic-operations/documents/managed-lanes/f0019528-2017_hov_degradation_report_action_plan-a11y.pdf, Figure 4, "District 4 (Bay Area) Map of Degraded HOV Facilities," page 15, and "Latest 5-Year Degradation Status,' page 17 (20 September 2020).

59 Ibid, 4.

60 Ibid, 5.

Similarly, eastbound congestion, such as in the evening commute home, is the worst at the ends of the Bay Bridge. In San Francisco, the majority of the traffic has to be compressed into only three lanes at the bottleneck just before the last San Francisco Bay Bridge on-ramps, which allows higher speed on the Bridge proper once past the bottleneck. Delays are also the rule on the Oakland side where exiting travelers divide between I-80, I-580 North and South, I-880, and local street off-ramps. The temporarily faster speeds for eastbound Bridge traffic are somewhat offset by congested conditions at these exits.

But the higher speeds on the Bridge proper are fragile. If there is a bad day, the time required on the Bay Bridge itself can increase significantly. With an Express Lane, this type of delay can be reduced or even eliminated for the travelers in the Express Lane, which would make bus travel across the Bay Bridge far more advantageous. For SOVs in the need for speed, it would make HOT lane charges more valuable, producing additional toll revenues that can be used for improved transit. One element of the comprehensive Express Lane network to and from I-80 is already in place at the Oakland end of the Bay Bridge. If and when others are completed, being able to avoid delays on the travel over the Bay Bridge proper could eliminate a major share of total congestion time uncertainties.

3.3.2 EVIDENCE FROM ELSEWHERE

This type of bus service commonly has among the highest farebox recovery ratios and the lowest taxpayer subsidies, particularly per passenger-mile, of any transit mode. This service will be primarily positioned as premium service for mostly longer trips (the minimum road trip length from the East Bay to San Francisco is approximately eight miles), which will carry a premium fare after the initial roll-out of service on each new line (besides the ADA senior and disabled and student/youth discount fares, other discount fare programs could be made available for other riders, as appropriate).

This project would operate similarly to that provided for decades by the long-haul commuter bus service operators into the Port Authority Bus Terminal in Manhattan. Table 3 is a statistical comparison of this bus service, and that of New Jersey Transit Corporation (NJTransit) commuter rail service. The bus service is comparable to what is proposed for the Bay Bridge.

TABLE 3: NEW JERSEY LONG-DISTANCE TRANSIT SERVICES MODAL OPERATING STATISTICS 2018

	Commuter Bus	NJTransit Commuter Rail
Reported Statistics		
Operating Expenses	$192,295,040	$1,016,958,264
Fare Revenue	$169,048,871	$561,748,246
Unlinked Passenger Trips	16,581,341	87,059,367
Passenger-Miles	575,131,248	2,148,539,449
Revenue Vehicle-Hours	1,089,088	1,889,904
Revenue Vehicle-Miles	30,619,190	62,182,061
Fares & Directly Generated Revenue[61]	$192,490,047	$656,020,870
Calculated Performance Indicators		
Average Trip Length (miles)	34.7	24.7
Average Operating Speed (miles per hour)	28.1	32.9
Average Passenger Load	18.8	34.6
Farebox Recovery Ratio	87.9%	55.2%
Operating Ratio (Op Ex/Fare & Dir Gen Rev)	100.1%	64.5%
Cost per Passenger	$11.60	$11.68
Fares per Passenger	$10.20	$6.45
Subsidy per Passenger	$1.40	$5.23
Cost per Passenger-Mile	$.334	$.473
Fare per Passenger-Mile	$.294	$.261
Subsidy per Passenger-Mile	$.040	$.212

Source: All data from National Transit Database, "Profile" for each reporter, for the 2018 reporting year, Federal Transit Administration, https://cms7.fta.dot.gov/ntd/transit-agency-profiles (2 July 2020). Commuter Bus data is for eight transit operators, Academy Lines, Inc.; Community Transit Inc.; DeCamp Bus Lines, Hudson Transit Lines, Inc., Lakeland Bus Lines, Inc.; Olympia Trails Bus Company, Inc.; Rockland Coaches, Inc.; and Suburban Transit Corporation. Community Transit and Olympia Trails, which together carry 6.4% of unlinked passenger trips, do not report passenger miles to the National Transit Database; they are omitted from the cost/fare/subsidy per passenger-mile and average trip length statistics.

From Table 3, it can be fairly concluded that the service provided and consumed for Commuter Bus (CB) and NJTransit Commuter Rail (CR) passengers is similar: long-haul, primarily peak period, suburb-to-central-city commutes. The average CB ride is 40% longer,

[61] Ibid. Directly Generated operating revenue, which is directly generated by transit operations, primarily consists of advertising on transit vehicles and in transit stations and parking. Directly Generated is reported only in total for NJTransit. For purposes of this analysis, the total NJTransit Directly Generated revenue was allocated to Commuter Rail. NJTransit Commuter Rail accounted for 46.9% of total operating expenses and 57.6% of total fares in 2018; so, this 100% allocation is obviously an overstatement.

but this is due, in large part, to the CR passengers that transfer in Newark to the Port Authority Trans-Hudson (PATH) heavy rail line to the six Manhattan (and seven New Jersey)[62] stations that get them closer to their ultimate destinations rather than Penn Station, the sole Manhattan CR stop, and the CR New Jersey stations.[63] Another reason for the longer CB trips is that some CB routes provide local collector service before transitioning to long-haul express service. Still others are express for less than half of the route,[64] which also partially explains why the CR average operating speed is 17% higher.

The average fares per passenger-mile are also similar, with CB 13% higher. But CB costs are 29% lower per passenger-mile, which leads to CB subsidies being 73% lower per passenger and 81% lower per passenger-mile. Indeed, if non-fare operating revenues like advertising and parking are included, these eight CB operators, in total, actually broke even in 2018, with a 100.1% operating ratio, compared to a very generously calculated 64.5% for CR.

NJTransit's CR service is well regarded; indeed, its 55.2% farebox recovery ratio for 2018 exceeded the industry average of 48.5%.[65] The 87.9% weighted average farebox recovery ratio for the CB service is among the highest in the nation, as both CB and CR benefit from the same high-density land use at both ends of the trip, coupled with very well-established trip patterns.

It is very common, nationally, for commuter bus service to have higher farebox recovery ratios than non-commuter bus, as illustrated in Table 4.

62 Port Authority Trans Hudson "Service Maps," Port Authority of New York and New Jersey, undated, https://www.panynj.gov/path/en/schedules-maps.html (2 July 2020).

63 (Commuter Rail) "System Map," New Jersey Transit Corporation, undated, https://d2g63oyneaimm8.cloudfront.net/sites/default/files/2020-03/Rail_System_Map.pdf, (2 July 2020).

64 "Commuter Map," Academy Lines, Inc., *Website*, undated, http://www.academybus.com/Commuters/Map.aspx, (2 July 2020).

65 "2020 Public Transportation Fact Book," American Public Transportation Association, *Website*, 2020, https://www.apta.com/wp-content/uploads/APTA-2020-Fact-Book.pdf "National Totals for Selected Modes, Report Year 2018," 4. (2 July 2020).

TABLE 4: URBAN AREAS WITH COMMUTER AND NON-COMMUTER BUS SERVICE 2018

Area	State	Name	Farebox Recovery %	
			CB	Non-CB
Ann Arbor	MI	Ann Arbor Area Transportation Authority	78.3%	15.8%
Lancaster	CA	Antelope Valley Transit Authority	53.6%	17.0%
Austin	TX	Capital Metro Transportation Authority	12.8%	11.4%
Cobb Co.	GA	CobbLine	18.1%	22.3%
Lawrenceville	GA	Gwinnett County Transit	27.1%	16.6%
Houston	TX	Metropolitan Transit Authority of Harris Co.	35.2%	9.0%
Los Angeles	CA	City of LA Department of Transportation	26.9%	11.2%
Northern Virginia	VA	Potomac and Rappahannock Transportation Commission	57.8%	11.3%
Oakland	CA	AC Transit	22.7%	15.9%
Roseville	CA	Roseville Transit	55.8%	6.2%
Santa Clarita	CA	Santa Clarita Transit	30.2%	12.9%
Seattle	WA	Sound Transit	27.5%	
		King County Metro		25.4%
Everett	WA	Community Transit	78.2%	10.8%
Vallejo	CA	Solano County Transit	42.1%	12.6%
Pinole	CA	Western Contra Costa Transit Authority	61.1%	14.4%
Simple Averages			**41.8%**	**14.2%**

Source: National Transit Database, 2018 Profiles. Unfortunately, not all transit agencies that operate commuter bus service report it, or do not properly report it; therefore, the systems included are somewhat arbitrary; the selection of those reported is largely based on those with what appears to be reasonable data.

With good planning, and proper start-up and operation, this type of premium bus service can be operated in the Bay Area with high farebox recovery ratios and low taxpayer subsidies.

3.3.3 THE TRANSITION

The type of bus service being discussed could begin implementation in a matter of years, not decades. It can start with improvements to existing bus lines and then add lines consistent with demand and opportunities over a period of time. Each new line added and or existing line changed provides ever more information as to the costs, opportunities, and potential issues for the next new line.

As discussed previously, if a new route is not successful, even after a period of time and attempts to make it work better through marketing/promotion, changes to the service, reduced service, etc., it can be abandoned and the buses, operators, and fixed facilities diverted to other routes. And all components, to include the BBTC, can be delayed until initial rollout provides proof of demand.

Ideally, a number of routes identified as high-performance would be rolled out at the same time that the Express Lanes on the bridge are started. As proof of concept is established, then and only then would the program move on to the facility changes:

- The Bay Bridge Transfer Center, between the toll plaza and the incline section, where riders can rapidly change between buses that picked them up from near their East Bay homes and origin points to buses that will take them directly to their San Francisco job and other destinations, and vice versa;
- Bus maintenance and operating facilities.

Planning and design on these routes and facilities can be initiated quickly, but the construction decisions can wait a while.

As previously stated, a major component of this program should be the encouragement of direct service to a variety of destinations in San Francisco. Mainly, this will provide better transit and generate more ridership. Also, if this concept is fully developed, the buses entering San Francisco could exceed the assumed 300 buses/hour[66] capacity of the Salesforce Transit Center to handle the traffic. Given that the upper, long-distance bus bay is configured for 36 bus boarding bays,[67] (not including the five bus bays at street level fully utilized by Muni buses[68]), this would require one bus per bay slightly over every seven minutes, which may not be high compared to the Port Authority Bus Terminal in Manhattan, which most of those New Jersey buses serve. Port Authority handles over 700 buses/hour at 197 bus gates on five levels.[69] Besides the obvious design of good transit service to attract more riders, this is why bus operations to other than the Salesforce Transit Center should be carefully studied.

---

66 CCTS, "Table 11, Long-term options service, capacity, and capital cost estimates," 47, 2 October 2020.

67 Station Map – Salesforce Transit Center – Bus Deck, AC Transit http://www.actransit.org/wp-content/uploads/STC-BusDeck.pdf, (2 October 2020).

68 "Station Map – Salesforce Transit Center –Street Level," AC Transit, *Website*, http://www.actransit.org/wp-content/uploads/STC-StreetLevel.pdf, (2 October 2020).

69 Port Authority of New York and New Jersey, Port Authority Bus Terminal Maps, https://www.panynj.gov/bus-terminals/en/port-authority.html (2 October 2020).

3.4

DESIGN, IMPLEMENTATION, AND OPERATIONS CHALLENGES

There are many potential challenges to the new kind of transportation services being proposed in this study. The following subsections discuss each one briefly.

3.4.1 BRIDGE EXPRESS LANE LAYOUT/SAFETY

The physical layout of the proposed Bay Bridge Express Lane will present challenges, including safety issues. While proposed contraflow lanes have their own problems (see subsection 3.4.6), this discussion assumes that the Express Lanes would be the right lanes in each direction on the Bay Bridge, i.e., on the north side in-bound to San Francisco, on the south side traveling to Oakland.

3.4.2 TREASURE ISLAND ON- AND OFF-RAMPS

The westbound on- and off-ramps for Treasure Island (TI) and Yerba Buena Island are from and to the rightmost lane, the most northern, the same lane that would be best to convert to an Express Lane to San Francisco. If that lane were the Express Lane, a lot of traffic would be crossing through the Express Lane, particularly since TI is already in the midst of major development. The on-ramp from TI to San Francisco is an obsolete design, with a stop sign only a few feet from the active lane with absolutely no acceleration ramp at all. If the Express Lane works and vehicles are moving at a good pace, this could be a safety *and* capacity concern without any evident solution that would not be extremely complex and expensive. Yet, that same on-ramp has been there for 84 years, so, evidently, drivers have figured out how to handle it.

Going east to Oakland, the off-ramp to Treasure Island is an obsolete design on the left (north) side, but it will not have any direct impact on an Express Lane to Oakland on the right side. Wisely, Caltrans took advantage of the Bay Bridge east span reconstruction to provide longer, straighter, and safer on- and off-ramps to and from Oakland. These are long enough to provide a safe transition to/from freeway speeds to a dead stop and vice versa.

Drivers accessing or leaving TI will almost certainly want to maximize their time in the Express Lanes because they will be moving faster than the general-purpose lanes. Hence, the Express Lanes will require clearly marked limits to their use so that motorists not

wishing to be charged know where to exit to the general-purpose lanes. Since it is not feasible to allow a non-tolled starting period to allow people to get familiar with the new way of operations, some amount of driver negative feedback will likely occur. The public information and on-road signage and communication must be early, extensive, and continuing.

3.4.3 TOLL PLAZA LEFT BUSWAY/HOV LANE CROSSOVER TO EXPRESS LANE

While most buses entering the Bay Bridge from the East Bay go through the HOV lanes on the right (north) end of the toll plaza, some use the HOV lanes on the left (south) end. These buses will have to move over at least four lanes to the right to gain access to the Express Lane, barring major new construction of a fly-over lane.

3.4.4 SALESFORCE TRANSIT CENTER CROSSOVER TO EASTBOUND EXPRESS LANE

From the Salesforce Transit Center eastbound to Oakland, buses would have to travel though the general-purpose lanes to reach the Express Lanes on the right (southern) side. Accessing Treasure Island from San Francisco will require buses using the right-side Express Lane to move over four lanes to access the left-side off-ramp. It may turn out to be better if eastbound buses to Treasure Island simply stay in the left-most lane and not utilize the Express Lane.

3.4.5 IMPRACTICALITY OF SAFETY BARRIERS SEPARATING LANES

Separating the Express Lanes from the general-purpose lanes by barriers, like the very successful Golden Gate Bridge Movable Median Barrier,[70] is not practical for many reasons, one of which is that collisions and other emergencies on the Bridge require vehicles to change lanes to get around disruptions. A fixed barrier that would produce an isolated single lane would make it difficult to recover from any breakdown and extremely difficult to recover from any type of a collision. For example, how could a tow-truck reach a disabled vehicle, given a miles-long back-up on the Express Lane? If there are no physical

[70] "Movable Median Barrier," Golden Gate Bridge, Highway and Transportation District, undated, https://www.goldengate.org/bridge/bridge-operations/moveable-median-barrier/ (14 April, 2020).

barriers, then trying to keep vehicles that should not be, and do not want to be, in the Express Lane from entering it comes down to design, education, and enforcement. There is clear evidence that Express Lanes separated only by pavement stripes are working well elsewhere in the Bay Area and across the country, though never perfectly.

3.4.6 CONTRAFLOW LANE

A contraflow bus lane to San Francisco (a bus lane traveling in the opposite direction from the other lanes) has been proposed at various times over the years, generally on what is now the far-left, northernmost lower-level eastbound lane[71] because that would have the best access to the Salesforce Transit Center.

Any consideration of a contraflow lane on the Bay Bridge would absolutely require a physical barrier, with the accompanying problems discussed above. Also, the contraflow lane proposal has been solely for the to-San Francisco, westbound morning commute; this has never been proposed for eastbound travel.

3.4.7 HOV ON-RAMPS OVERLOAD

On-ramps to existing HOT/HOV lanes throughout the Bay Area are often overloaded, which can add minutes to each bus trip. Many on-ramps are two-lane, one allowing HOVs (and buses) to bypass ramp metering, but buses are frequently delayed getting to the bypass lanes. Other than dedicated Express Lane on-ramps, which are expensive and generally difficult to provide due to the existing built environments, there are limited good solutions apparent. Even where built, buses can still be delayed in access due to back-ups from other authorized (and unauthorized) users. Whatever can be done, within practical limits, should be done to extend the HOV-only lanes and on-ramps.

[71] Michael Cabanatuan, "Wrong-way bus lane: right fix for Bay Bridge jams?," SFGate, *San Francisco Chronicle,* 17 May 2015.

3.4.8 ENVIRONMENTAL CLEARANCE PROCESS FOR PROPOSED BAY BRIDGE TRANSFER CENTER (BBTC)

The proposed westbound BBTC, to be located off the existing roadways into the Bay on the westbound side, would, in the absence of special permission from the California Legislature, have to go through the CEQA process. This should be assumed necessary for the eastbound component as well, even if it is to be located on existing dry land and replacing little-used industrial facilities, particularly since the additional costs and delays of adding the eastbound to the westbound CEQA process and documentation would be relatively small extra work. If federal funds were to fund the BBTC or other cost of what is herein proposed, then NEPA would almost certainly apply. In the past, however, MTC has proven very successful in shifting funds to finance major capital projects, so it is certainly possible for such a project to not be subject to NEPA.

California Gov. Gavin Newsom recently signed into law SB288 (Weiner, d-11, San Francisco), "California Environmental Quality Act: Exemptions: transportation-related projects,"[72] which "… would further exempt from the requirements of Ceqa certain projects, including projects for the institution or increase of new bus rapid transit, bus, or light rail services on public rail or highway rights-of-way, as specified, whether or not the right-of-way is in use for public mass transit, as specified, and projects for the designation and conversion of general purpose lanes, high-occupancy toll lanes, high-occupancy vehicle lanes, or highway shoulders, as specified."

While this appears to offer an exemption to most of the potential projects proposed in this study, "the bill would repeal the above-described exemptions on January 1, 2023."[73] Use—or abuse, depending on one's point of view—of the CEQA process to delay or stop projects or to force concessions favorable to those filing CEQA claims, has been a matter of intense discussion for many years and, while consensus on systemic revision has yet to develop, sponsors of some projects have been able to work with members of the legislature to gain statutory exemptions from CEQA, and this may be an example of such.[74] Given that this bay

72 "SB-288 California Environmental Quality Act: Exemptions: Transportation-Related Projects.(2019-2020)**,"** California Legislative Information, 4 September 2020, http://leginfo.legislature.ca.gov/faces/billnavclient.xhtml?bill_id=201920200sb288, (30 September 2020).

73 Ibid.

74 Carly Graf, "New law makes sustainable transit easier, faster and cheaper to implement," *San Francisco Examiner*, 28 September 2020, https://www.sfexaminer.com/news/new-law-makes-sustainable-transit-easier-faster-and-cheaper-to-implement/, (30 September 2020).

bridge express lanes proposal is still in its very early stages, the full project development process is unlikely to be sufficiently developed to employ this exclusion in less than approximately 23 months. While a comprehensive revision of CEQA or special CEQA exemption legislation might be possible, it would be unwise to assume that these will occur.

As described in section 4.2, the likely organization for managing the proposed project from scope to planning to design to construction to implementation to operation will likely be a multi-agency body structurally similarly to the body established for the Core Capacity Transit Study. Assuming it goes forward, public outreach and environmental clearance will be an important part of that process. Caltrans, as the owner and operator of the Bay Bridge and most of its connections, will likely be the designated responsible entity for the NEPA/CEQA process, whatever it might be, likely with MTC/BATA having a major role in financing the work.

3.4.9 POSSIBLE LEGAL PROBLEMS WITH TOLLING AN INTERSTATE HIGHWAY

An attorney experienced in the field should be engaged early to ensure that an Express Lane on the Bay Bridge would be unquestionably legal. The Bay Bridge is part of I-80 and there is a general prohibition in law against tolling portions of the Interstate Highway System.[75] This is unlikely to be a problem for several reasons. First, there is a statutory exception for toll roadways and bridges that were built and operated prior to their being included in the Interstate Highway System, which is the case with the Bay Bridge. Second, part of the MTC Express Lane plan is dozens of miles of such lanes on I-80, I-580, I-680, and I-880 (Figure 7, "MTC Full Build-Out Express Lane Plan"). Third, California is a long-time participant in FHWA's Value Pricing Pilot Program, which encourages transportation agencies to use variable pricing to control congestion.[76] Under this program, freeway operators may implement variable pricing on congested general-purpose lanes of Interstate

[75] "MAP-21 – Moving Ahead for Progress in the 21st Century, Guidance General Tolling Programs," Federal Highway Administration, undated, https://www.fhwa.dot.gov/map21/guidance/guidetoll.cfm (16 April 2020).

[76] Value Pricing Pilot Program, https://fhwa.dot.gov/ipd/tolling_and_pricing/tolling_pricing/vppp.aspx, (20 October, 2020).

highways for congestion-control purposes. Oregon DOT is under way obtaining final FHWA approval to do so on portions of I-5 and I-205 in the Portland area.[77]

3.4.10 TOLL ENFORCEMENT WILL REQUIRE CAREFUL PLANNING AND IMPLEMENTATION

Since toll authorities have been dealing with similar issues for decades, and FasTrak has been operating on Bay Area bridges and Express Lanes for over a decade, and the Bay Area toll booths will be gone before the Bay Bridge Express Lanes go in, there is a large body of experienced specialists, best practices, and lessons learned. Problems of enforcing HOV occupancy level and toll collection are no different from those being dealt with routinely on the Bay Area's existing Express Lanes.

[77] "FHWA Letter Lays Out Rules for Oregon DOT Highway Tolling Initiative," *AASHTO Journal*, 18 January 2019.

PART 4

RECOMMENDATIONS

4.1 IMPLEMENT LONG-HAUL HIGH-SPEED BUS SERVICE ON EXPRESS LANES

This study's primary recommendation is that long-haul commuter express bus service, operating on Express Lanes wherever possible, be given a through and unbiased professional review as a means of improving surface transportation in the San Francisco Bay Area. This should be done in comparison to other options, which, for transit, are primarily passenger rail plus ferry service.

The primary focus of this study is the Transbay corridor, including the conversion of one lane in each direction on the San Francisco-Oakland Bay Bridge to Express Lanes and the construction of a pair of transfer stations between the Bay Bridge toll plaza and the incline section. The other transit options are another BART tube and/or an electrified commuter/intercity rail tunnel and the completion of the Caltrain track to the Salesforce Transit Center.

The express bus routes should take every advantage of existing, in-construction, and emerging components of the MTC Express Lanes network. Further, the provision of the greatest benefit to riders on this bus service should be properly evaluated in coordination with the other factors that go into the scheduling decisions. Also, closing gaps in the planned Express Lanes network should be studied, even if potential bus service on these

lanes is not currently seen as significant, including the following road corridors (listed in numerical route order in Table 5).

TABLE 5: STUDY CORRIDORS FOR EXPRESS LANES AND EXPRESS BUS SERVICE

Corridor	To Be Studied For	
	Express Lanes	Express Bus
California State Route 4 from Antioch to I-80	X	X
California State Route 24/I-980 from Walnut Creek to I-880	X	X
I-80 from Sacramento to the Carquinez Bridge	X	X
I-80 from over/from the Carquinez Bridge to current I-80 Express Lane	X	X
I-80 from Oakland to San Francisco over Bay Bridge	X	X
California State Route 84 from I-880 in Hayward to US 101 San Mateo	X	X
California State Route 92 from I-880 in Hayward to US 101 San Mateo	X	X
US 101 from Marin County to San Francisco	X	
US 101 from I-380 in No. San Mateo County/I-280 to San Francisco CBD	X	X
US 101 from Marin County to San José and Gilroy		X
I-580 from Central Valley to Livermore	X	
I-580/I-238 from I-680 in Dublin to I-880 in Oakland	X	
I-580 from Central Valley to Dublin/Pleasanton BART and I-880		X
I-580 from I-80 over the Richmond Bridge to U.S. 101 in Marin Co.		X
I-680 from Fairfield to California State Route 4	X	
I-680 from I-80 in Fairfield to San José		X
I-880 from Hegenberger Road near Oakland Airport to Bay Bridge	X	X
I-880 from East Bay to San José		X

Source: Author analysis based on express lanes data from MTC.

In Table 5 what appears to be duplication of corridors reflects that components of some freeways already have partial express lanes. In other cases, such as through San Francisco, and California State Route 84 in San Mateo County, express bus routes would operate partly on surface streets, where there is no possibility for express lane construction.

The Express Lanes network corridors that would provide the most immediate benefits to express bus service are California State Route 24/I-980 from Walnut Creek to I-880 and I-880 from Hegenberger Road near Oakland Airport to the Bay Bridge, thereby providing rapid access to and from San Francisco from the north, east, and south of the Bay Bridge.

The long-haul, high-speed express bus service should be evaluated as a total network, but it is likely that, if it is implemented, it will be done in phases, rolling out individual corridors one at a time. Properly conducting such studies will require long and continued interaction with stakeholders, with a particular emphasis on Caltrans and MTC. Without their cooperation and support, nothing of importance can be accomplished.

Most important, these studies must be pursued with the same level of enthusiasm as Bay Area passenger rail studies. This is not to recommend any effort to make this type of bus service on Express Lanes look better than is justified, just that reasonable efforts should be made to objectively consider such service, and to refrain from overstating the advantages or understating the disadvantages of potential alternative transit and other surface transportation concepts.

4.2 FOSTER SUPPORT THROUGH COMMUNITY OUTREACH, INFORMATION, AND POLITICS

Gaining support and understanding of a new transportation concept requires considerable educational effort to deal with lack of knowledge, preconceived ideas, and other non-tangible obstacles to getting to "Yes." Some key concerns that must be dealt with are discussed in subsections 4.2.1–4.2.9.

4.2.1 IDENTIFYING PROJECT SPONSOR AND CONTROL ORGANIZATION

All work on this project, from conceptual planning to design, construction, implementation, and operation, must have a responsible sponsor organization. The Bay Area has a long history of major transportation projects that, like this one, cross political jurisdiction lines and involve multiple governmental units of all types and levels. The structure of the organization that led to the Core Capacity Transit Study exemplifies how this has been done in the past, and it even involves many of the same organizations.

This process would start by defining the project and its objectives, then move on to gathering support from the entities involved; searching for funding sources (MTC, BATA, Caltrans, US DOT, other stakeholders); setting up the decision-making and oversight board, executive committee, and technical committees, and project team (almost certainly to include consultants); and finally adopting procedures, end-products, and schedules.

4.2.2 DEALING WITH PREJUDICE AGAINST BUS

Even though it is well-known that express bus riders are different from local transit riders, there is still a widespread belief that bus will not attract people out of their cars. This belief, which is not totally incorrect but frequently overemphasized, is likely to influence both potential riders and potential decision-makers. For the former, the problem is less severe, as this type of service doesn't have to attract every potential passenger in the beginning. If it works, ridership will grow as the value and utility of these services prove themselves. However, for decision-makers, in an industry and a region where no one can say yes to such a proposal unilaterally but many individuals and organizations can say no, it could be a far more serious problem.

The best response is to plan and then provide quality service. Quality transit starts with getting people from where they are to where they want to go, when they want to go, quickly and reliably. As indicated previously, for many transit users and potential transit users, good bus service can be their best transit solution. This type of bus service has great potential to provide short walk trips on both ends of the transit ride and minimum transfers, which are two main factors in transit vs. non-transit modal choice decisions.

One main reason why many riders regularly take transit to San Francisco is to avoid paying San Francisco parking fees, which can be dozens of dollars daily in the Financial District. An expanded, reliable long-haul commuter express bus network could be of great interest to East Bay commuters that do not currently have good transit options to San Francisco.

4.2.3 COUNTERING DRIVER/TAXPAYER OPPOSITION TO CONVERTING GENERAL-PURPOSE TO EXPRESS LANE

Some drivers and taxpayers will likely object to converting a pair of existing general-purpose lanes on the Bay Bridge into Express Lanes, taking them out of service for them without their payment of an additional toll.

There is legislative interest in this type of conversion. In the 2020 session of the California Legislature, Assemblyperson Rob Bonta (D-18. Alameda, Oakland, San Leandro, Assistant

Majority Leader) introduced AB2824,[78] "Bay Bridge Fast Forward," which "… would require (MTC), (Caltrans), and certain transit operators, on or before January 1, 2022, to jointly submit to the Legislature a comprehensive plan to improve bus and very high occupancy vehicle speed and travel time reliability along the San Francisco-Oakland Bay Bridge corridor." Unfortunately, the bill was introduced just prior to COVID-19 becoming the overarching governmental concern and causing extreme slowdown of action by the legislature, and this bill wound up with non-urgent bills relegated to no action this year.

Such motorist concerns can be allayed through public education, explaining why this change will improve overall transportation, including providing advantages to single-occupant vehicle drivers. A recent review of the I-405 Express Toll Lanes in the Puget Sound Area[79] found:

- In aggregate, the facility provided $50 million in time savings and reliability benefits to paying users, while collecting $31 million in revenue, for a net benefit of $19 million.
- Because higher-income households take more trips, they accrue significantly more net benefits in aggregate than lower-income users.
- Per trip, however, *lower-income* drivers benefit more than higher-income drivers.

4.2.4 COUNTERING DRIVER/TAXPAYER OPPOSITION TO A TOLL LANE ON A TOLL ROAD

Some drivers will object to a toll lane on a toll bridge. But if that bridge (or a toll road) is congested during peak periods, offering a faster and more reliable alternative for time-sensitive trips will be valued by some customers for some of their trips. No one would be required to use the Express Lane, but it would be there for those who need it enough to pay for it. The "Lexus Lane" claim—that only the wealthy will use the Express Lane—is falsified by experience with such projects nationwide. Usage of express lanes is very broad by demographics, with only relatively minor variances by age, race, gender, and income,

[78] "AB-2824 Bay Bridge Fast Forward Program, (2019-2020)," California Legislative Information, 5 May 2020, http://leginfo.legislature.ca.gov/faces/billstatusclient.xhtml?bill_id=201920200ab2824 (30 september 2020).

[79] Hallenbeck, et al., "I-405 Express Toll Lanes – Usage, Benefits, and Equity."

and most users are not every-trip users, spending the money only when they have what they believe to be a good reason.[80]

There is U.S. precedent for toll roads with lanes that require the payment of additional tolls. While these examples added lanes, rather than converting existing lanes, this has been done before, such as the Puerto Rico Route 22 "Dynamic Toll Lane"[81] and the multiple segments of toll roads in Florida.[82]

4.2.5 COUNTERING OBJECTIONS TO INCREASING ROAD CAPACITY

Some environmental and land-use interests may object to any change intended to increase road capacity, speed of road travel, making suburban commutes more palatable, or potentially increasing vehicle-miles traveled.

This proposal adds no lanes to the bridge, and it primarily benefits transit. Moreover, this type of bus transit is "green," particularly as transit buses transition to battery-electric or other zero-emission power plants.

4.2.6 FOSTERING EARLY AND CONTINUAL MEETINGS WITH ELECTED OFFICIALS

It is vital for proponents to confer with various elected officials, from the individual cities and counties in the Bay Area as well as members of the legislature and the governor early and often, beginning before the planning process even starts. This is an example of never getting too far along in any matter in any political jurisdiction without letting the elected officials know what is being proposed. There may be a need to get statutes changed to enable this project to proceed, and there may be opportunities to simplify and shorten the process through gaining the passage of favorable legislation.

---

80 True North Research for the Orange County Transportation Authority, *Customer Satisfaction Survey for 91 Express Lanes*, Orange County Transportation Authority, 15 October 2011, Table 1, "Demographics of Customer Overall and High-Frequency Users," page 6, https://www.91expresslanes.com/wp-content/uploads/2014/04/91_11_full.pdf (1 July 2020).

81 Michelle Kantrow-Vasquez, "Puerto Rico highway 22 "dynamic toll lane' opens today," *News is My Business*, 15 August 2013, https://newsismybusiness.com/puerto-rico-highway-22-dynamic-toll-lane-opens-today/, (30 September 2020).

82 "Florida Express Lanes – Frequently Asked Questions" Florida Department of Transportation, http://floridaexpresslanes.com/faqs/, (30 September 2020).

4.2.7 PRIORITIZING EARLY AND CONTINUAL MEETINGS AND COMMUNICATIONS WITH LOCAL COMMUNITIES

It is also critically important to work with all local jurisdictions, particularly those where the roads to be impacted and residents to be considered for such bus service are located. Cities and counties have a high degree of legal control over many important transit activities, including placement of bus stops and bus shelters (most bus shelter agreements are between cities and shelter operators, which sell advertising and pay the cities a share of the revenues), and bus pads at bus stops (in California, the maximum bus axle weight is 20,500 pounds;[83] a bus continually stopping at the same location, particularly on a thin asphalt road on a hot summer day, can do major damage, so the common practice is to upgrade the pavement areas where the buses stop). Each city and county (particularly for unincorporated areas of a county) also has major control over park-and-ride lots and siting of operating yards.

4.2.8 PRIORITIZING EARLY AND CONTINUAL MEETINGS WITH MTC BOARD AND STAFF

There is an obvious requirement to work closely with the region's MPO. The MTC has been active on Express Lanes for many years and has sponsored most of the previous studies that have been discussed in earlier sections of this study, as well as three local ballot measures to increase Bay Area bridge tolls. MTC must sign off on all significant transportation projects before its proponents can even apply for state and federal funding, and MTC is itself a major source of funding for transportation projects, both from funds it directly controls and those from the state and federal governments that go through it. In the absence of specific legislation to the contrary, in its BATA (or other) alter ego, MTC will also be responsible, or primarily responsible, for approving and funding the actual express lane toll collection hardware and software and setting the toll system and algorithms.

Also, the shift to Express Lanes on the Bridge could impact the funding that is generated for MTC to distribute. Through three ballot measures (the latest of which is still under judicial challenge), MTC will be collecting up to $5 (plus inflationary increases) for each

[83] California Vehicle Code §35554.(a)(1), "California Legislative Information," California State Legislature, *Website*, undated, http://leginfo.legislature.ca.gov/faces/codes_displayText.xhtml?lawCode=VEH&division=15.&title=&part=&chapter=5.&article=1. (27 April 2020).

passenger car using the Bay Bridge by 2025 in addition to the $3 toll going to Caltrans.[84] If one of the five lanes in each direction is made into a Express Lane, not accessible to some single occupant vehicles, then MTC could lose toll revenues two ways: (a) conversion of toll-payers to transit passengers, and/or, (b) decline in the number of toll payers due to the reduced capacity for "regular" vehicles. Potentially, this could result in MTC requiring a share of the Express Lanes revenue as compensation for its lost toll revenues before such solutions could be considered, although this would likely be offset or even exceeded by the toll revenue increases from HOT lane fares.

4.2.9 CONDUCTING EARLY AND CONTINUAL MEETINGS WITH CALTRANS AND STATE GOVERNMENT SENIOR ADMINISTRATORS

Finally, there must be a great deal of effort spent working with Caltrans, which owns and operates almost all of the major bridges in the Bay Area (the major exception being the Golden Gate Bridge), the California Interstate Highway System roads, other California freeways, and many other roads—and will operate the proposed Bay Bridge Express Lanes. Nothing will change in regard to Bay Bridge operations without the express permission and cooperation of Caltrans, and trying to get the legislature to allow it without Caltrans' prior sign-on is not advisable.

"… there must be a great deal of effort spent working with Caltrans, which owns and operates almost all of the major bridges in the Bay Area (the major exception being the Golden Gate Bridge), the California Interstate Highway System roads, other California freeways, and many other roads—and will operate the proposed Bay Bridge Express Lanes."

[84] "Toll Funded Investments," "Regional Measures 1, 2, and 3," MTC, undated, https://mtc.ca.gov/our-work/invest-protect/toll-funded-investments (1 July 2020).

Caltrans, working with MTC/BATA, has approved converting the Bay Bridge to cashless toll collection,[85] which will eliminate the toll booths (and toll collectors) that have been a fixture since the Bridge was opened over eight decades ago. "Open Road Tolling" is widely accepted as offering multiple advantages, including speed through the tolling process. However, the speed advantage will be limited or non-existent on the Bay Bridge during the morning San Francisco-bound peak period due to the bottleneck caused by the metering lights, where the flow from the 20 lanes (including Bus/HOV lanes)[86] approaching the toll plaza is metered to more effectively merge into the five lanes on the Bridge proper. The metering lights effectively regulated the flow onto the Bridge lanes and therefore the total Bridge throughput, rather than the prior endless "zipper merges" since their 1974 installation. But during the morning peak, their back-up extends beyond the toll plaza far into the toll plaza approach, so speeding up the actual toll-taking activity will provide, at best, only marginal increases in volume or trip time.

Caltrans has not always been seen as friendly to transit. Specifically, in regard to the Bay Bridge, many long-time Bay Area transit enthusiasts still blame the then-state highway engineer and what is now Caltrans for taking the Key System off the Bay Bridge. For well over a decade, the Key System operated rail transit service from the East Bay to the old Transbay Terminal on two rail lines on the lower level of the Bridge. The Key System tracks were removed when the bridge was converted from the original configuration (autos operating in both directions on the upper level and trucks and trains operating in both directions on the lower level) to the present all-rubber-tire, westbound on the top deck and eastbound on the lower level.[87] (In fairness to the people making that decision, Key System ridership had dropped from 26 million annually at the World War II peak to four to five million annually,[88] approximately 19,000 across the Bay per day, by 1954.[89] The plan was to

85 "Bay Area Toll Authority Oversight Committee Meeting Minutes 4 September 2019 Agenda Item 5b,"

86 "Bay Bridge Metering Lights Upgrade," Metropolitan Transportation Commission, 19 February 2020, https://mtc.ca.gov/our-work/plans-projects/major-regional-projects/bay-bridge-east-span/bay-bridge-metering-lights, (30 September 2020).

87 Chris Carlsson, "Transbay Terminal – Historical Essay," *FoundSF*, Shaping San Francisco, undated, https://www.bing.com/search?q=transbay+terminal+%E2%80%93+historical+essay&form=ANNTH1&refig=0d7d4b9d8ea84ec2b091adefbf6bc53a&sp=1&qs=HS&pq=trans&sk=PRES1&sc=8-5&cvid=0d7d4b9d8ea84ec2b091adefbf6bc53a, (29 April 2020).

88 Ibid.

89 Will Spargur, "The Rise and Fall of Street Cars in the US from the perspective of the Key System," presented at AC Transit Transbay Taskforce Meeting, AC Transit, *Website*, 10 November, 2009, https://www.slideshare.net/ACTransit/2009-key-system-history-presentation-at-transbay-taskforce (1 July 2020).

convert the former Key System rail transit to new bus service AC Transit.[90] The change was a major safety improvement, almost totally eliminating head-on collisions on the Bridge by converting it to single-direction travel by level.)

Caltrans has certainly recognized the importance of higher occupancy travel on the Bridge for decades, starting with the bus/HOV access lanes. Caltrans and MTC have also promoted the "Forward" projects, including Bay Bridge Forward[91] and those for other toll bridges and areas.[92] Bay Bridge Forward includes improvements to Bus/HOV access to the Bridge, including conversion of general-purpose lanes and shoulders, and new bus park-and-ride lots.

Caltrans is an engineering organization at heart. Presentation of well-founded technical research, including demonstration of increased transportation capacity, should be a very powerful argument to present to transportation professionals. This is particularly true when combined with other good presentations to the Caltrans chain of command and authorizing bodies up to the governor, the legislature, and the California Transportation Commission, who sometimes tend to be more swayed by other, more non-technical, types of arguments. Meeting with Caltrans personnel early and often, and treating their feedback with the respect it deserves, would be most appropriate.

4.3 PREPARE FOR THE IMPACT OF INCREASED TELECOMMUTING

This study ends the same way it began—with a very brief discussion of what Bay Area surface transportation might look like after the COVID-19 public health emergency is finally resolved, however that may work out.

Many experts are projecting that the rapid and generally successful transition from traditional office work to work-at-home may become a significant factor in both land use

90 "History of East Bay Public Transportation," AC Transit, undated, http://www.actransit.org/about-us/in-the-community/history-of-east-bay-public-transportation/, (1 July 2020).

91 "Bay Bridge Forward," Metropolitan Transportation Commission, https://mtc.ca.gov/our-work/operate-coordinate/traveler-services/forward-commute-initiatives/bay-bridge-forward, (14 July 2020).

92 "'Forward' Commute Initiatives," Metropolitan Transportation Commission, *Website*, https://mtc.ca.gov/our-work/operate-coordinate/traveler-services/forward-commute-initiatives, undated, (30 September 2020).

and urban area mobility, reducing the volume of peak-hour commute trips. According to Kate Lister, Global Workplace Analytics:

> *We estimate that 56% of the U.S. workforce holds a job that is compatible (at least partially) with remote work. … Gallup data from 2016 shows that 43% of the workforce works at home at least some of the time. Our prediction is that the longer people are required to work at home, the greater the adoption we will see when the dust settles. We believe, based on historical trends, that those who were working remotely before the pandemic, will increase their frequency after they are allowed to return to their offices. For those who were new to remote work until the pandemic, we believe there will be a significant upswing in their adoption. Our best estimate is that we will see 25-30% of the workforce working at home on a multiple-days-a-week basis by the end of 2021.*[93]

This will also impact demand for, and the market price of, the type of commercial office space that has been driven by the conventional wisdom. This crisis has hugely reduced traffic congestion, which has only begun to return as more non-office businesses re-open to varying degrees. Transit use, which has been declining for years, has decreased to a small fraction of prior levels, and no one knows when or if it will begin to return to even the lower pre-COVID-19 ridership levels. Transit operating costs per passenger have increased significantly because of far lower load levels due to transit trip reduction, social distancing for remaining riders, new cleaning and passenger/public/employee protection protocols and equipment, and non-transit travel options (including not traveling) becoming relatively more advantageous.

This is a time for intense study of how travel behavior is changing. It is not a time for approving major capital projects absent educated guesses of what Bay Area urban form and surface transportation will look like in years and decades to come.

[93] Kate Lister, "Work-at-Home After Covid-19 – Our Forecast," https://globalworkplaceanalytics.com/work-at-home-after-covid-19-our-forecast, Global Workspace Analysis, (September 30, 2020).

This is a time for intense study of how travel behavior is changing. It is *not* a time for approving major capital projects absent educated guesses of what Bay Area urban form and surface transportation will look like in years and decades to come. Most specifically, the public and decision-makers must resist efforts to gain immediate approval of major changes and of proposed major transportation capital projects, because some project advocates may fear that, if approval is not gained quickly, then the land use, transportation, and fiscal changes could make their proposals impractical and unjustifiable in the future. Hasty approvals while the future is so uncertain could lead to committing many billions to projects that might not be viable in the post-COVID-19 world.

ABOUT THE AUTHOR

Thomas A. Rubin, CPA, CMA, CMC, CIA, CGFM, CFM, has over four decades of experience as a transit industry senior executive, consultant, and auditor. He founded and managed the transit audit and consulting practice of what is now Deloitte and grew it to the largest in the accounting industry, serving well over 100 transit agencies, metropolitan planning organizations, state DOTs, and the US DOT with a variety of audit and consulting projects and has devoted decades to Bay Area surface transportation agencies and projects. He is the former chief financial officer of the Alameda-Contra Costa Transit District in the East Bay and the Southern California Rapid Transit District, the third-largest transit agency in the U.S.

His clients have included Caltrans, Bi-State Development Agency (Saint Louis), Chicago Transit Authority, Dallas Area Rapid Transit, Denver Regional Transportation District, Metra, Golden Gate Bridge, Highway and Transportation District, Metro-Dade Transit (Miami), Metropolitan Transportation Authority, New Jersey Transit, San Francisco Muni, and Santa Clara Valley Transit Authority.

He has a BSBA in accounting and finance from the University of Nebraska-Lincoln and a MBA from Indiana University-Bloomington. He has made hundreds of presentations at industry and professional associations and authored dozens of papers on a variety of topics from long-term capital/operational/financial planning and modeling to performance auditing to peer analysis.