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MTI MINETA TRANSPORTATION INSTITUTE

The Effects of the COVID-19 Pandemic on Transit in the San Francisco Bay Area

Richard W. Lee, PhD
Christopher E. Ferrell, PhD
John M. Eells, MCP
David B. Reinke, MRP, MS
Charles Rivasplata, PhD
Luana Chen, BA

MINETA TRANSPORTATION INSTITUTE

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Richard W. Lee, PhD: 0000-0002-7385-4336
David B. Reinke, MRP, MS: 0000-0003-0969-2261
Christopher E. Ferrell, PhD: 0000-0002-3285-1008
Charles Rivasplata, PhD: 0009-0000-6405-6781
John M. Eells, MCP: 0000-0003-3564-2962
Luana Chen

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16. Abstract
This report presents the findings from our study for the California State Assembly Transportation Committee on the effects of the COVID-19 pandemic on Bay Area Transit. The study consisted of a review of the literature on the effects of the pandemic on transit in the US, a detailed look at changes in ridership and economics for Bay Area transit agencies, comparisons of Bay Area transit ridership changes to those in similar US metropolitan areas, and analysis of possible remedies to restore the financial health of Bay Area transit agencies. Bay Area transit ridership has recovered somewhat from the depths of the pandemic, but remains below pre-pandemic levels: bus ridership is currently 20 percent lower and rail ridership is 60 percent lower than before 2020. Much of the pre-pandemic transit ridership, especially on rail, was from professional and technical workers; many of these have continued to work at home, even after the official end of the pandemic. Federal funding provided short-term operating funding relief transit, but several agencies—BART, SFMTA, and Caltrain in particular—face severe funding shortfalls beginning in fiscal year 2026. Part of the shortfalls could be made up through a combination of fare increases and service reductions, but high fixed operating costs make it impossible for these agencies to remain viable without additional outside funding. The feasible funding sources from a financial standpoint are (1) a surcharge to bridge tolls, (2) an additional sales tax, or (3) a combination of toll surcharges and sales taxes.

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Mineta Transportation Institute
College of Business
San José State University
San José, CA 95192-0219
Tel: (408) 924-7560
Fax: (408) 924-7565
Email: mineta-institute@sjsu.edu

transweb.sjsu.edu/research/2313

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1. Executive Summary

1.1 Introduction

This report presents the findings from our study of the effects of the COVID-19 pandemic on Bay Area transit operators. The study was requested by the California Assembly's Transportation Committee and was funded by Senate Bill 1 through the Mineta Transportation Institute. This Executive Summary presents a brief overview of our key findings and a discussion of possible remedies for the current financial crisis faced by several of the major Bay Area operators.

1.2 Summary of Findings

The main findings of this study are summarized below:

Demand

Like most other US metropolitan areas, the Bay Area saw a large drop in transit ridership during the pandemic.

Bus and rail ridership in the Bay Area have shown some recovery since the pandemic but remain substantially below pre-pandemic levels.

Bus ridership has recovered faster than rail ridership and is now at about 80 percent of pre-pandemic levels.

Rail ridership has been much slower to recover. Muni and VTA rail ridership is about 60 percent of pre-pandemic levels, but ridership on BART and Caltrain is under 45 percent of pre-pandemic levels.

Mode shares have changed significantly for work trips since the pandemic.

Working at home has increased substantially from pre-pandemic levels.

Most of the decrease in transit ridership appears to be due to an increased number of employees working at home.

Downtown San Francisco vacancy rates remain among the highest of any major city in the US, indicating that working at home has sharply reduced the number of trips to this major transit destination. It is likely that a large percentage of workers will continue to work on hybrid office/at-home work schedules.

Level of service

Most agencies have made cuts to service to adjust for lower ridership.

Muni and AC Transit have eliminated a number of express routes that formerly served long-distance commute trips.

BART has made some service cuts by increasing its headways, particularly during the peak periods where ridership demand has declined.

Economics and finance

- Bus farebox recovery rates are less than half of what they were before the pandemic.
- Rail farebox recovery rates have fallen even more than bus recovery rates.
- BART and Caltrain used to have farebox recovery rates of over 70 percent, but these percentages have declined to about 20 percent.
- All agencies have drawn down on their federal money allocations for operating funds.
- The largest agencies will face severe funding shortfalls beginning fiscal year 2026 (FY26).

1.3 Possible Remedies

There is no easy solution to these problems. This report presents several possible remedies and their anticipated effects on fiscal health, equity, and the environment.

The possible remedies fall into three categories:

Increase ridership

- Reducing fares will very likely decrease rather than increase total fare revenues.
- Improving service will add costs which are not likely to be offset by added fare revenue.

Reduce operating costs

- Implementing service cuts to adapt to lower demand would not reduce costs nearly enough to offset major budget shortfalls beginning in FY26.
- Implementing severe service cuts would likely cause a severe drop in demand. Operators would probably not be able to reduce costs enough to offset major revenue shortfalls.

Seek additional revenue sources

- Increasing fares would generate additional revenue but would not be enough to offset major operating budget shortfalls.
- Implementing additional taxes such as a regional half-cent sales tax could largely offset budget shortfalls for the large operators, including Muni and BART.
- Raising bridge tolls on all the state bridges in the region would increase revenue for transit operators and reduce auto demand, which would also benefit the environment.

1.4 Conclusions

Overall, we conclude that:

- BART, Muni, and Caltrain are the agencies that face the most severe fiscal crisis.
- The only feasible way for these systems to remain viable is to provide additional funding from outside sources such as bridge toll surcharges or additional taxes.

2. Literature Review

This chapter presents a review of the literature pertaining to the regional impact of the COVID-19 pandemic on transit. The purpose of this review is to identify and analyze existing research surrounding the effects of the pandemic on transit ridership. In addition, it seeks to identify travel patterns and employment trends, as well as the current state of the strategies and practice of adjusting transit to respond to today's realities.

2.1 How the COVID-19 Pandemic Has Changed Travel Patterns and Mode Choice

While the pandemic period had profound effects on U.S. travel behaviors in the short run, there were changes in the lead up to it as well, and there appear to be post-pandemic changes in store for an indefinite period into the future. The following literature describes these changes as reported in the academic and popular media for each of the following time periods: (1) the pre-pandemic period, from 2010 to 2019; (2) the pandemic period, from 2020 through 2021; and (3) the post-pandemic period, from 2022 on.

2.1.1 Pre-pandemic travel behaviors

Particularly when compared to dramatic changes seen in the COVID-19 pandemic period (discussed below), U.S. travel patterns in the years prior to the pandemic were fairly stable, albeit with a steady trend away from transit use in favor of single-occupant vehicle and ridehail (e.g., Uber and Lyft) travel. The literature suggests that these changes were generally attributable to: (1) increases in ridehail services, drawing patrons away from traditional transit operations (Gelinas 2023; Erhardt et al. 2022); (2) increasing numbers of people working at home /telecommuting (Erhardt et al. 2022); (3) growing household incomes (Schouten et al. 2021; Erhardt et al. 2022), (4) increasing auto ownership rates (Schouten et al. 2021; Lee and Lee 2022), (5) changes in the proportions of demographic groups (e.g., Hispanic/Latinx) in the U.S. and California populations (Schouten et al. 2021); and (6) changing travel behaviors of households within demographic groups (Schouten et al. 2021).

Gelinas (2023) noted that during the pre-pandemic period between 2015 and 2018, transit ridership stagnated or fell as the popularity of ridehailing services gained riders due in part to firms such as Uber and Lyft subsidizing their rides to gain market share and as local and state governments struggled to figure out the means to regulate this new business. However, by 2019, riders began to return to transit as governments adjusted and as ridehailing firms struggled to achieve profitability by raising their fares.[1]

Both demographic changes in the U.S. and the travel behaviors of demographic groups were responsible for these shifts in travel patterns leading up to the pandemic. Schouten et al. (2021)

studied the pre-pandemic transit ridership market changes in California from 2009 to 2017 and found substantial geographic differences across the state, with ridership growing in the San Francisco Bay Area, and declining in the Greater Los Angeles area. Overall, statewide drops in the state's transit ridership levels drowned out the increases seen in the SF Bay Area, with drops statewide led by Hispanics and households without access to autos. These declines were also fed by large changes in the composition of California residents' demographic profiles, with declines in the number of low-income households and the number of carless households among the most notable shifts. Furthermore, these same household types (low-income and carless) were also less likely to use transit, suggesting that not only had the state's composition of households changed, leading to fewer people riding transit statewide, but the rates at which these traditionally transit-dependent riders rode transit dropped as well during the pre-pandemic period.[2]

In a study from Boston, Basu et al. (2021) found similar results to those found by Schouten et al. (2021), suggesting trends there (and perhaps in other regions across the U.S.) were similar to those found in California. In Boston, increasing car ownership was linked to decreasing ridership during the pre-pandemic period.

Erhardt et al. (2022) also studied the factors causing pre-pandemic transit ridership declines in the U.S., where bus patronage dropped by 15 percent from 2012 and 2018 while rail transit ridership fell by three percent. They found the growth in ridehailing (e.g., Uber, Lyft) services and usage were the most influential factors causing these transit patronage declines, followed by lower gas prices, higher fares, higher incomes, more teleworking (work at home), and higher rates of car ownership, while some smaller ridership gains made over the same period came from expanded transit services and land-use changes (e.g., densification) around stops and stations.[3]

Epstein et al. (2022) used the National Transit Database to evaluate the national and California-specific trends in transit ridership and service levels before and during the pandemic, finding that while transit ridership declined during the 2010s, "transit funding steadily increased each year,"[4] suggesting factors other than transit service levels as the cause for falling patronage.

In a more focused study of specific transit operators, Wasserman and Taylor (2023) used the Bay Area Rapid Transit (BART) system as a case study example of the trend over the past century towards increasing ridership in peak commute periods while patronage has decreased for non-work trips in off-peak periods. As a result, BART suffered from overcrowding during peak periods and in peak directions along chokepoint corridors heading into and out of downtown San Francisco, causing the agency to seek means to add capacity for these routes. By analyzing peak and off-peak trips as affected by station-level and system characteristics, Wasserman and Taylor found both peak and off-peak riders were influenced most by the number of transfers they needed to make on their trips and their transit travel times, while peak period riders were also affected by the time-competitiveness of BART versus driving and the amount of employment clustered near BART stations. Over the study period, the influence of travel times on ridership waned, while the influence of the number of transfers, destination station-area employment, and transit-auto travel time competitiveness increased in importance. These findings suggest that in the years leading up to the pandemic, the increasing peaking problems of BART ridership and operations were related to the increasing influence of peak period travelers and the decreasing numbers of off-peak riders.[5]

2.1.2 Pandemic effects on travel behaviors

The COVID-19 pandemic has had unprecedented effects on travel patterns in the U.S., particularly with respect to commuters. Analysis of the literature reviewed for this study suggests that these changes were generally attributable to: (1) dramatic increases in the numbers of people working at home/telecommute instead of commuting (Matson et al. 2022; Javadinasr et al. 2022; Osorio et al. 2022; Epstein et al. 2022; Magassy et al. 2023; Halvorsen et al. 2023; Soria et al. 2023); (2) large drops in white, high-income, and well-educated transit riders and drivers (Hu and Chen 2021; Matson et al. 2022; Epstein et al. 2022); (3) increased "peak spreading" of commuter traffic and transit ridership, wherein more flexible work hours and requirements led to people commuting during non-peak hours (Halvorsen et al. 2023; Nickerson and Rowan 2023; Bhagat-Conway and Zhang 2023); (4) accelerating rates of auto ownership (Basu et al. 2021; Javadinasr et al. 2022); and (5) the combined effects of reduced transit services with public perceptions of service unreliability, overcrowding, and a lack of personal safety (from COVID-19 exposure in close quarters and crimes) leading to decreased ridership (Basu et al. 2021; Osorio et al. 2022; Xiao et al. 2022).

Hu and Chen (2021) analyzed 20 years' worth of Chicago transit ridership data to identify the explanatory factors involved in the pandemic patronage drops. They found that the pandemic affected ridership at 95 percent of Chicago's transit stations, with an overall drop of 72 percent from pre-pandemic levels. As seen in other studies in other areas of the country, ridership drops were most severe in station areas with more commercial uses, and higher proportions of white, high-income, and well-educated residents. Interestingly, areas that saw more COVID deaths also saw smaller ridership declines, likely stemming from the fact that more disadvantaged communities are also likely to have more "essential" workers who are also more transit dependent.[6]

Changes were seen for other modes as well, with indications that non-work-related travel in lower density, suburban environments increased as work-related trips in more urban areas fell. Zhang and Fricker (2021) modeled the effects of the pandemic on non-motorized mode use on 12 pedestrian and bicycle trails in 11 cities across the U.S. They found that while walking and cycling along these trails fell in dense urban areas, they increased in less dense (e.g., suburban) cities.[7]

Similarly, as a result of the pandemic, Basu et al. (2021) found that concerns about service unreliability and overcrowded transit during the pandemic led to a lack of trust in the region for Massachusetts Bay Transportation Authority's (MBTA's) transit operations in the Boston area. As a result, large shares of zero-car households intended to eventually buy a car (19 percent), with roughly a quarter of these planning to buy one within the following year (26 percent).[8]

Matson et al. (2022) studied the changes in mobility patterns in the U.S., comparing these behaviors in the pre-pandemic and early pandemic periods. To “avoid/reduce” physical contact during the pandemic, the U.S. population significantly shifted from commuting to the workplace to working at home through telecommuting and increased their online shopping activities to replace shopping trips. At the same time, active mode use for leisure purposes increased as well, as people sought to break their lockdown behavior patterns, seeking exercise and socially distanced leisure activities. Additionally, these changes were not consistent across the economic spectrum, with few differences found between blue- and white-collar workers in terms of their propensity to physically commute; during the pandemic, blue-collar workers, generally considered “essential,” were much less likely to telecommute, while white-collar workers were much more likely to work at home.[9]

According to Javadinasr et al. (2022), car ownership and demographic trends led to changes in transit ridership and travel behavior in general during the pandemic. Their findings suggest a pandemic-caused increase in the share of workers who worked frequently from home (more than once per week) from 16 percent pre-pandemic to 46 percent during the pandemic.[10]

Osorio et al. (2022) studied ridership changes on the Chicago Transit Authority’s (CTA’s) bus and rail modes before and during the pandemic, finding that the government’s executive orders mandating shutdowns that led to remote working (i.e., work at home) and remote learning (school online) largely account for ridership declines. Early in the pandemic, the public’s sense of fear in reaction to COVID-19 death reports was responsible for an 18 percent decrease in rail and a 21 percent decrease in bus ridership. However, this “fear effect” waned as the pandemic wore on, with so-called “caution fatigue” setting in among transit patrons.[11]

Epstein et al. (2022) used National Transit Database (NTD) data to evaluate the national and California-specific trends in transit ridership and service levels before and during the pandemic, finding that while transit ridership declined during the 2010s, “transit funding steadily increased each year.”[12] California and the nation’s pandemic ridership loss rates closely mirrored one another, and ridership recovery has proceeded slowly for both as well. Ridership in California fell faster than did the service hours the state’s transit operators provided; most of the cuts in the state’s vehicle-hours of service (VSH) fell on buses (73 percent of pre-pandemic levels in July 2022), while rail’s VSH was higher (2 percent above pre-pandemic levels). While ridership during the pandemic fell proportionately less for small operators than large, small operators recovered more slowly during the pandemic years. Overall, essential service workers and low-income transit dependents continued using transit throughout the pandemic much more than wealthy, white “choice” commuter riders with good access to rail services who left transit for working remotely from home and increased driving.[13]

Magassy et al. (2023) developed a work travel mode choice model (including work-at-home) based on a nationwide (U.S.) panel survey of individuals, comparing travel behaviors before and during the pandemic, and forecasting post-COVID commuting mode choices. They found that the pandemic reduced driving- and transit-to-work mode patronage, with increases in work-at-home telecommuters. The pandemic also affected socio-economic groups differently, with minority groups and those living in more urban, transit-rich environments exhibiting a lower drop in transit use during the pandemic than other groups.[14]

In contrast to Magassy et al. (2023), Xiao et al. (2022) studied the resilience of ridership on Salt Lake City's light rail system during the pandemic and found that while higher density urban form patterns near stations are traditionally thought to lead to higher transit ridership, social distancing rules and guidance during the pandemic may have led people to avoid the densely built areas to prevent exposure to the COVID-19 virus. This led to a lower level of transit ridership than would have been expected in otherwise transit-supportive built environments, i.e., around light rail stations in the Salt Lake City metropolitan area.[15]

Halvorsen et al. (2023) studied transit ridership trends and causal factors in New York City's transit systems finding that both buses and subways suffered severe ridership drops during the pandemic, with higher ridership declines for both seen in the Central Business District (CBD) while lower declines were seen in lower income areas with high pandemic-essential services employment such as eastern Brooklyn and the Bronx. Bus and subway also both experienced so-called "flattened peaks" or "peak spreading," wherein peak periods see reduced ridership levels while off-peak hours increase. Both modes also saw an increase in average trip length.[16]

According to Nickerson and Rowan (2023), Bay Area traffic patterns changed dramatically due to the pandemic, with drive times down (reflecting less traffic and congestion), trains less than half-full, and peak congestion periods "creeping back – just at different times" of the day (i.e., peak spreading).[17]

Ziedana et al. (2023) used NTD data to study the differences found across the U.S. in transit ridership losses from the pandemic and their rates of recovery thereafter. Transit ridership reached a 100-year low in 2020 as the pandemic shut down much of the nation's economic activities. However, by June of 2021, ridership started to recover, albeit at a slower rate than was hoped for. After the first year of recovery (by June 2022), ridership nationally was only two-thirds of pre-pandemic levels. However, just as there were geographic differences in ridership declines seen during the pandemic, so too the recovery, with some metropolitan areas like Tampa, Florida and Tucson, Arizona reaching pre-pandemic levels or higher, while others struggled to rise above the two-thirds level. The researchers suggest that those areas that recovered more quickly also extended their free-fare programs started during the pandemic well into the recovery period, though any direct causal links between free fares and ridership recovery need further analysis. Finally, the researchers did not find any correlation between service provided and ridership losses during the pandemic period, as both transit productivity measures and ridership followed the same trends as the pandemic wore on.[18]

Similarly, Speroni et al. (2023) conducted a survey and structured interviews of transit agency staff from operators around the U.S. in the second half of 2020, finding that while transit agencies adapted quickly to the new realities of the pandemic, they have struggled to address the loss of revenues from fares as ridership levels collapsed. While transit's role as an important social service provider to disadvantaged communities and essential service workers was highlighted and recognized, the outlook for revenue recovery appeared to present a long-term challenge to the industry and a threat to the very communities and people that it served so well during the most challenging months of the pandemic.[19]

Bhagat-Conway and Zhang (2023) suggest that highway expansion plans in California based on pre-pandemic congestion forecasts should be re-evaluated for the post-pandemic era, since their analysis of peak period traffic in that state found that peak spreading increased after the pandemic's lockdown period, even as overall daily traffic volumes returned to pre-pandemic normal. They found that "the level of spreading was fairly consistent in Summer 2021 and Winter 2022, even as people increasingly returned to their routines."[20]

Descant (2023) says that commute transit riders have disappeared across the country during the pandemic, forcing transit agencies to rethink their service models to adjust to the new reality.[21] This has led to the development of new transit strategies and investment plans.

In her *New York Times* article, Karlamangla (2023) quotes Robert Powers, General Manager of BART, arguing that the slow return of office workers to downtown San Francisco offices is the main reason BART ridership is struggling to get above 50 percent of pre-pandemic levels: "San Francisco is at the tail end of the return-to-the-office train, so to speak, and so it's kind of a very unique set of circumstances that we're trying to navigate here."[22] Karlamangla contrasts BART's mainly regional commuter rail service ridership rebound to SF MUNI's bus and light rail rebound to 80 percent of pre-pandemic levels, serving mainly local trips between city neighborhoods. Furthermore, Karlamangla (2023) quotes Powers: "Ridership has rebounded more on Saturdays and Sundays than during the week, suggesting that people are more interested in returning to BART for other kinds of trips than they are for commuting to work." [23]

In contrast, He et al. (2022) used a national survey of U.S. transit riders conducted in the fall of 2020 (in the depths of the pandemic period) to find that people with lower access to vehicles and below the poverty threshold were more likely to keep riding transit during the crisis: "Riders who reported higher transit use include those without access to a vehicle, people with a disability, those who live under twice the poverty threshold, those who lost income during the pandemic, those who live in households with only one adult, and those more frequently using bus or rail. At the same time, female riders were less likely to use transit during the pandemic."[24] Among those who were less likely to use transit were Hispanic people who avoided it because they were concerned about encountering "law enforcement relative to their non-Hispanic counterparts,"[25] as well as those who lost jobs and cut back on riding transit to save money. Finally, more wealthy, white-collar workers who were largely able to work at home were also among those who substantially cut back on their transit use.[26]

Studying ridership and pedestrian trip-making patterns in Chattanooga and Nashville, Tennessee during the first year of the pandemic, Wilbur et al. (2023) found that ridership declines came prior to the service cutbacks made during the crisis by the respective operators for both regions. Most of these declines came from peak period commuters, suggesting many of these people had either switched to working at home/telecommuting or were driving instead of riding transit. Findings from the analysis of cell phone data in Chattanooga support the hypothesis that more people were driving, as indicated by foot traffic in the city which rebounded more quickly than transit ridership, suggesting people returned to the workplace but were driving to get there. Finally, the research team found that neighborhoods with more non-college worker jobs maintained transit ridership better than areas with a lot of college educated employment.[27]

Jiao et al. (2023) analyzed pandemic transit ridership changes in Austin, Texas and found that geographic areas where there were high shares of older, Black, or Hispanic populations, tended to maintain transit ridership levels better, while areas with high unemployment saw steeper declines.[28]

Kar et al. (2022) evaluated changes in access to basic services (e.g., groceries and health care) in 22 U.S. cities resulting from pandemic period service cuts. These cuts significantly reduced access for traditionally vulnerable communities (e.g., Black, high poverty, low-income, and zero-car households) to these crucial destinations, with greater losses seen in cities with sprawling development patterns during this period.[29]

Owen et al. (2023) studied the effects of economic and demographic inequalities on pandemic period transit ridership changes in the Chicago, Illinois metropolitan area. They found that neighborhoods with large shares of low socioeconomic status (SES) residents had more challenges in employing social distancing and working at home than other, more well-to-do neighborhoods, leading to associated disparities in COVID-19 exposure, infection, and death rates. Furthermore, even a year after the pandemic started and vaccinations began to roll out along with businesses and other employers reopening, economically privileged neighborhoods did not return to transit.[30]

Finally, Dasmalchi and Taylor (2022) studied the pandemic period shifts in transit ridership and service levels in Los Angeles, Houston, and Boston. Their findings indicate that of these three metro areas, Houston, which had recently (2015) restructured their entire bus network and schedules to reduce headways, had the best match between transit supply and demand (ridership) and had the best balance of riders and service during the pandemic. While the distribution of riders and service grew more unequal for all three cities during the pandemic, as it waned, so too did these inequalities. As of October 2020, ridership in all three cities had fallen to roughly half that of 2019 (pre-pandemic levels), but the relative inequalities between service supply and ridership demand in Los Angeles had grown more equal. They found that it was less equal in Boston and Houston than in 2019, even though Houston remained the most equal of the three in absolute terms. These changes in ridership-to-service inequalities were mostly driven by the changes seen in ridership travel patterns during the pandemic, although they were somewhat mitigated by transit service adjustments, seen most clearly in the case of Los Angeles.[31]

2.1.3 Post-pandemic travel behaviors

While the effects of the pandemic on travel behaviors are still unfolding, there are a limited number of sources from academic and popular literature that have sought to identify these effects and predict how they will play out in the future. The effects of the pandemic on travel behavior, as discussed previously, have proven somewhat intransigent during the post-pandemic period and may continue to be so well into the future. Analysis of the literature reviewed for this study suggests that these changes were generally attributable to: (1) continuing high rates of work at home/telecommuting instead of commuting (Javadinasr et al. 2022); (2) transit ridership levels that tend to be low due to a slow rate of return to commuting to work (as opposed to working at home) and a slow return to transit among commuters (Javadinasr et al. 2022; Magassy et al. 2023); and (3) the return-to-transit ridership trends, which while relatively slow, will be led by minority groups and residents of urban areas well-served by transit (Magassy et al. 2023).

Post-pandemic, transit ridership has been slow to recover across the U.S. Brady (2022) cites American Public Transportation Association (APTA) statistics showing that while transit ridership fell to 20 percent of pre-pandemic levels at its nadir in April of 2020, it had recovered to 70 percent of pre-pandemic levels in the U.S. by September of 2022. Brady points out that while this recovery has been substantial, the significant loss of transit riders across the country is causing severe financial strain to the nation's transit operators.[32]

According to Javadinasr et al. (2022), car ownership and demographic trends led to changes in transit ridership (and travel behavior in general) during the pandemic and in the post-pandemic period. Their findings suggest a post-pandemic decrease in auto (9 percent) and transit (31 percent) commuting, largely resulting from the growth in work-at-home and hybrid employment rates (30 percent).[33]

Post-pandemic ridership recovery has been uneven as well. Kamisher (2022a) noted the San Francisco Bay Area had recovered proportionally fewer (55 percent) of its pre-pandemic ridership than the Los Angeles region (71 percent) as of August of 2022.[34] According to Karlamangla (2023), in September 2023, BART adjusted its service to meet these new travel patterns, increasing service on nights and weekends and cutting back service weekdays.[35]

Sureshbabu et al. (2022) studied the ways in which older adult Americans used public transit during and after the pandemic, employing an online survey of participants from a range of diverse geographical locations. Their findings suggest that older adults have changed their travel patterns since the pandemic, many due to fears of contracting COVID-19, but have had difficulties finding transportation solutions for these trips.[36]

Magassy et al. (2023) developed a travel mode choice model (including work-at-home) based on a nationwide (U.S.) panel survey of individuals, comparing pre- and during-COVID travel behaviors and forecasting post-COVID commuting mode choices. Their findings suggest transit ridership is likely to remain at roughly 30 percent below pre-pandemic levels into the post-pandemic future.

Brey (2023) points out that pandemic and post-pandemic changes are complicated by the lack of data and methods necessary for transit planners to forecast the effects of new policies, procedures, and investments. While pre-pandemic forecasting methods were improving, the new realities of the post-pandemic world are forcing transit planners to gather new data on travel behavior patterns and potentially develop new methods to adapt.[37]

2.2 Which Market Segments Have Seen the Biggest Transit Patronage Declines?

As the pandemic progressed and eventually receded, transit ridership showed few signs that it would return to pre-pandemic levels anytime soon (Paul and Taylor 2022; Brady 2022; Javadinasr et al. 2022; Kamisher 2022a; Kamisher 2022b; Magassy et al. 2023). Several analysts have analyzed the transit ridership market segments that have seen the biggest declines, finding that: (1) race played a role in determining ridership declines, with white riders exhibiting the biggest declines, while minority riders tended to stick with transit (Paul and Taylor 2022; Qi et al. 2023; He et al. 2022; Jiao et al. 2023; Owen et al. 2023); (2) high income ("choice") riders also tended to abandon transit during the pandemic and are slow to return, while low income ("transit dependent") riders have continued riding transit throughout the same period (Paul and Taylor 2022; Qi et al. 2023; Magassy et al. 2023; He et al. 2022; Kar et al. 2022); (3) commuter ridership during peak demand periods (i.e., "rush hour") fell dramatically as white-collar office employees took up work-at-home in large numbers, while off-peak ridership declined much less (Karlamangla 2023; Magassy et al. 2023; Wilbur et al. 2023; Descant 2023); (4) rail ridership, typically patronized by "choice" commuter riders during peak periods pre-pandemic, fell dramatically during the pandemic and has struggled to rebound to anything close to pre-pandemic levels in most travel markets, while bus ridership, typically patronized by more off-peak, non-work, and transit-dependent riders, suffered relatively fewer pandemic losses and rebounded to near pre-pandemic levels in most travel markets (Paul and Taylor 2022; Kamisher 2022b; Magassy et al. 2023; Osorio et al. 2022); (5) well-educated riders tended to stop riding transit and have been slow to return, presumably since these people were often riding transit to work, and transitioned to working at home with the onset of the pandemic (Qi et al. 2023; Wilbur et al. 2023); and (6) metropolitan areas with high concentrations of white-collar (particularly high tech) office and service economy workers tended to lose more transit riders than areas with more industrial, blue-collar workers (Kamisher 2022a; Karlamangla 2023b; Woodhouse 2023).

The pandemic ridership plunge was geographically, demographically, and temporally uneven. For example, Paul and Taylor (2022) studied the changes in bus transit ridership during the first year of the pandemic (2019 and 2020) in Boston, Houston, and Los Angeles at the neighborhood level. Analyzing stop-level boarding, passenger survey, and census/American Community Survey (ACS) data, they found poor and non-white neighborhoods lost proportionally fewer bus riders than white and higher income ones, but as the pandemic wore on in 2020, the gap between low- and high-ridership-loss neighborhoods shrank. They further found that ridership in Los Angeles and Houston held up better than in Boston. They attributed these findings largely to differences in demographics and the built environment between these two southwestern cities and Boston's older, northeastern context. They conclude that transit played a critical role in serving disadvantaged communities during the early months of the pandemic and that it was likely that serving these communities may prove critical to successfully emerging from it.[38]

Qi et al. (2023) studied the pandemic's effects on transit ridership in the top 20 U.S. metropolitan areas. Their findings suggest that higher income, well-educated, high employment, and high percentage Asian population regions had larger reductions in transit ridership during the pandemic, while high poverty, high percentage Hispanic population regions experienced smaller ridership reductions.[39]

Javadinasr et al. (2022) found that work trip transit mode share saw the largest percentage drop (-68 percent) of all modes when comparing pre-pandemic (10.9 percent) to the pandemic (3.5 percent) time periods, while the share of commuters walking to work fell by 48 percent from 3.1 to 1.6 percent during the pandemic. The research team also found that "before the pandemic, the average number of commute days was 4.1 days per week, which then plummeted to 1.75 and 1.87 days per week" during the pandemic.[40]

Magassy et al. (2023) found that the pandemic has affected socio-economic groups differently, and, as a result, their expected mode choice behaviors in the post-COVID world are expected to differ as well. Specifically, Magassy et al. predict that minority groups and those living in more urban, transit-rich environments will likely show a higher rate of return to riding transit in the post-pandemic world, leading to their recommendation that transit services be reconfigured or expanded to better serve these groups in the future. However, higher income commuters, the mainstay of many high-capacity, high-speed rail transit systems in the U.S., are expected to exhibit the lowest levels of return to transit behavior. As a result, the authors remain uncertain as to whether it will be worth the effort to tempt these so-called "choice riders" back to transit after the pandemic:[41] "Individuals residing in very high income households are found to depict the lowest level of transit share recovery following the pandemic. Individuals in such an income bracket are choice riders to begin with, and the pandemic appears to have had a significant and long lasting impact on their use of transit."[42]

Kamisher (2022b) pointed out that rail transit in the tech corridors of the Bay Area (serving largely white-collar, peak period commuters) was hit particularly hard during the pandemic, where "[o]nce bustling stations that catered to tech commuters now resemble hushed mausoleums."[43]

2.3 Has There Been a Significant Shift to Other Modes?

As a result of the COVID-19 pandemic, there was a clear decrease in travel, primarily in 2020 and 2021. However, by the end of 2021 while transit ridership in much of the United States was still well below pre-COVID levels, private vehicle use increased in a number of markets. The long-term result has been that in most major markets, private vehicle use has returned to pre-COVID levels, as many former transit riders have largely become either private vehicle users or work-at-home telecommuters (Halvorsen et al. 2023; Nickerson and Rowan 2023; Bhagat-Conway and Zhang 2023; Basu et al. 2021; Javadinasr et al. 2022; Osorio et al. 2022; Xiao et al. 2022).

Some of the early research on pandemic-caused mode shift focused on the pandemic's adverse impact on transit ridership and general mode choice decisions, as well as resulting increases in traffic congestion and vehicle emissions. For example, Das et al. (2021) provide insights into the potential shifts from transit to private vehicle usage due to the COVID-19 pandemic. They found that trip characteristics such as travel time, overcrowding, and hygiene are strongly associated with mode shift preferences from public transport to car use. They concluded that efforts should attempt to restore confidence by providing a safe, secure, and healthy environment for travelers.[44]

Sureshbabu et al. (2022) studied changes in transit use among persons 65 and older as a result of the COVID-19 pandemic. They found that these older adults were faced with key mobility challenges, including the fear of coming down with or spreading the virus and the lack of available buses after March 2020. They analyzed how older adults living in large metropolitan cities in the United States have used and perceived transit during the pandemic. Through online surveys of older adults from a variety of locations, they found that older adults had changed travel patterns since the onset of COVID-19, experienced challenges in using transit, and expressed concerns about catching the virus while using public transportation. While this study reported that many older adults believed that mobile technology could improve user access to transit, it did not appear to study if older adults were attracted to other travel modes.[45]

As far as the pandemic's effect on active transport modes and transit, Christoforou et al. (2023) explored the contention that the pandemic led to a significant shift from public transport to bike-sharing. They performed short- and medium-term intermodal analysis which revealed correlations between trip volumes, duration, and COVID-19 policy measures. Results indicated that specific pre-pandemic factors (e.g., travel purpose, weather, type of day) played a role during the pandemic in terms of transit and active mode choices. In addition, they found that obligatory mask wearing during the pandemic helped restore trust in the safety of public transport; however, basic recommendations encouraging riders to wear a mask seem to discourage the use of public transport in favor of cycling.[46]

Magassy et al. (2023) traces the evolution of mode use during the pandemic using a novel panel survey data set collected from a representative sample of individuals across the United States. Results suggest that transit patronage is likely to remain depressed by about 30 percent for the foreseeable future, in the absence of substantial changes in service configurations. This study also shows that minority groups and those living in higher density regions are more likely to exhibit a return to transit use in the post-pandemic period.

2.3.1 What is the effect of increased work-from-home on transit patronage?

Pre-pandemic effects of work-at-home on transit patronage

Prior to the COVID-19 pandemic, the effects of telecommuting/WFH on travel behavior, and on transit ridership in particular, were considered small and increasing slowly; however, sources disagree on exactly how these trends played out over time. According to Jin and Wu (2011), "fewer people were telecommuting overall [in 2009 as compared to 1995 and 2001], whereas infrequent telecommuters increased relatively."[47] Nevertheless, these findings do not match the findings of Arbogast et al. (2019), who found that the number of people working primarily from home increased from 0.7 percent of full-time workers in 1980 to 3 percent in 2017. These inconsistencies—where Jin and Wu found fewer people were telecommuting over a partially overlapping time period to that measured by Arbogast et al., who found that the percentage of full-time workers grew—suggest that the researchers used different measurement techniques, definitions of key concepts (e.g., telecommuting versus occasional working at home), study timeframes (1995 to 2009 versus 1980 to 2017), and different data sources/collection methods.

For example, the year of Jin and Wu's second dataset, 2009, coincided with the so-called Great Recession (also known as the Global Financial Crisis). Between October 2008 and April 2009, in the U.S., an average of 700,000 people per month lost their job.[48] This indicates that while both the share and number of people working from home may have dropped during the Great Recession—particularly since those who feared losing their jobs who had telecommuted previously were now incentivized to return to the office more regularly for reasons of job security—the share and number of telecommuters rose again in the years following the Great Recession and before the pandemic. Therefore, the recession may have contributed to a decrease in telecommuting frequencies during the study period, according to Jin and Wu (2011).[49] And while Arbogast et al. (2019) found that work-at-home had rebounded by 2017,[50] it seems clear that even if the number or share of full-time workers decreased during the pre-pandemic period, the findings of both research teams suggest an overall trend towards increased telecommuting.

While many early telecommuting researchers thought that increases in work-at-home would lead to an equivalent reduction in trip-making (and associated VMT) (e.g., Kitamura 1990; Nilles 1991; Pendyala et al. 1992), somewhat discouragingly, Jin and Wu (2011) found that since low-frequency telecommuters tended to have multiple part-time jobs and longer distances to travel for work, they generally drove more than their non-telecommuting counterparts. Nevertheless, Jin and Wu also found that *frequent* telecommuters tended to drive *less* than non-telecommuters, suggesting that for this group of super telecommuters, some individuals substitute working from home in exchange for commuting, while less frequent telecommuters make up for less commute driving with more work- and nonwork-related driving that overwhelms these travel reductions.[51]

Similarly, Arbogast et al. (2019) found that the average work-at-home worker in 2017 drove more miles per year (almost 18,000 total) than the typical worker who primarily commutes (almost 15,000 miles per year). This suggests the relationship between telecommuting and auto travel is not strictly one of substitution, wherein commuters telecommute from home instead of driving to work, but rather complementarity, where telecommuters use the time freed up by work-at-home to drive for other non-work trips and/or move their residences further from their place of work. As a result, the work commute (and other purpose) trips are longer and more likely to be done by auto.[52]

In terms of work-at-home effects on transit and other non-auto mode use, Jin and Wu (2011) found that telecommuters were more likely to use transit for commuting on days when they went to their places of work, and overall to "walk and bike slightly more than non-telecommuters."[53] Chakrabarti (2018) distinguishes between frequent and occasional telecommuters when describing their differences with non-telecommuters in terms of transit use, walking, and other physical activities. Frequent telecommuters have an increased likelihood of walking, using transit, and increased odds they'll engage in 30 minutes of moderate intensity exercise each day (e.g., bicycling), while occasional telecommuters increased transit use, but not walking.[54]

2.3.2 Pandemic and post-pandemic effects of work-at-home on transit patronage

There has been a great deal of popular media coverage of the challenges posed to commuter-oriented (particularly rail) transit systems resulting from the pandemic (for example, see Woodhouse 2023; Karlamangla 2023a; Karlamangla 2023b; Li 2023; *The Economist* 2023; Gelinas 2023). The San Francisco Bay Area's rail transit systems are no different, and in many ways appear to be more at risk from the long-term effects of a structural change in work-at-home behavior patterns. Karlamangla (2023a), writing for *The New York Times*, noted that several major California transit systems struggled during (and after) the pandemic due to the increases in work-at-home, more so among the tech sector rider-heavy operators serving the SF Bay Area. For example, BART has only recaptured roughly 35 percent of its pre-pandemic patronage. Li (2023) points out that while other transit systems around the country have bounced back substantially, BART's very slow recovery stands out.[55] While other transit agencies around the state, including systems in Los Angeles, the East Bay's AC Transit, and even San Francisco's Muni transit system, have recaptured more riders (up to around 75 percent of pre-pandemic levels), BART and Caltrain, both serving the tech employment-heavy centers of Silicon Valley and downtown San Francisco, have suffered greatly at the hands of new work-at-home patterns that have reduced their ridership by as much as 75 percent.[56]

Woodhouse (2023) points specifically to the Bay Area's "heavy concentration of technology jobs that can easily be done from home"[57] as the reason for BART's ridership and fare revenue recovery woes. This link between the health of downtown San Francisco's office market and ridership on the BART system that serves it suggests BART's ability to recover its financial sustainability in the long run is tightly linked to the fate of downtown. Srivastava and Sylvan (2023) find this market has substantially collapsed since 2020, largely due to the growth in hybrid and remote work practices among its workers. Indeed, it appears that Downtown San Francisco is particularly vulnerable to the work-at-home trend, since it has "the second-most homogenous downtown in the United States, with more than 74 percent of its land area devoted to office uses. By comparison, those uses occupy only 49 percent of downtown Manhattan. Because of the diversity of businesses and land uses, including housing, entertainment, and academic institutions in Manhattan's high-density downtown areas, foot traffic is significantly higher there than in San Francisco, even though return-to-office rates are below 50 percent in both cities."[58]

Academic researchers have largely found similar findings to those reported in more popular media sources. Cohen (2020) points to National Association of Realtors' predictions for the 10 counties in the U.S. that will see the most growth in terms of work-at-home residents based on internet connectivity, percent of workers in office jobs, and population growth. Since the 10 counties identified are a combination of suburban/exurban or micropolitan areas with relatively low populations,[59] these findings suggest the near-term and midterm effects of work-at-home will likely lean towards urban dispersal from larger metropolitan areas with good transit services into areas where transit services are poor or non-existent. These residential and travel pattern shifts point to the likelihood of reductions in transit use overall, particularly for commute trips and the routes that serve them.[60]

Matson et al. (2022) studied changes in mobility patterns in the U.S. before, during, and after the pandemic. To "avoid/reduce" physical contact during the pandemic, many sectors of the U.S. population significantly shifted from commuting to work-at-home through telecommuting and increased their online shopping activities to replace shopping trips. At the same time, active mode use for leisure purposes increased as well, as people sought to break their lockdown behavior patterns, choosing to exercise and partake in socially distanced activities. Additionally, these changes were not consistent across the economic spectrum, with few differences found between blue- and white-collar workers in terms of their propensity to physically commute, while during the pandemic, blue-collar workers, generally considered "essential," were much less likely to telecommute, and white-collar workers were much more likely work at home.[61]

Acknowledging that low ridership during the pandemic will likely continue "for a few years" after the pandemic ends, Litman (2021) strikes a more positive pose and asserts that the nascent ridership recovery seen in 2021 will likely continue due to transit's critical role in providing mobility services to urban communities. Just as 9/11 led to some doubt about the future of dense, urban areas and the transit that serves them, Litman wrote that both would return to pre-pandemic levels in short order, presumably with work-at-home levels also returning to form.[62]

Analyzing two-wave panel survey data taken in April 2020 and May 2021 in multiple U.S. states, Javadinasr et al. (2022) found significant changes in respondents' travel behaviors during (observed) and after (expected) the pandemic. Importantly, the survey analysis suggests a 30 percent increase in work-at-home activities from pre-pandemic levels, and as a result, "auto and transit commuters are expected to be 9 percent and 31 percent less than pre-pandemic, respectively."[63] These findings suggest "[t]he remarkable shift to work-at-home will also significantly alter the commute work patterns,"[64] including a lower number of commute trips, lower transit ridership, new trips to new destinations, and different traffic patterns overall that will occur outside the traditional morning and evening peak periods.[65]

Paul and Taylor (2022) compared pre-pandemic (2019) ridership patterns with those during the pandemic's first year (2020) in Boston, Los Angeles, and Houston, showing that work-at-home was responsible for much of the disproportionate impacts on transit operators and riders. They found that early in the pandemic, poor and non-white neighborhoods lost fewer riders than those characterized as high-income and white, but as time went on, the gap between them shrunk. These findings suggest that since white, high income residents are more likely to work well-paying office jobs accessed by commuter transit services, and since they also were more likely (and able) to work at home during the pandemic, commuter-oriented, high capacity, high speed (e.g., rail) transit services were hit with the hardest ridership losses, while more short-haul, non-commuter services (e.g., bus) suffered less. The authors conclude that transit's role as a social service provider was heightened during the pandemic, and they expect this trend to continue in the future.[66]

Citing remote work rates during the pandemic unseen in the pre-pandemic era, Chapple et al. (2023) used mobile phone data with user locations to compare pre- (2019) to post-pandemic (2022) activity patterns in 62 U.S. downtown areas, finding that San Francisco's downtown had the largest reduction in activity levels over this period, with 31 percent of pre-pandemic levels and a high of 135 percent in Salt Lake City. Overall, they found that those downtowns that recovered well had several favorable characteristics, including lower commute times and a healthy presence of accommodation, food, health care destinations, and an active construction employment sector.[67]

Duranton and Handbury (2023) modeled the effects of work-at-home on downtown and suburban real estate values in the post-pandemic world, concluding that work-at-home will reduce commuting costs, and in the process provide a "commuting dividend" to those workers from the cost savings. Once the costs of setting up a home office from which they can work are accounted for, Duranton and Handbury expect the remaining commuting dividend to increase housing prices overall as work-at-home-ers seek more space for their new lifestyles.[68]

2.3.3 What are the relationships between auto use, congestion, and transit use?

Pre-pandemic effects of auto use and road congestion on transit use

Research on the effects of various factors related to pre-pandemic automobile use on transit ridership and mode share suggest transit mode choice is heavily influenced by: (1) household car ownership and availability rates (Chakrabarti 2017; Manville et al. 2023); (2) auto travel times relative to transit travel times (Chakrabarti 2017; Hu et al. 2023); (3) highway/freeway congestion levels (Beaudoin and Lawell 2018; Marshall and Dumbaugh 2020; Hu et al. 2023; Manville et al. 2023); and (4) transit service supply (Beaudoin and Lawell 2018).

Beaudoin and Lawell (2018) studied the short-, medium-, and long-term effects of transit service supply on freeway congestion levels in 96 U.S. urban areas from 1991 to 2011. They found that in the short-term (0–4 years), additional transit services bring a small reduction in VMT per freeway lane-mile (a 10 percent increase in transit services brings a 0.7 percent decrease in VMT per freeway lane-mile), indicating a small substitution effect where transit replaces auto travel on freeways. However, in the medium- (5 year) and long-term (6–10 year) timeframes, where latent and induced demand effects have sufficient time to take hold, there is no measurable substitution effect, and therefore no detectable effect of transit supply on auto freeway travel and congestion. The researchers conclude that while transit supply has a short-run effect on auto congestion, these effects are eventually overwhelmed by latent and induced demand effects as those who wished to travel by car but didn't because of congestion levels eventually fill the slack in the capacity of the freeway network created by increased transit services.[69]

Marshall and Dumbaugh (2020) studied pre-pandemic relationships between traffic congestion and the economic health of U.S. metropolitan areas, including transit mode share, finding that "[e]ight of the top ten congested cities rank in the top ten for highest transit mode share, and four rank in the top ten for highest active transportation mode shares."[70]

Hu et al. (2023) developed a model of the "sensitivity of commute travel times in US metro areas due to potential changes in commute patterns,"[71] using historical (pre-pandemic) ACS data. They found that assuming a 25 percent shift of transit riders and carpooling commuters to single-occupant vehicles, metropolitan areas with high transit mode shares and high congestion levels on highways, such as San Francisco and New York City, would see an average commute time increase of 20 minutes and 12 minutes per commuter respectively. These travel time increases would be roughly equivalent to an annual cost of time increase for individual commuters of $1,601 for San Francisco and $1,065 for New York City.[72]

Manville et al. (2023) analyzed the factors correlated to pre-pandemic (2000–2019) transit ridership declines in Southern California. While their findings "strongly suggest that increasing private vehicle access helped depress transit ridership," they also found that the congestion levels in the study region increased transit relative to auto accessibility to jobs during the period from

2014 to 2017, mitigating the ridership losses due to higher car ownership rates.[73] This suggests that increasing congestion levels played an important role in determining transit ridership in the pre-pandemic era (at least in Southern California), albeit perhaps to a somewhat lesser degree than auto ownership rates.

Pandemic and post-pandemic effects of auto use and road congestion on transit use

In addition to the four factors relative to auto use discussed above that affected transit ridership and mode choice before 2020, the pandemic introduced the following, interrelated influences: (1) reduced peak period congestion levels depressing commuter transit ridership (Moretti 2021); (2) the related hollowing out of many large downtown employment centers that were served by high-capacity, high-speed transit services that led to higher auto and lower transit mode shares (Moretti 2021); (3) the shift from work- to non-work related travel in large metropolitan areas, which served to depress transit ridership and increase auto VMT (Streetlight Data n.d.; Chakrabarti 2017; Marshall and Dumbaugh 2020; Manville et al. 2023); and (4) the increases of work-at-home/remote work brought on by the pandemic which depressed both transit and auto travel in the short term, but from which auto commute travel bounced back more quickly than transit use (Hu et al. 2023; Bhagat-Conway and Zhang 2023).

Moretti (2021) studied the effects of the pandemic on travel patterns in the U.S., finding that while "congestion patterns have been flattened"[74] during the first months of the pandemic, by the end of it (early spring 2021), evening rush hour traffic had returned to pre-pandemic levels (with 45 out of the 100 largest metro areas registering higher traffic volumes than before) and mid-day traffic volumes were higher as well. Transit ridership, over roughly the same period, fell to between 20 (during the first months of the pandemic) and 40 percent (during the final months of 2020) of pre-pandemic levels. Both congestion levels and transit ridership patterns were severely impacted by the pandemic, but transit suffered more in percentage terms and recovered more slowly as the pandemic went on since transit mostly serves downtown-oriented trip-makers, downtown commercial building occupancies were severely depressed, and traffic congestion levels were depressed as well, leading the remaining commuters to downtowns to choose driving over transit, further depressing transit ridership and slowing its recovery. Ultimately, Moretti concluded that transit ridership recovery post-pandemic would "hinge upon what happens to 'downtowns' and job centers."[75]

Streetlight Data (n.d.) studied the effects of the pandemic on the travel patterns in the top ten most populous U.S. metropolitan areas from 2020 to 2022, finding "VMT metrowide is 4 percent above pre-COVID levels on average, whereas VMT downtown is 27 percent below pre-COVID levels."[76] These findings suggest that instead of dropping in absolute terms, drivers shifted their travel patterns in terms of trip purpose, time of day, and destinations, reducing their travel to previously congested downtown, employment-rich areas in favor of travel to other metropolitan areas for non-work purposes. Nevertheless, even though drivers appear to have taken advantage of the freedom of travel choices enabled by the work-at-home policies enacted by employers and government, Streetlight Data found that since vehicle-hours of delay (VHD) have risen to nearly pre-pandemic levels during the latter months of the pandemic period, and since VMT has also risen during the same period, congestion was merely shifting locations (away from downtowns) and times (away from pre-pandemic peak periods) within most metropolitan areas. Furthermore, transit suffered during the pandemic period since the researchers cited above (Chakrabarti 2017; Marshall and Dumbaugh 2020; Manville et al. 2023) found that less auto congestion leads to lower transit ridership, since Streetlight Data (n.d.) found that all but the largest metropolitan areas in the U.S. have relatively few transit services except for those serving downtown areas, and since congestion and traffic patterns have shifted away from these downtown-oriented corridors.[77]

Hu et al. (2023) developed a model to capture the potential changes in commute travel times when large changes in commute patterns—such as those seen in the pandemic—take place. Using this model to anticipate the possible effects of the pandemic, Hu et al. note that although there would likely be large congestion travel time/cost increases related to a massive and sudden mode shift to auto travel, these impacts could be mitigated by an increase in work-at-home.[78]

Bhagat-Conway and Zhang (2023) analyzed peak period traffic in California during the pandemic finding peak-spreading increased after the lockdown period of the pandemic, even as overall daily traffic volumes returned to pre-pandemic normal, suggesting motorists are unlikely to revert to their pre-pandemic travel patterns and the peak-spreading seen from the pandemic will be maintained, particularly as a result of the growth in work-at-home.[79]

Popular media sources have documented the return of driving and congestion levels to pre-pandemic levels in many cities (Boehm 2023; Estacio 2022; Their 2023). Indeed, congestion levels in the post-pandemic period seem equally high and troubling to Bay Area commuters as compared to media reports from other metro areas (Kamisher 2023; Madrigal 2023). Madrigal (2023) cited the San Francisco Bay Bridge as an example of how while transit ridership remains stubbornly low during the post-pandemic period, "some mornings, congestion heading into San Francisco is even worse than in 2019."[80] Kamisher (2023) supports this notion as well, stating recently, "Bay Bridge speeds have slowed by 32 percent for many drivers."[81]

The lack of congestion seen on highways during the early months of the pandemic was seen as a significant cause for low commuter transit mode choice and ridership levels, but as the recovery has proceeded and VMT levels have returned to near-normal levels, increasingly researchers are looking to more nuanced relationships between congestion and transit to explain the rebound in auto traffic levels without a corresponding rebound in transit ridership.

2.4 What are the Opportunities for Generating More Ridership or Adjusting Transit Service?

In an effort to save transit services from further decline or even elimination, a number of authors have explored ways of gaining back transit ridership through adjustments to transit service characteristics (e.g., frequencies, connections, fares).

Watkins et al. (2022) studied the pre-pandemic period's declining transit ridership to identify its causes and effective strategies to mitigate and reverse them in the pre- and post-COVID eras. Their findings indicate that during the pre-pandemic period, ridership was highest along peak hour routes, and the best methods to increase ridership were focused on transit priority, discounted fares, and other "condensed service" measures such as "restructuring transit networks, fare innovation and real-time technology, new on-demand services, and dedicated right[s]-of-way."[82] Based on these findings, the researchers recommend five strategies to increase transit ridership in the post-pandemic period: "(1) Rethink mission, service standards, metrics, and service delivery; (2) rethink fare policy; (3) give transit priority; (4) consider partnerships with shared-use mobility providers carefully; and (5) encourage transit-oriented density."[83]

While transit ridership has undeniably suffered since the pandemic, Lee and Lee (2022) note that U.S. patronage declined throughout much of the previous two decades. Their analysis showed that from 2002 to 2017, the declining costs of auto ownership and use were the most significant factors in driving down transit ridership in the 85 largest metropolitan areas in the U.S. When comparing the influence of the costs of driving to the costs of transit fares over this period, the research team found they were, at the very least, equal, with perhaps driving costs even having slightly more of an influence between the two. The authors conclude that efforts to regain transit ridership in the post-pandemic period could be significantly enhanced by increasing the costs of driving through congestion charges and carbon emissions taxes, while simultaneously decreasing the time-costs of transit by improving transit travel times using dedicated bus lanes and signal prioritization.[84]

Erhardt et al. (2022) also explored ways in which agencies could recover ridership. For example, they looked to developing strategies by focusing on "ridership corridors, or areas serving the most essential workers. These strategies "could involve rethinking how street space is allocated to give priority [to] those vehicles carrying the most passengers, or they could involve adjusting the price incentives—including gas prices and fares—given to different modes of travel."[85]

Soria et al. (2023) analyzed survey data of Chicago transit riders collected during the pandemic to identify factors related to their "abandonment" of transit and the likelihood of their return. They identified three factors as the most influential in these decisions: teleworking, unemployment, and access to vehicles. Somewhat different results were found for the influence of social and economic disadvantage on transit abandonment, where those who were more "vulnerable" in terms of race, ethnicity, and gender were more likely to show decreased ridership and less likelihood of returning.

As for measures to attract riders back following the pandemic, the authors' analysis suggests that fare integration between transit, ridehailing, and micromobility services would encourage people to ride transit more often.[86]

Osorio et al. (2022) noted that while CTA's "reactive" cleaning and sanitation programs to address public health concerns among riders may have also played a role in mitigating the fear effect, these efforts are unlikely to bring ridership back substantially since the most important factors determining CTA's ridership losses are the result of work-at-home employment policies and stay-at-home executive orders. To lure "choice riders" who now work at home back to transit, they suggest transit agencies may need to develop new, innovative programs such as launching discount programs, promotional activities, improving service quality on key routes, and new advertising campaigns.[87]

Liu et al. (2023) studied how long it took for transit ridership to recover from disruptive events in the past such as terrorist attacks and epidemics. They found that in most cases, and apart from the 9/11 terrorist attacks, ridership levels returned to pre-event levels within a year. Other related factors influencing the severity of ridership losses and the duration of recovery were executive orders (e.g., school closures), transportation service level changes (e.g., station closures), and public fear-inducing media reports. Possible measures to attract riders back to transit mentioned included cleaning/sanitizing transit vehicles and stations, promotions and advertising campaigns, and service adjustments to better serve emerging demand patterns.[88]

Truong (2023), noting that BART had only recovered roughly 40 percent of their pre-pandemic ridership, referenced a Bay Area Council poll showing that many BART riders did not feel safe riding the system. The poll found that 46 percent of riders said they had witnessed a crime while riding. This suggests that improving security on the system may help BART with its ridership recovery.[89]

Gurevich (2023) points to the same Bay Area Council poll, concluding that only 19 percent of respondents cited their ability to work at home as a reason for not returning to riding BART for their commute, while 45% "cited cleanliness, fear or lack of security as reasons for not wanting to ride BART." These findings indicate that many Bay Area white-collar workers would consider returning to the office using BART, despite the benefits offered by work-at-home.[90]

2.5 Effects of, and Policies to Address the COVID-19 Pandemic on Downtowns

Since the initial impacts of COVID-19 were felt in 2020, numerous cities in the U.S. and abroad have attempted to revitalize downtown areas adversely impacted by decreases in economic activity in these areas. Various authors have addressed this broader need to introduce policies that can help attract future growth to downtowns.

Milder (2020) analyzed the remote work trends before and during the COVID-19 pandemic to predict whether it is a practice that is likely to outlast the crisis of the pandemic. Responses to a Gallup survey revealed that remote work already existed and was growing in the early to mid-2010s leading up to the pandemic. Various data collected by a MIT research team, the Federal Reserve Bank of New York, and a Harvard Business School research team revealed that while remote work (i.e., work-at-home) grew tremendously during the pandemic, larger companies tended to have larger shares of their workforces working remotely compared to smaller businesses, and certain industries, particularly those with better-educated and higher-paid workers, were better suited for remote work. Milder also analyzed other impacts of remote work, including non-health related benefits of widening candidate pools, decreased need for office space, and remote work enabling workers to find more affordable housing options.[91] These findings suggest that pre-pandemic successful, white-collar job centers may have more trouble than other centers with more diverse employment bases at attracting on-site employers back to their offices and regaining their previous transit ridership levels.

Indeed, turning to the impacts on public transit, Milder observed that COVID-19 was devastating on public transit ridership, particularly so for commuter rail, noting "[w]hen COVID-19's impacts really hit with full force, commuter rail 'all but disappeared'" (Milder 2020, p. 147). He attributes the struggle of transit operators' recovery to issues they were already experiencing before the pandemic, such as service disruptions and failures as well as management and budget issues. He additionally noted that concerns that stemmed from the pandemic reinforce negative public attitudes toward transit and indirectly reinforce remote work. Overall, Milder predicted that remote work is likely to be a lasting trend because it was already growing in the years leading up to the pandemic and there are many co-benefits of remote work for both employers and employees.[92]

Hutson and Orlando (2022) analyze data on rents and vacancy rates from Austin, Texas and Los Angeles (LA), California to understand the new needs of the post-pandemic population and form recommendations for changes to existing land use. The analysis revealed a sustained increase in demand for industrial uses and sustained decrease in demand for retail uses, which is consistent with existing literature. The analysis also revealed a greater demand for multifamily housing in Austin due to increased population growth and greater demand for housing in the periphery of LA due to the removal of location restraints by remote work. Office spaces were found to have rising vacancies and rents, indicating that landlords were unwilling to rent out office space at decreased costs and may pivot to other uses. Accordingly, the authors identified that a mixed-use downtown with significantly more residential use is an ideal model and suggested that empty retail spaces are an ideal target for redevelopment and reuse into mixed-use spaces. They add that buildings should be designed with maximum flexibility to avoid being locked into a single use, which anticipates and is adaptable to future changes in needs.[93]

The rise of online retail contributed to decreased interest in malls through the 2010s and the "death" of malls was only exacerbated by the pandemic. Recent studies have found that people are now more likely to visit malls for an urban experience rather than shopping. Rao and Liu (2023) studied the structure and design of shopping centers to understand the preparedness of these spaces for urban transition and to identify design types that are better geared towards enhancing an urban sense of place. They employed a mixed-methods approach for their study to examine the spatial forms, types, and urbanity of 268 contemporary U.S. shopping centers with Apple Stores and their relationships with surrounding neighborhoods. Shopping centers with an Apple Store were selected because according to the researchers, Apple positions its shops in primary retail destinations which draws other significant stores to the area.[94] The analysis revealed that there are three main features of the current retail landscape of cities: experiment, experience, and emergence. They found that shopping centers with active experiments to try and adapt to changing market conditions are less likely to be impacted post-COVID by another "retail apocalypse" as their experiments in structure and design could enhance resiliency of these spaces. They also found that remodeled shopping centers with a "main street" feel that are under the control of a mall group and have ample car facilities were the most attractive retail types before and during the pandemic as these offer the type of urban experience many patrons are seeking while also providing easy car access. The last finding indicated that the emergence of urbanity in shopping centers occurs in two ways: (1) they are positively associated with population density, walkability, and residential building density while being negatively related to car dependency at the neighborhood scale, and (2) factors of an urban lifestyle, sense of publicness, and sense of health act as the anchors for attracting people to live, work, shop, and play in spaces in the post-COVID era; centers with a mixture of the street and town square experience, where people often need to pay for a range of amenities, are associated with a rise in public life consumption.[95]

3. Demand

3.1 Introduction

This Section and the next two ones following present a detailed discussion of the effects of the COVID-19 pandemic on transit in the Bay Area. In these discussions we focus primarily on what we term the Big 7 Bay Area transit agencies:

- AC Transit
- BART
- Caltrain
- Golden Gate
- SamTrans
- SFMTA (Muni)
- VTA

These are agencies that serve multiple counties or carry a significant portion of choice riders.[1] As shown in Table 3.1, these agencies account for over 90 percent of passenger trips and passenger miles, and nearly 90 percent of all transit service provided in the Bay Area.[2]

[1] By "choice riders" we refer to riders that are usually able to use modes other than transit if they so desire, as opposed to "dependent riders," whose only feasible travel choice is transit. The latter category typically includes persons without access to a car.

[2] Several Bay Area transit agencies, including Rio Vista, Union City, and Vacaville, are not NTD full reporting agencies and, therefore, do not report passenger miles. Union City and Vacaville do not report passenger trips.

Table 3.1 Agency Shares of Trips, Passenger Miles, and Revenue Service Pre- and Post-Pandemic

	Passenger trips		Passenger miles		Vehicle revenue miles		Vehicle revenue hours	
	2019	2022	2019	2022	2019	2022	2019	2022
AC Transit	11%	14%	6%	9%	12%	10%	17%	16%
BART	26%	18%	54%	46%	43%	48%	19%	24%
Caltrain	4%	2%	12%	8%	4%	4%	2%	2%
Golden Gate	1%	1%	3%	2%	2%	1%	2%	1%
SamTrans	2%	3%	1%	2%	4%	4%	6%	5%
SFMTA	45%	48%	14%	17%	13%	13%	28%	28%
VTA	7%	8%	6%	8%	11%	10%	14%	13%
Other agencies	4%	5%	5%	7%	11%	10%	12%	11%

Note in particular that BART accounted for over half the transit passenger miles in the Bay Area before the pandemic, and 25 percent of **all** reported transit passenger miles of travel in the entire State of California. These percentages have decreased to slightly less than half in the Bay Area and 16 percent statewide, respectively.

3.2 Transit Demand in the Bay Area

Monthly bus trips before, during, and after the pandemic are shown in absolute numbers and indexed values in Figures 3.1 and 3.2, respectively; graphs are shown for the Bay Area Big 7 transit agencies that operate bus service, with the remaining agencies aggregated together in the "other" category.[3] Note that bus ridership has, on average, recovered to about 80 percent of pre-pandemic levels for most operators. The low ridership figure for Golden Gate Transit is in part due to the transfer of a significant portion of its service to Marin Transit in October 2022.

[3] Unless otherwise noted, data for all transit operators are taken from the National Transit Database (https://www.transit.dot.gov/ntd/ntd-data). Monthly data are as shown. Annual data are for fiscal years.

Figure 3.1 Monthly Unlinked Passenger Trips – Bus

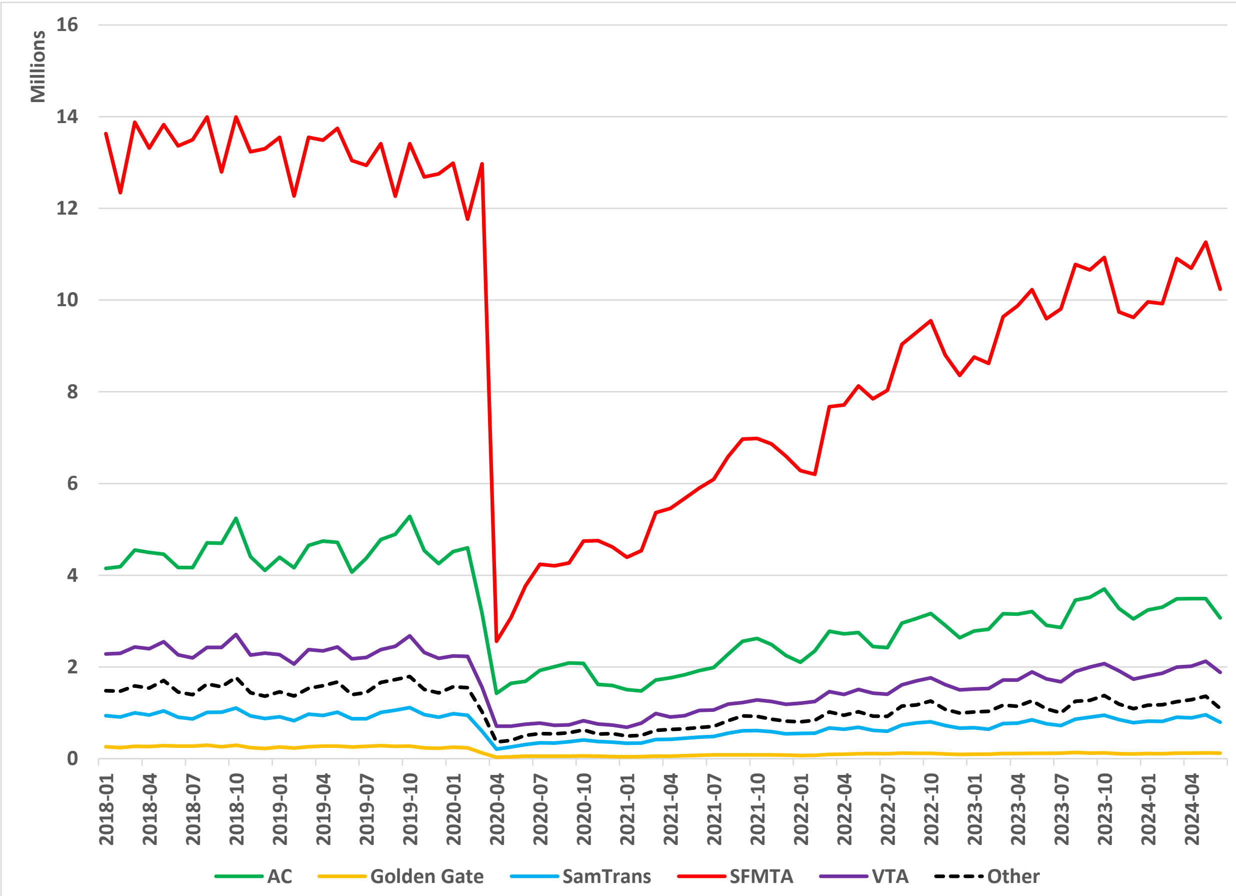
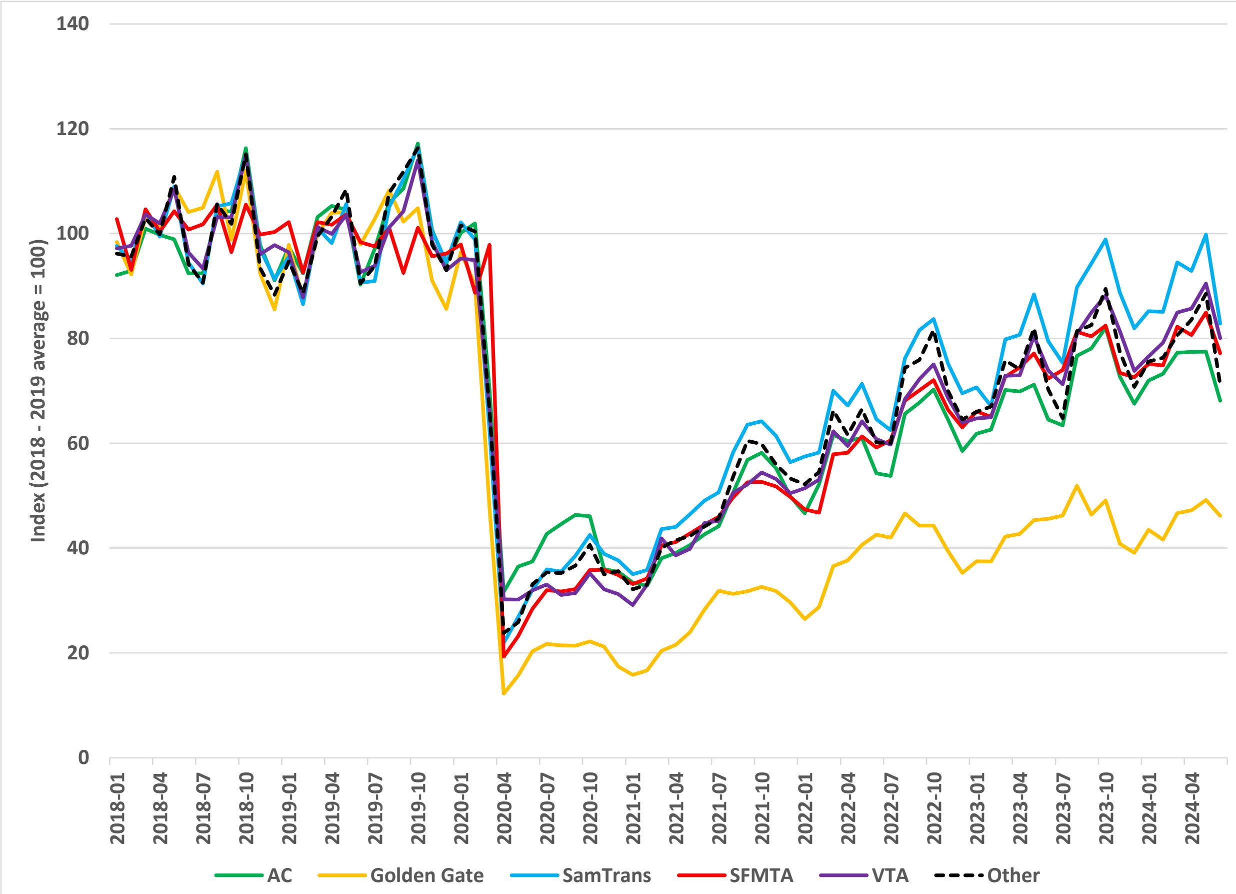


Figure 3.2 Monthly Unlinked Passenger Trips – Bus (Index)



In general, the trend lines for bus ridership are upward. If the current trend lines persist, most bus operators may eventually see bus ridership approach pre-pandemic levels in 2026 or 2027.

Rail ridership for the largest Bay Area rail operators is shown in Figures 3.3 (absolute numbers) and 3.4 (values indexed to pre-pandemic levels). Rail ridership has recovered much more slowly than bus ridership. In particular, ridership for Muni and VTA is now at about 60 percent of pre-pandemic levels, while BART and Caltrain are at about 40 percent of pre-pandemic levels. The recovery trend appears to be slowing for BART and Caltrain, while the trend for Muni and VTA appears to be continuing.

One possible reason for the slower recovery of BART and Caltrain ridership may be that trips to downtown San Francisco accounted for large percentages of their pre-pandemic ridership. These riders are, in general, higher-income riders and are, therefore, more likely to be choice riders rather than transit dependents. Indeed, as will be discussed below, it appears that higher income workers are much more likely to work at home than lower income workers.

Figure 3.3 Monthly Passenger Trips – Rail

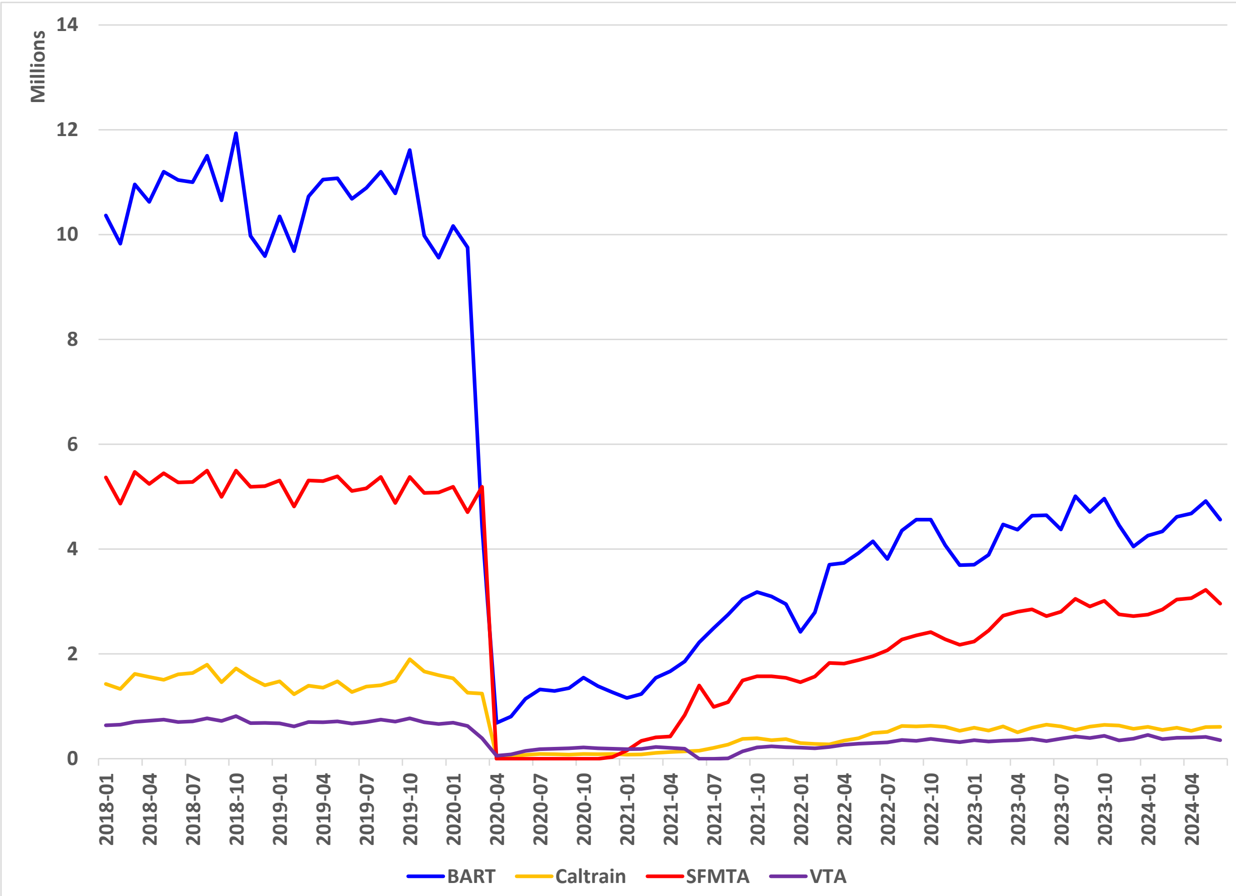
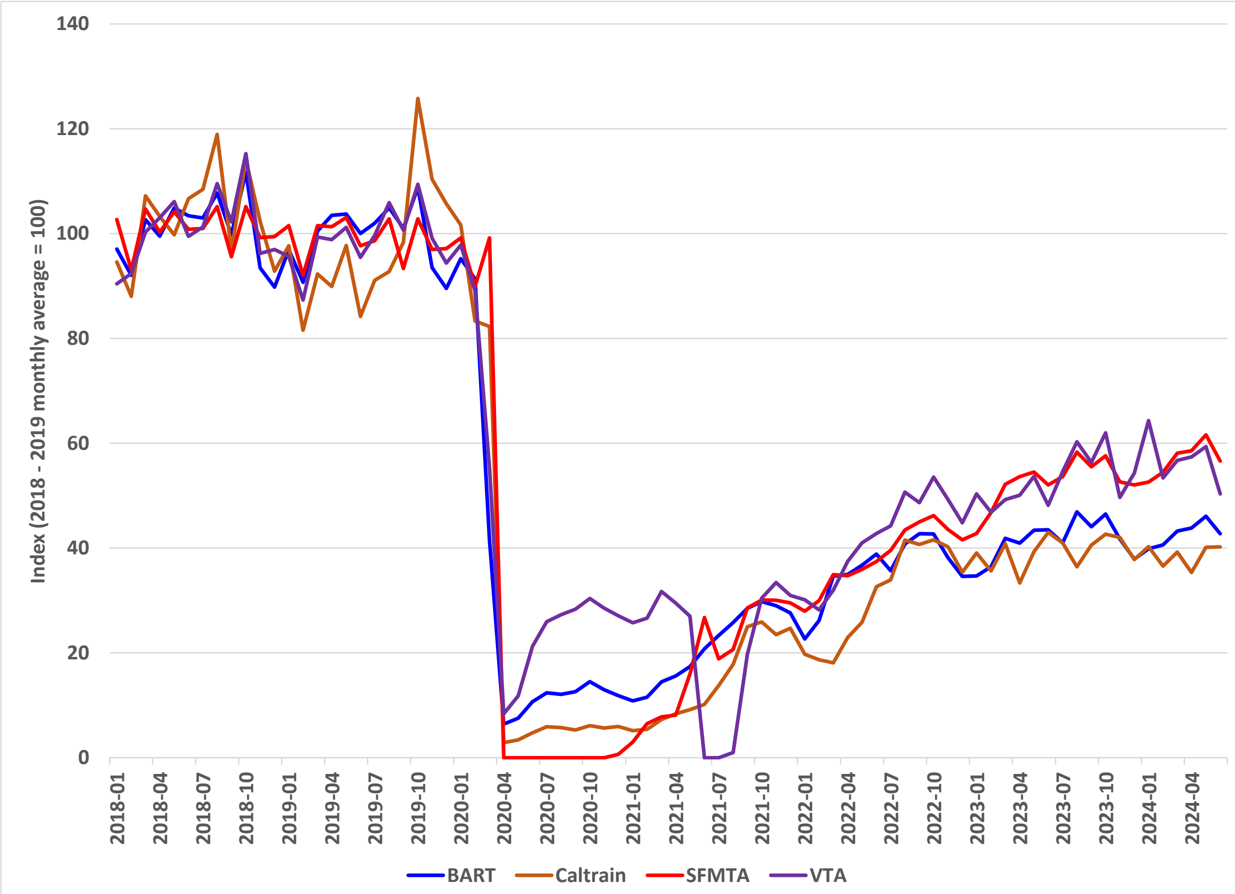


Figure 3.4 Monthly Passenger Trips – Rail (Index)



Annual passenger miles for the Bay Area transit agencies are shown in Figures 3.5 and 3.6 for bus and rail respectively.[4]

The most important thing to notice about rail passenger miles is that BART and Caltrain passenger miles have fallen off disproportionately higher than the numbers of trips, indicating that the decrease in ridership has been disproportionately higher for longer trips. This has significant implications for fare revenues, as longer trips on these systems are charged higher fares. The difference is especially acute for BART, which has seen a greater drop in transbay trips compared to other trips, since BART's fare structure includes a surcharge for transbay trips.

[4] FY22 data were the latest available data at the time of this report. Note that the "other" category includes Rio Vista, Union City, and Vacaville systems, which are not full-reporting agencies to the National Transit Database and which, therefore, do not report passenger miles.

Figure 3.5 Annual Passenger Miles by Fiscal Year, Bus

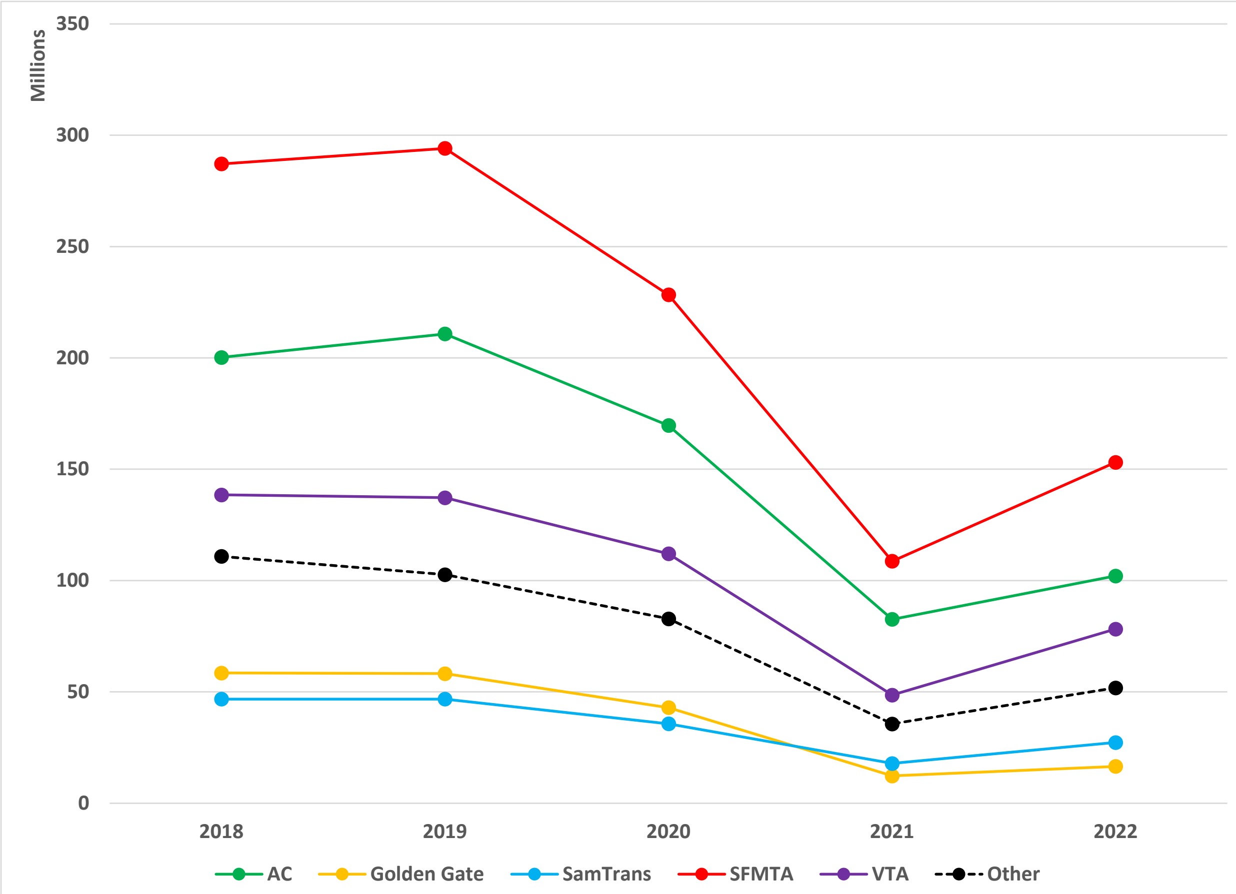
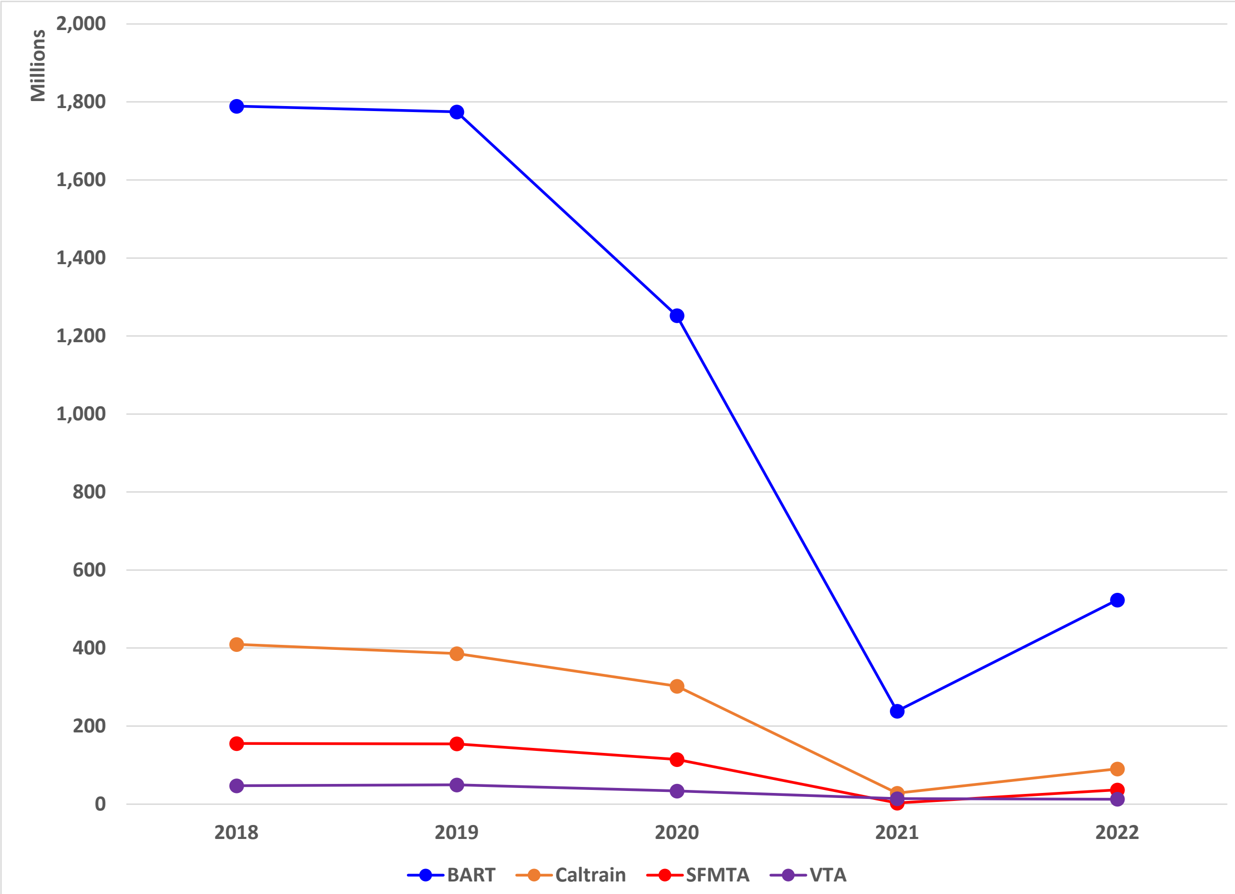


Figure 3.6 Annual Passenger Miles by Fiscal Year, Rail



BART continues to account for the vast majority of rail passenger miles, and nearly half the total transit passenger miles, in the Bay Area.

3.3 Components of Transit Demand Changes

3.3.1 Introduction

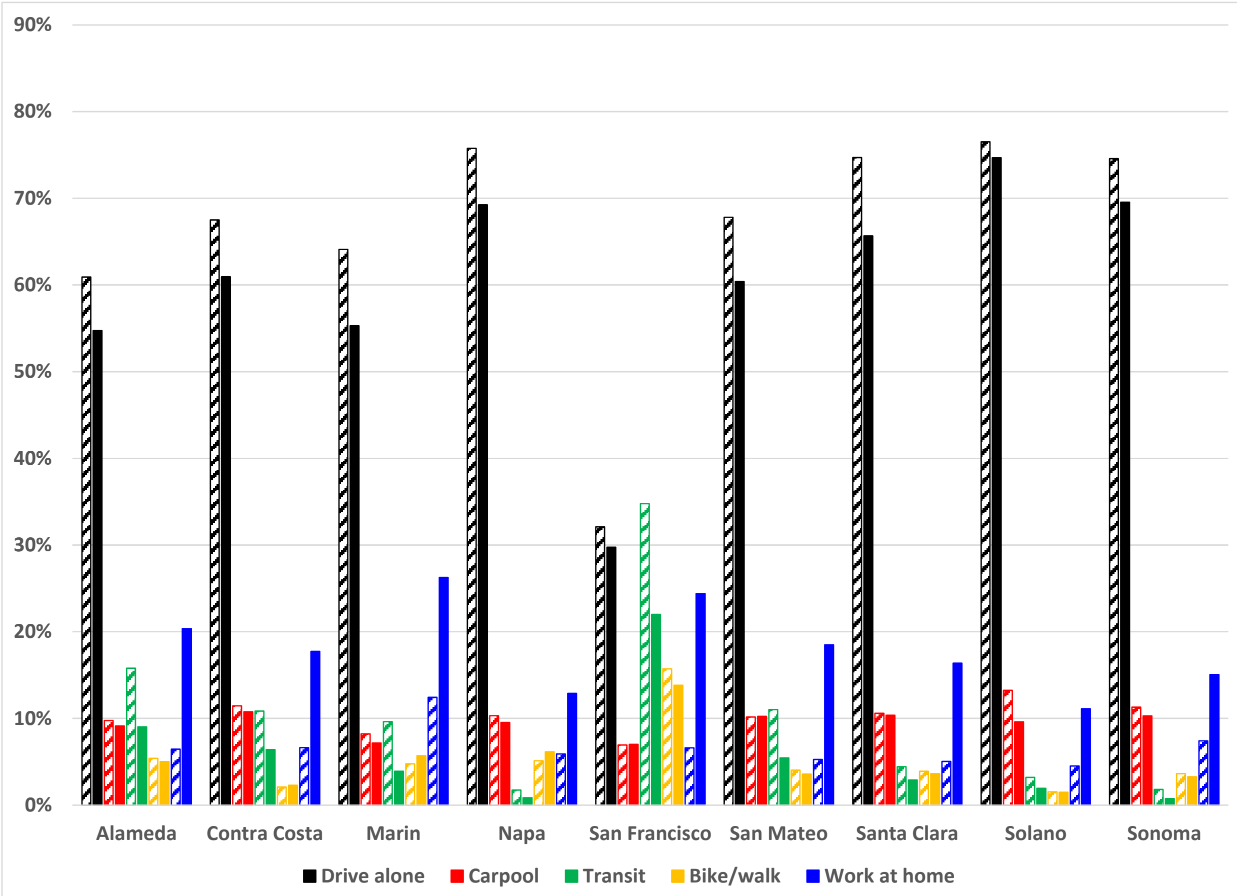
The results shown in Section 3.2 raise the question: where did all the transit riders go? This section offers some evidence on the causes of the decrease in transit ridership.

3.3.2 Mode to work

Figure 3.7 shows pre-pandemic (2015–2019) and post-pandemic (2023) mode to work data for each of the nine counties in the Bay Area.[5]

[5] The only available mode choice data for the Bay Area are work mode choice data from the American Community Survey. Since work travel accounts for the largest market share for most transit agencies, we focus on work travel in these analyses.

Figure 3.7 Mode to Work by County, 2015–2019 and 2023



Note: Hashed bars are for 2015–2019; solid bars are for 2023.

Comparisons between pre- and post-pandemic percentages indicate the following:

- In general, the proportion of workers who work at home was much higher in 2023 than before the pandemic.
- Transit work mode share has declined substantially.
- Drive alone and carpool percentages have declined.

A significant confounding factor to interpreting work mode data from the American Community Survey is that respondents are asked to state their *usual* mode of travel to work; the work mode question is phrased as follows:

How did this person usually get to work LAST WEEK? Mark (X) ONE box for the method of transportation used for most of the distance.

Hence, workers who follow a so-called "hybrid schedule"—i.e., come into the office one or more days per week and work at home other days—may not be accurately represented in the American Community Survey, suggesting that the actual percentages of people who work at home may be underrepresented in these data.

3.3.3 Changes in work mode over time

Time series perspectives on work mode changes are shown in Figures 3.8–3.11 for drive alone, carpool, transit, and work-at-home for residents of each of the nine Bay Area counties.

Figure 3.8 Drive Alone to Work, 2015–2019 to 2023

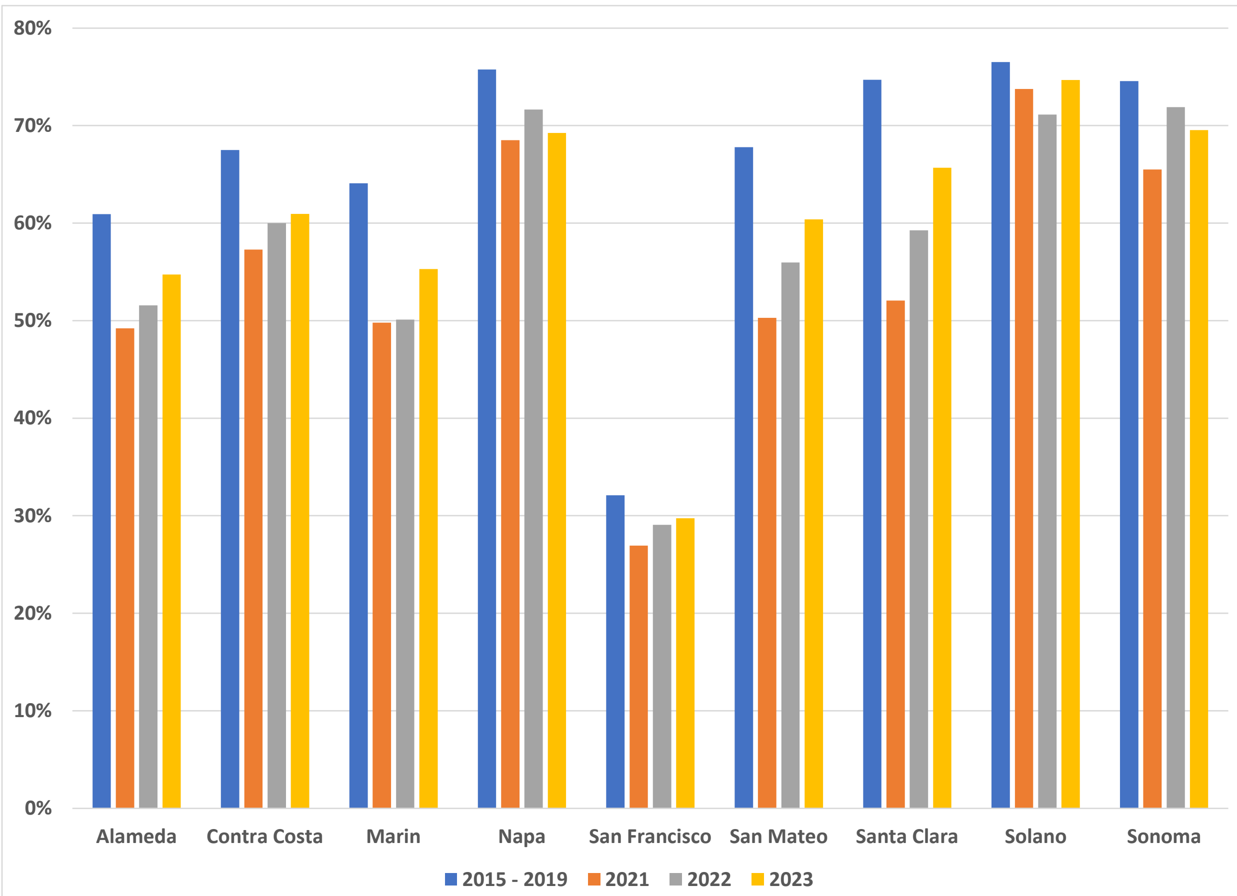


Figure 3.9 Carpool to Work, 2015–2019 to 2023

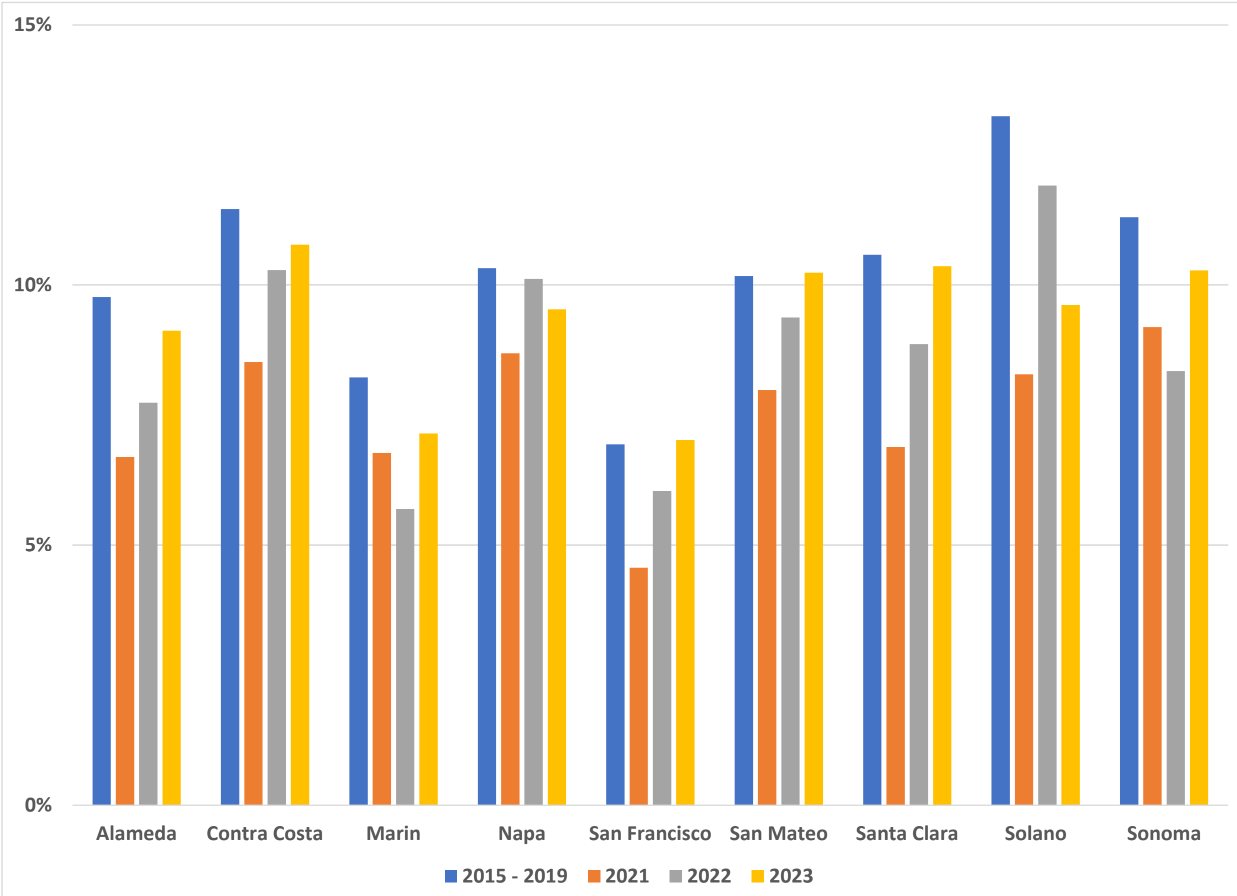


Figure 3.10 Transit to Work, 2015–2019 to 2023

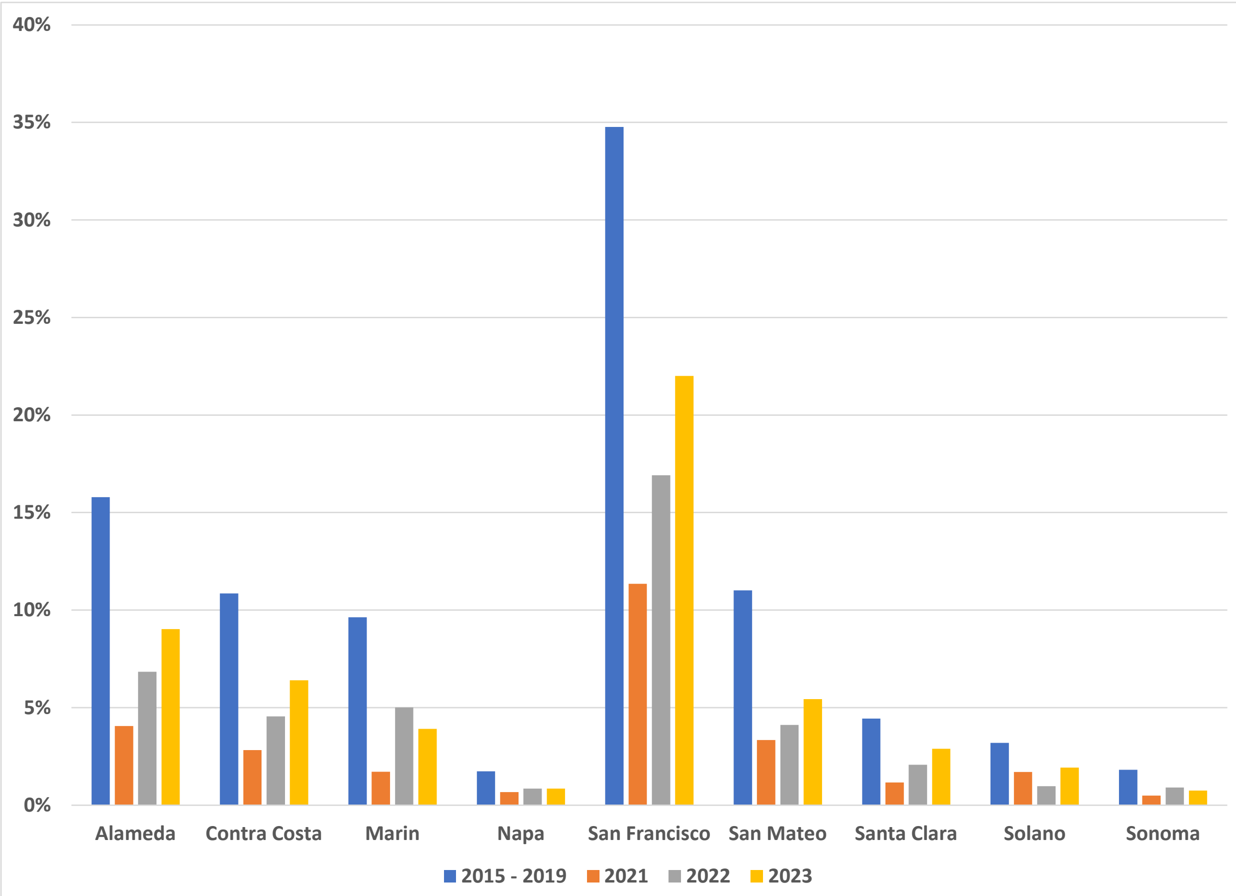
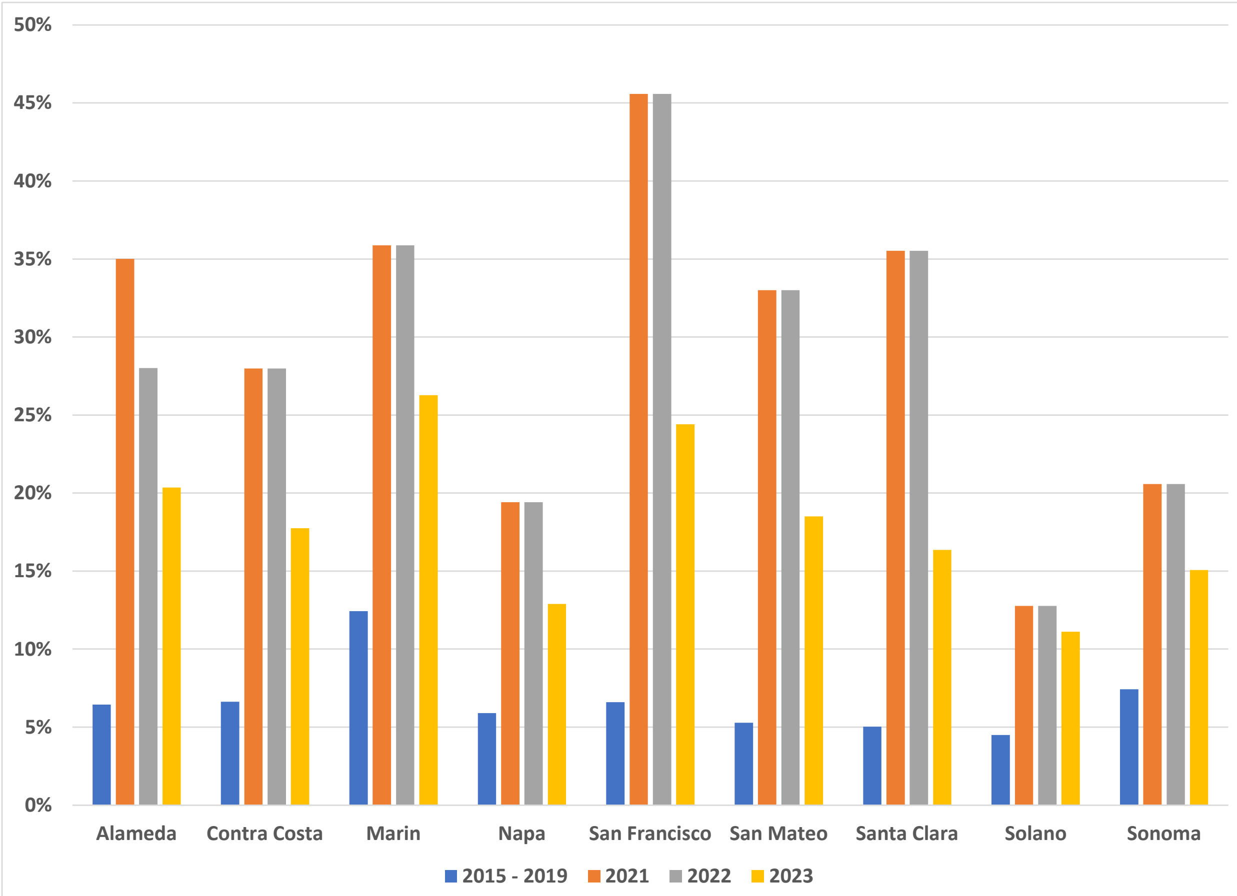


Figure 3.11 Work-at-Home, 2015–2019 to 2023



In general, the graphs show the following:

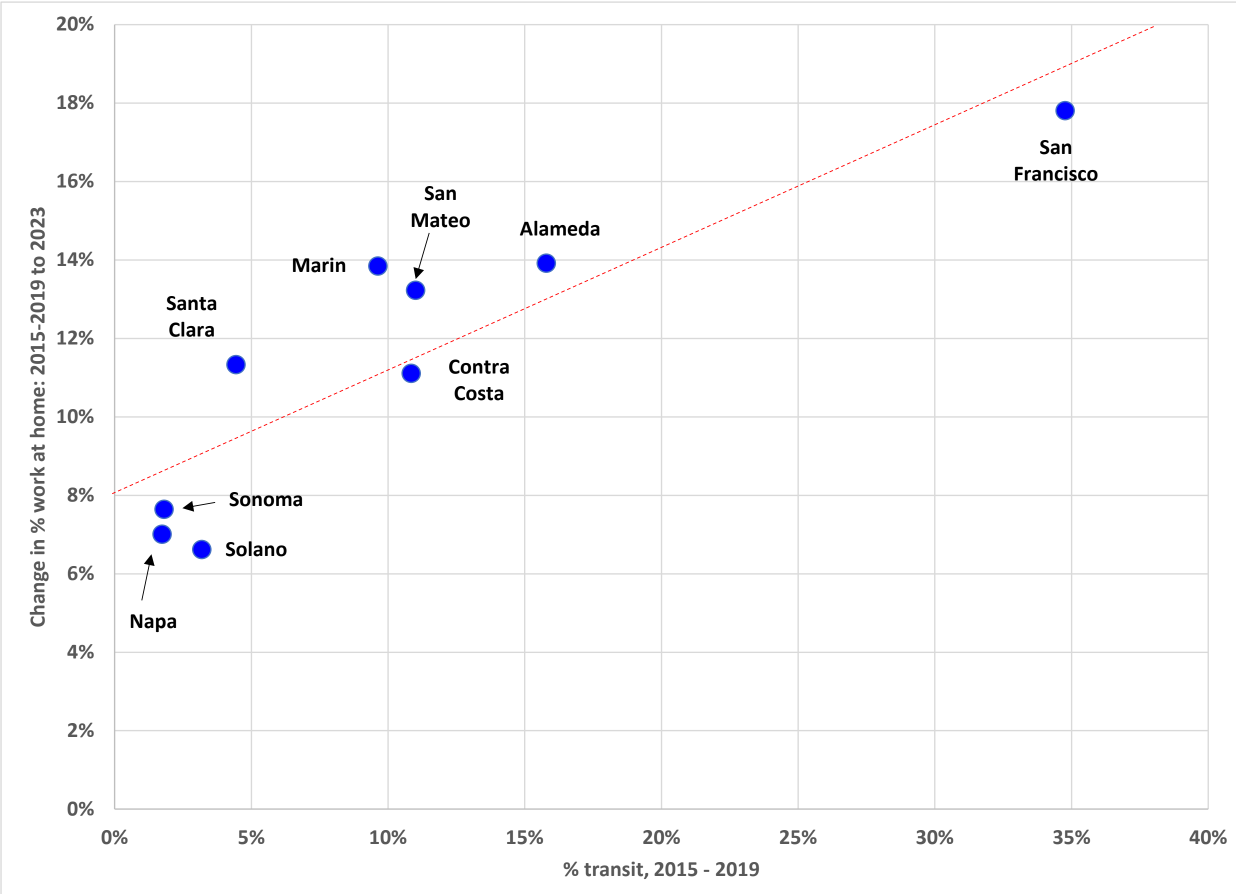
Post-pandemic percentages for commute modes (drive alone, shared ride, and transit) are somewhat lower than pre-pandemic levels.

Transit percentages have declined significantly. Although there appears to be some recovery from the extreme lows during the pandemic, post-pandemic levels of transit use are still significantly below pre-pandemic levels.

Work-at-home percentages have declined somewhat from their levels during the pandemic, but still remain at about triple pre-pandemic levels.

There is an interesting relationship between pre-pandemic transit work mode share and change in the work-at-home share, as shown in Figure 3.12.

Figure 3.12 Change in Percent Work-at-Home vs. Pre-Pandemic Transit Use, Bay Area Counties



The change in percentage work-at-home appears to be highly correlated with the pre-pandemic transit percentages, which may indicate that a significant portion of the post-pandemic work-at-home share may come from former transit users.

3.3.4 Employment, socioeconomics, and demographics

Median earnings by mode to work for 2023 are shown for the San Francisco and San José Metropolitan Statistical Areas (MSAs) in Figure 3.13 in dollar values and in Table 3.2 as percentages of median earnings for all workers.[6]

[6] San Francisco and San José MSA data were used as these cover the counties with the most transit services. MSA aggregations rather than counties were also used to reduce the margin of error in the percentages. Socioeconomic characteristics for workers who work at home were not tabulated in the American Community Survey prior to 2023.

Figure 3.13 Median Earnings by Mode to Work, San Francisco and San Jose MSAs

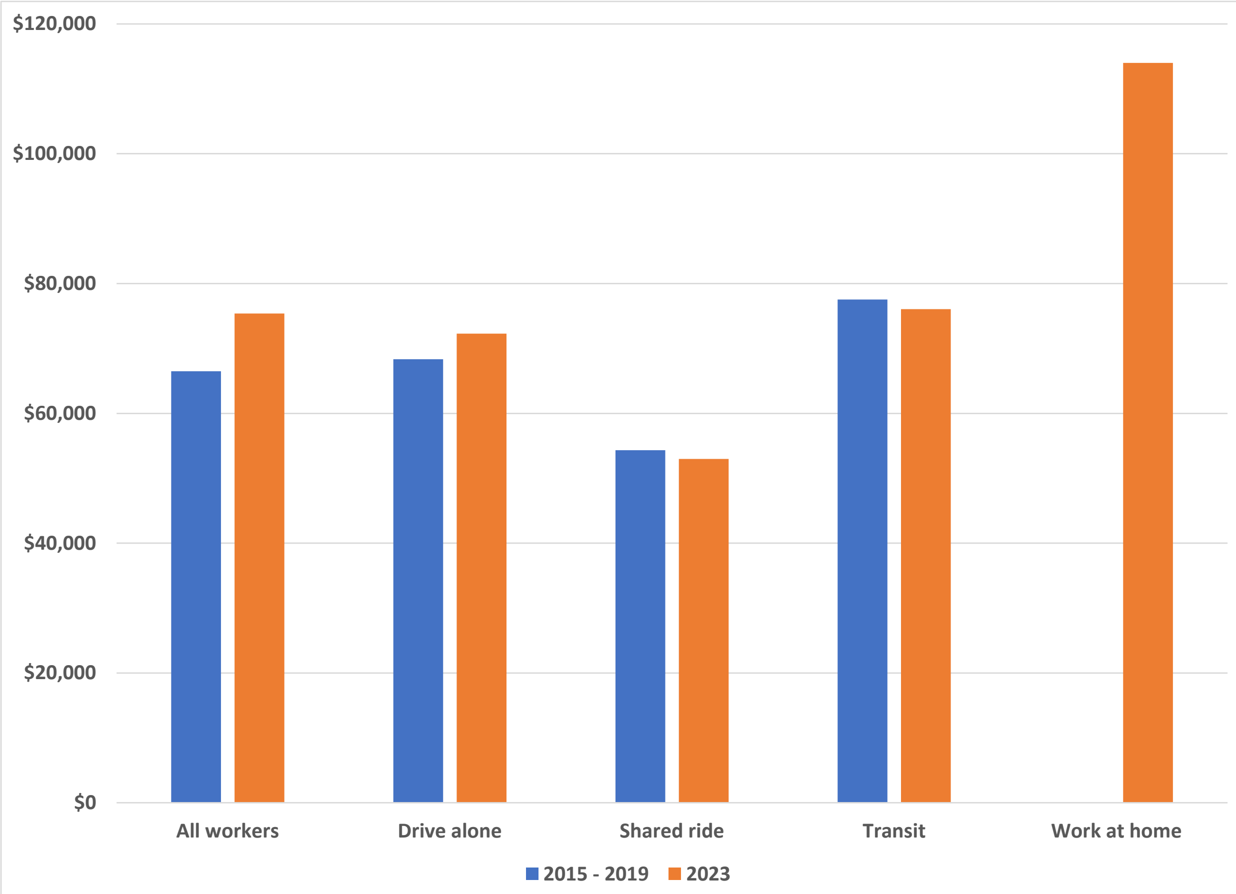


Table 3.2 Median Earnings of Mode Users as Percentage of Median Earnings for All Workers, San Francisco and San Jose MSAs.[7]

Mode to work	2015–2019	2023
Drive alone	103%	96%
Shared ride	82%	70%
Transit	117%	101%
Work-at-home	N/A	151%

[7] Technically, the nine-county Bay Area also includes the Napa, Santa Rosa, and Vallejo MSAs. San Francisco and San José MSAs were chosen because they include the great majority of transit service, especially rail, in the Bay Area. And combining data from other MSAs would add errors to the tabulation due to the sampling schemes used for the American Community Survey, from which these data were derived.

It is interesting to note that:

- Median earnings for those who work at home are substantially higher than for the employed population at large.
- Pre-pandemic earnings for transit riders were higher than average, but are now at average; hence, it appears likely that many higher-income transit riders are now working at home.
- Median earnings for drive alone and shared ride workers are also lower, indicating that a number of the higher-income earners in these groups before the pandemic are now working at home.

Figure 3.14 indicates that there are profound differences in work-at-home rates among occupational classes. Management, Business, Science, and Arts occupations have work-at-home rates of 25% while 16% sales and office workers work at home. Occupations such as service, construction and production have very low work-at-home rates, reflecting the fact that these jobs typically require work at external sites.

Figure 3.14 Work Mode by Civilian Occupation, San Francisco and San Jose MSAs, 2015–2019 and 2023

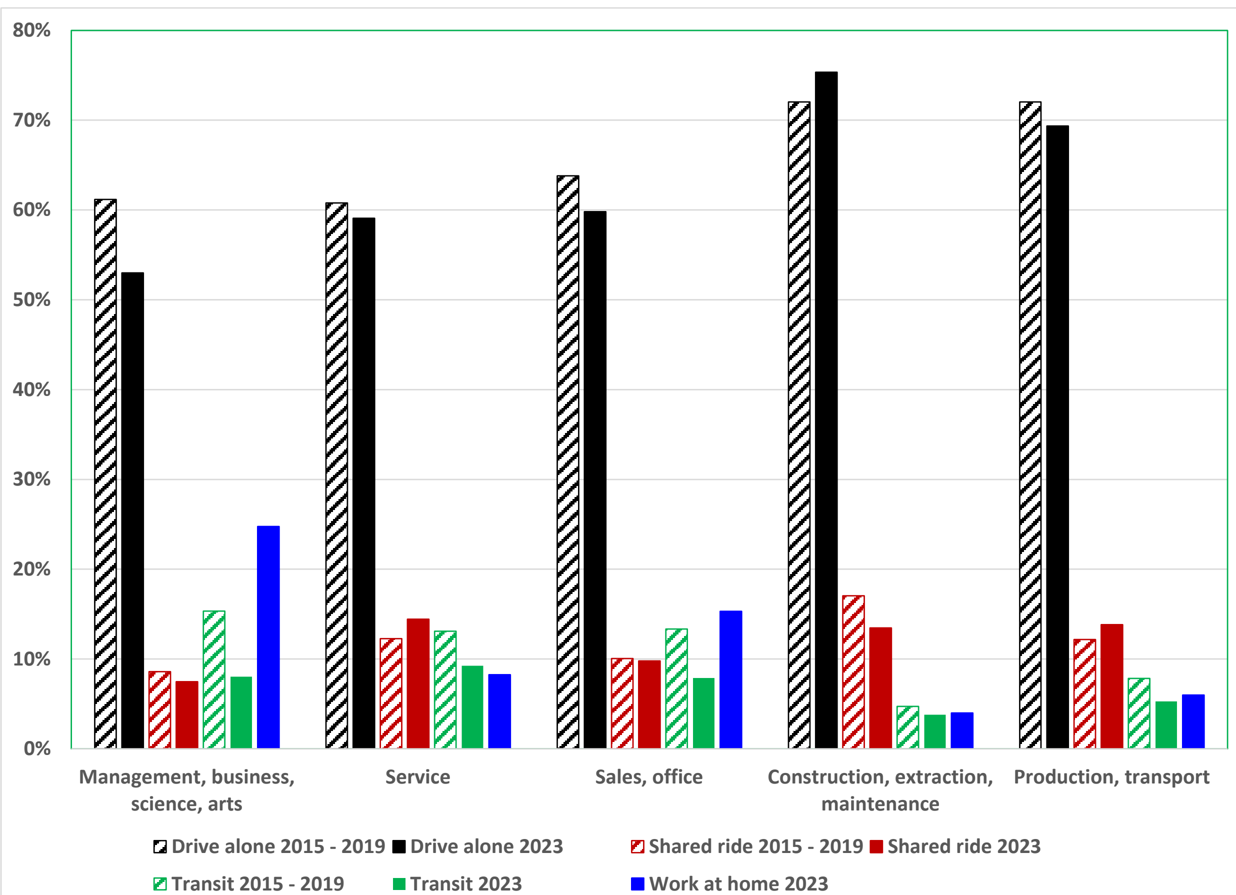
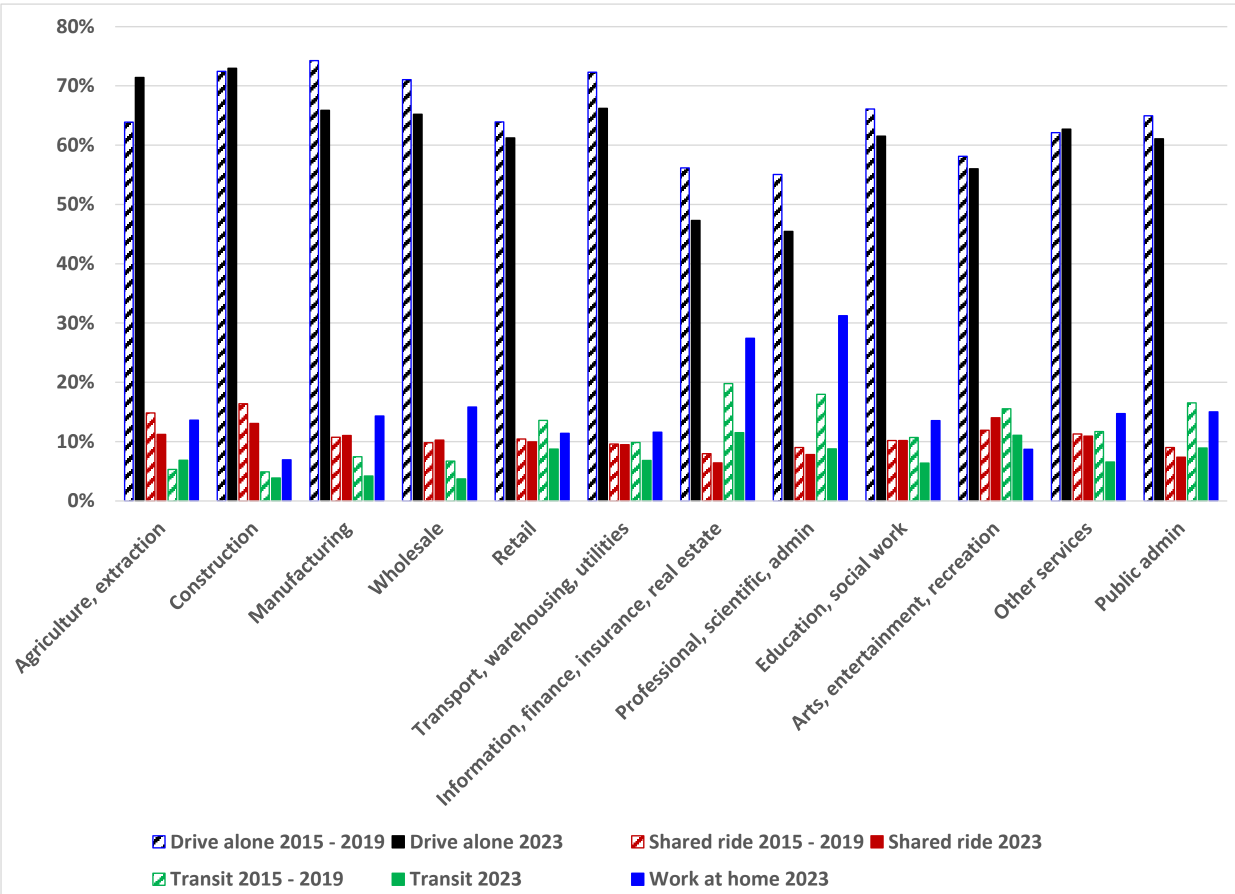


Figure 3.15 displays mode split by industry. Professional, Scientific, and Administrative firms had the highest work-at-home rates in 2023 with over 30% working at home in 2023. Information Finance Insurance and Real Estate had nearly 30% of their workers working at home. Other industries have substantially lower work-at-home rates, though all are higher than in 2019.

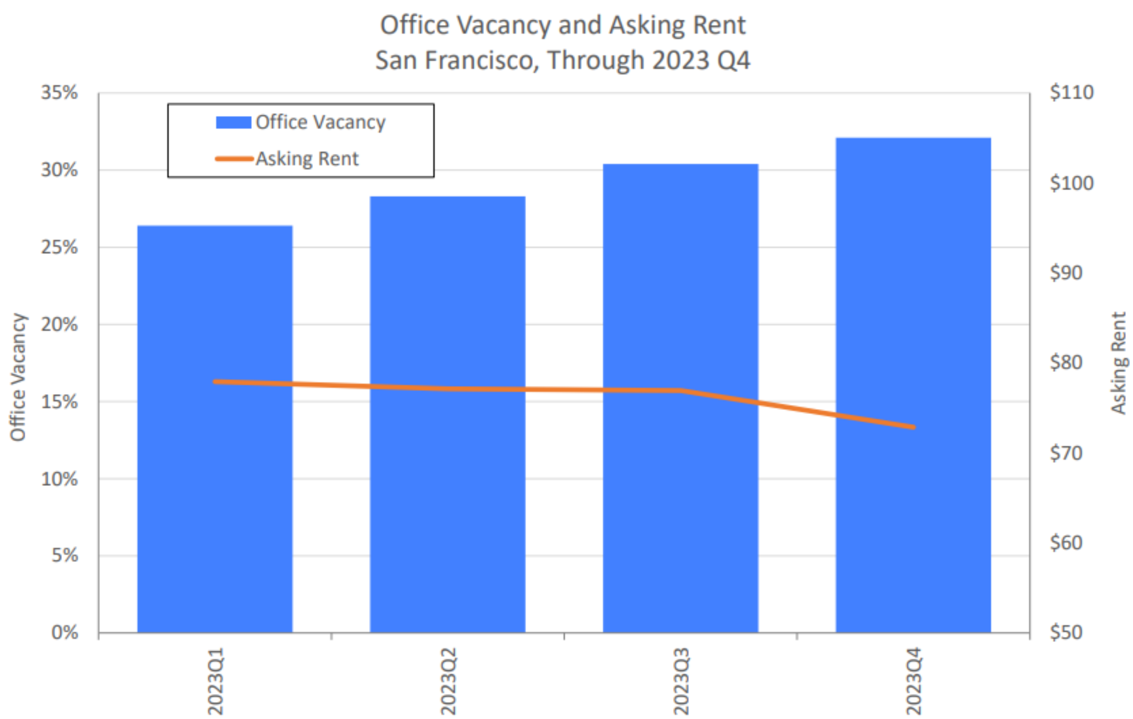
Figure 3.15 Work Mode by Civilian Industry, San Francisco and San Jose MSAs, 2015–2019 and 2023



3.3.5 San Francisco office vacancy rates

As noted above, transit operators serving San Francsico have recovered less than half their pre-COVID ridership. Persistently high office vacancy rates are a proximate cause. After reaching historic lows of under 5% in 2019, office vacancy rates rose to over 30% at the end of calendar year 2023 (Figure 3.16). During 2024, the vacancy rate rose further due to the exodus of several employers, including X/Twitter (San Francisco Office of the Controller, based on data compiled by Jones Lang LaSalle (JLL)). In July 2024, the San Francisco Controller cited data from Kastle Systems that indicated weekly office attendance in leased office space was less than 50% due to remote and hybrid employment patterns. Collectively, these data suggest that on a typical weekday there may be only one-third as many workers in downtown San Francisco in 2024 compared to 2019.

Figure 3.16 San Francisco Vacancy Rates and Asking Rents, 2023



3.4 Comparison to Other Metropolitan Areas

3.4.1 Introduction

To gain some perspective on changes in Bay Area transit use, we present some comparisons with other large metropolitan areas in the US. The metropolitan areas were chosen as follows:

- Other large metropolitan areas in California with rail systems:
    - Los Angeles
    - Sacramento
    - San Diego
- Other large West Coast metropolitan areas with rail systems:
    - Portland

    - Seattle
- Large metropolitan areas with older rail systems:
    - Boston
    - Chicago
    - Philadelphia
    - Washington, D.C.
- Other large metropolitan areas with newer, but still large rail systems:
    - Atlanta
    - Dallas
    - Miami

3.4.2 Transit ridership

Transit ridership indices for the Bay Area compared to other metropolitan areas are shown for bus and rail separately in Figures 3.17–3.20. West Coast and other metropolitan areas are separated out for the purposes of readability.

Figure 3.17 Bus Ridership Index, Bay Area vs. West Coast Metros

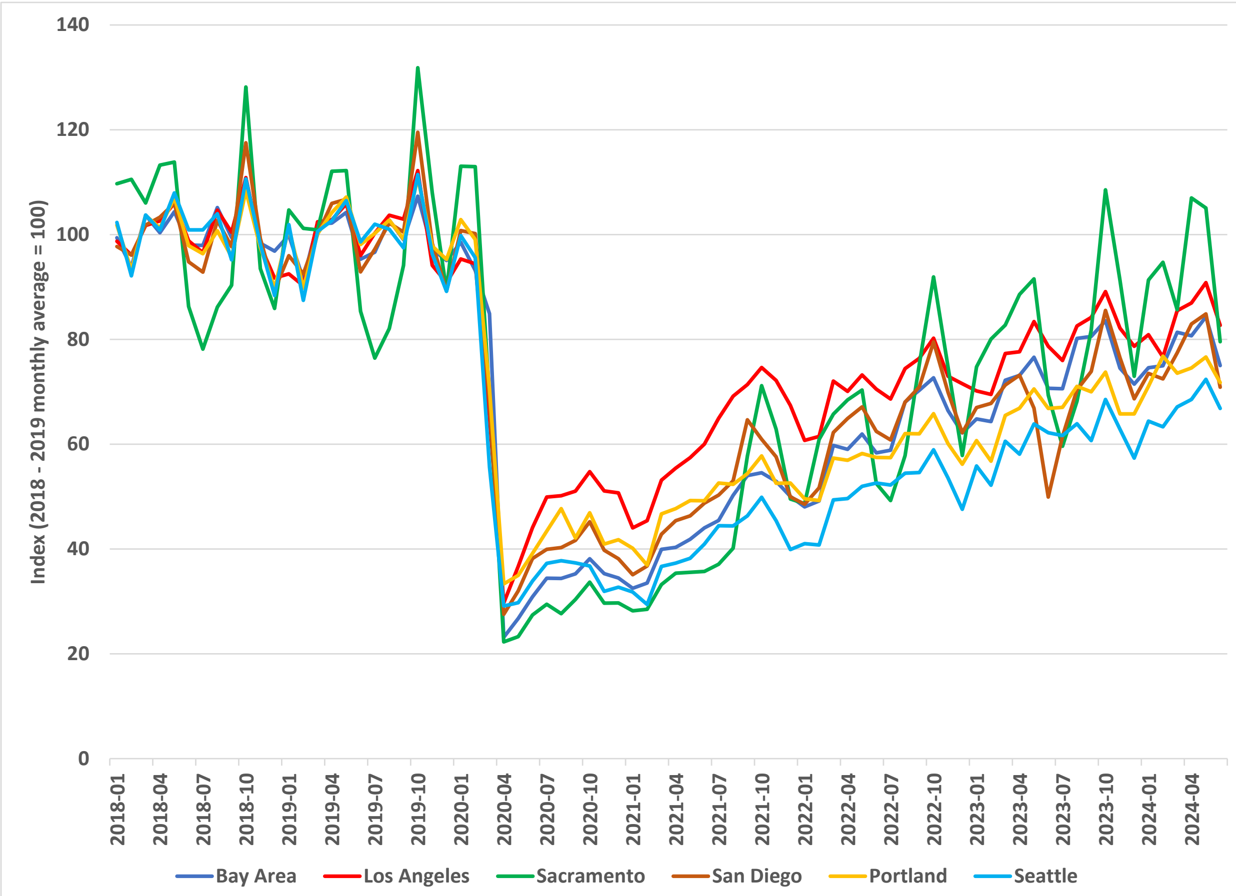


Figure 3.18 Rail Ridership Index, Bay Area vs. West Coast Metros

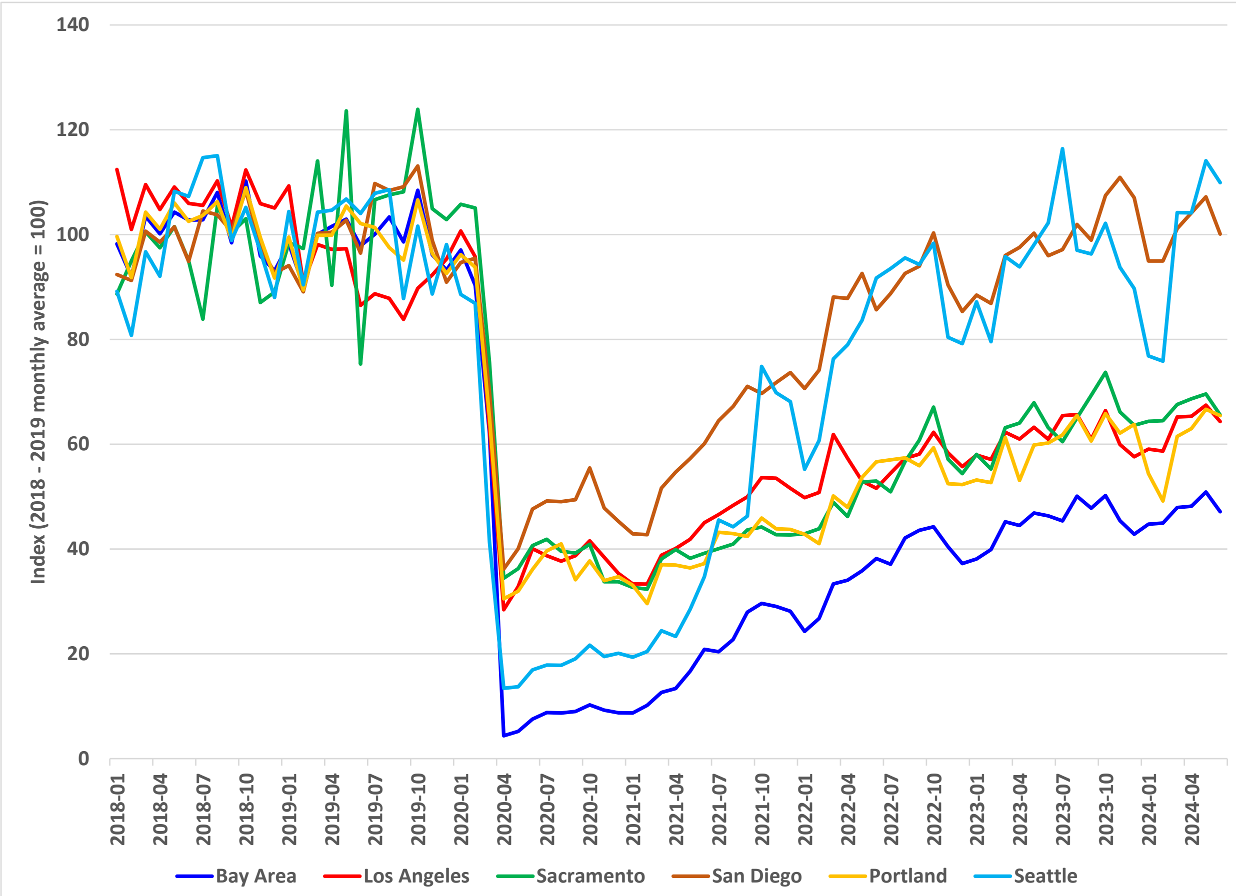


Figure 3.19 Bus Ridership Index, Bay Area vs. Non-West Coast Metros

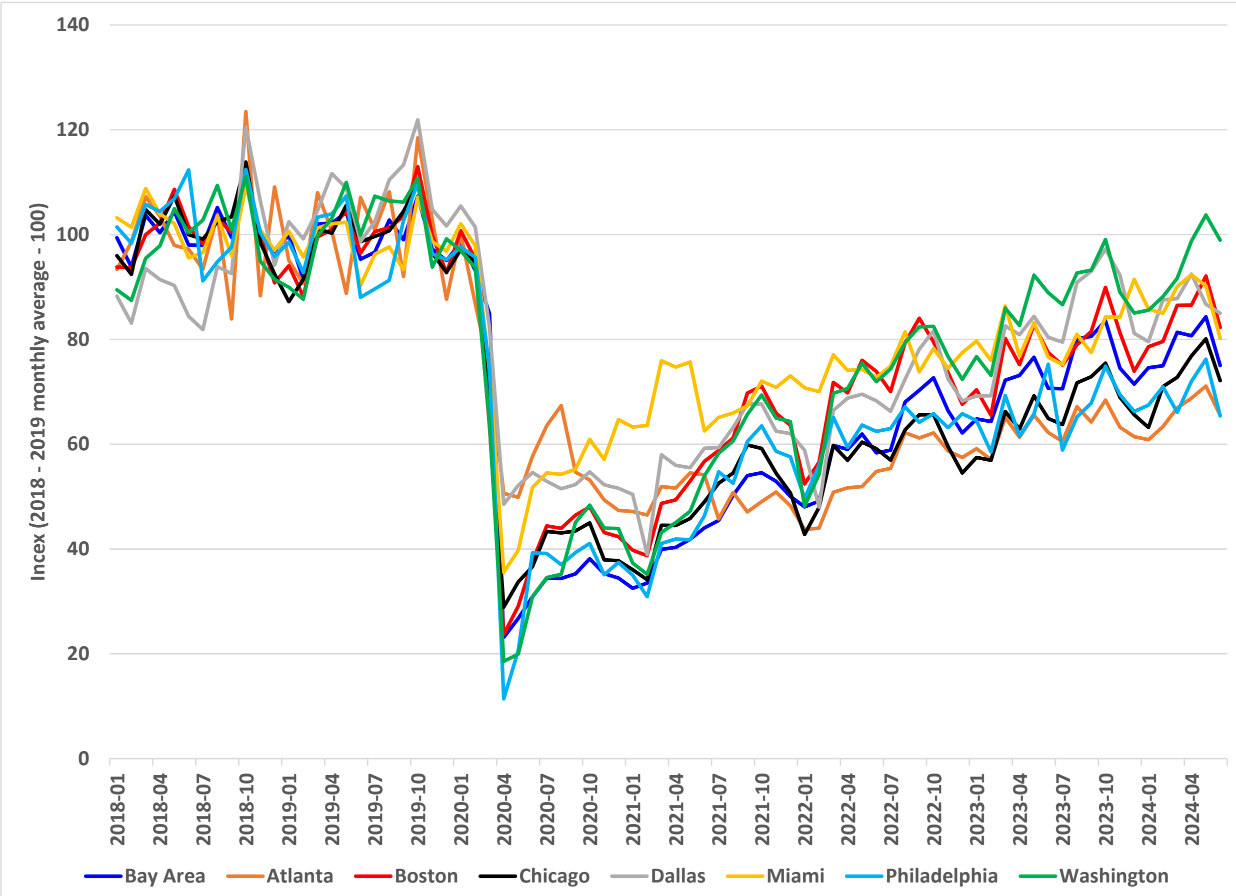
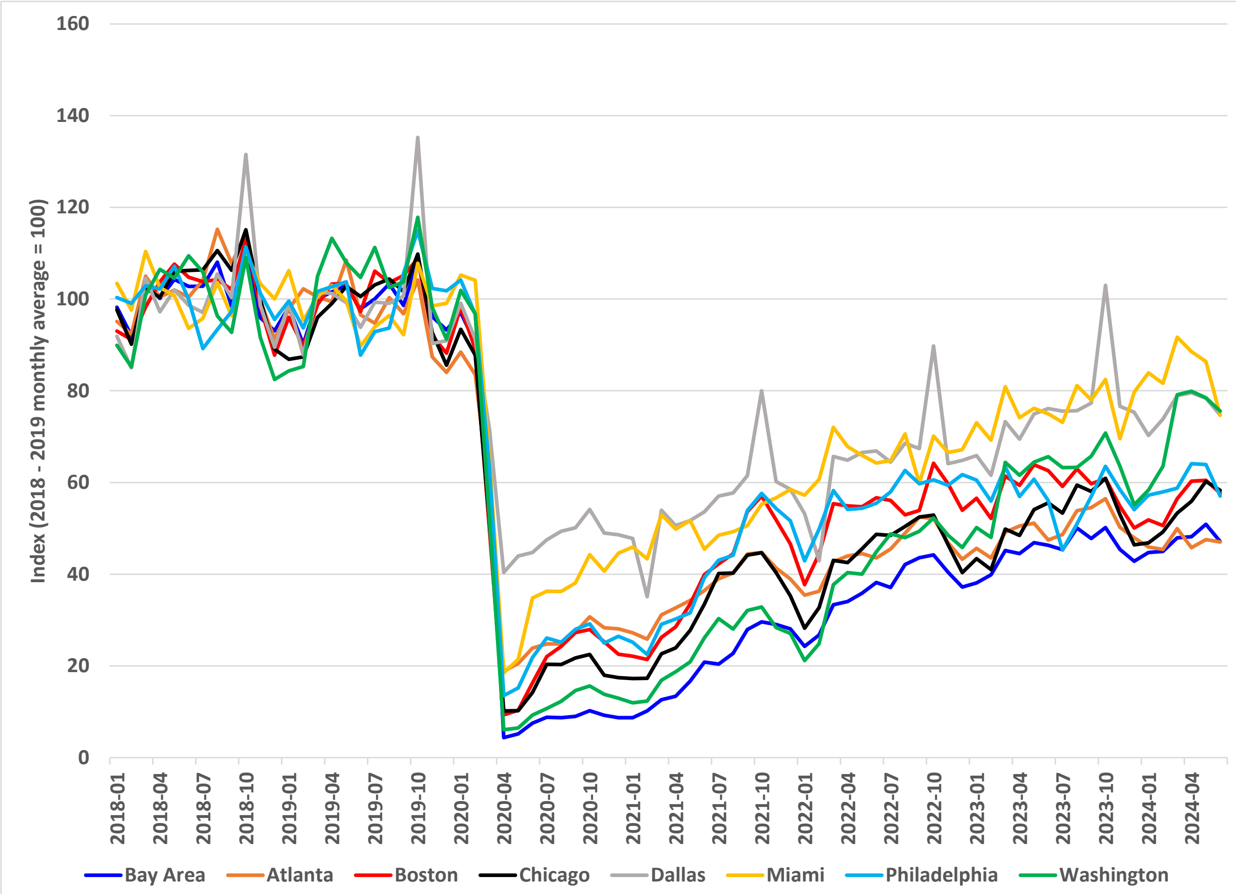


Figure 3.20 Rail Ridership Index, Bay Area vs. Non-West Coast Metros



These data show the following:

- All metropolitan areas included here show a similar pattern of transit ridership: sharp decline during the pandemic, followed by a slow recovery.
- Bus ridership has recovered much faster than rail ridership.
- Bay Area rail ridership recovery lags significantly behind that of other metropolitan areas.

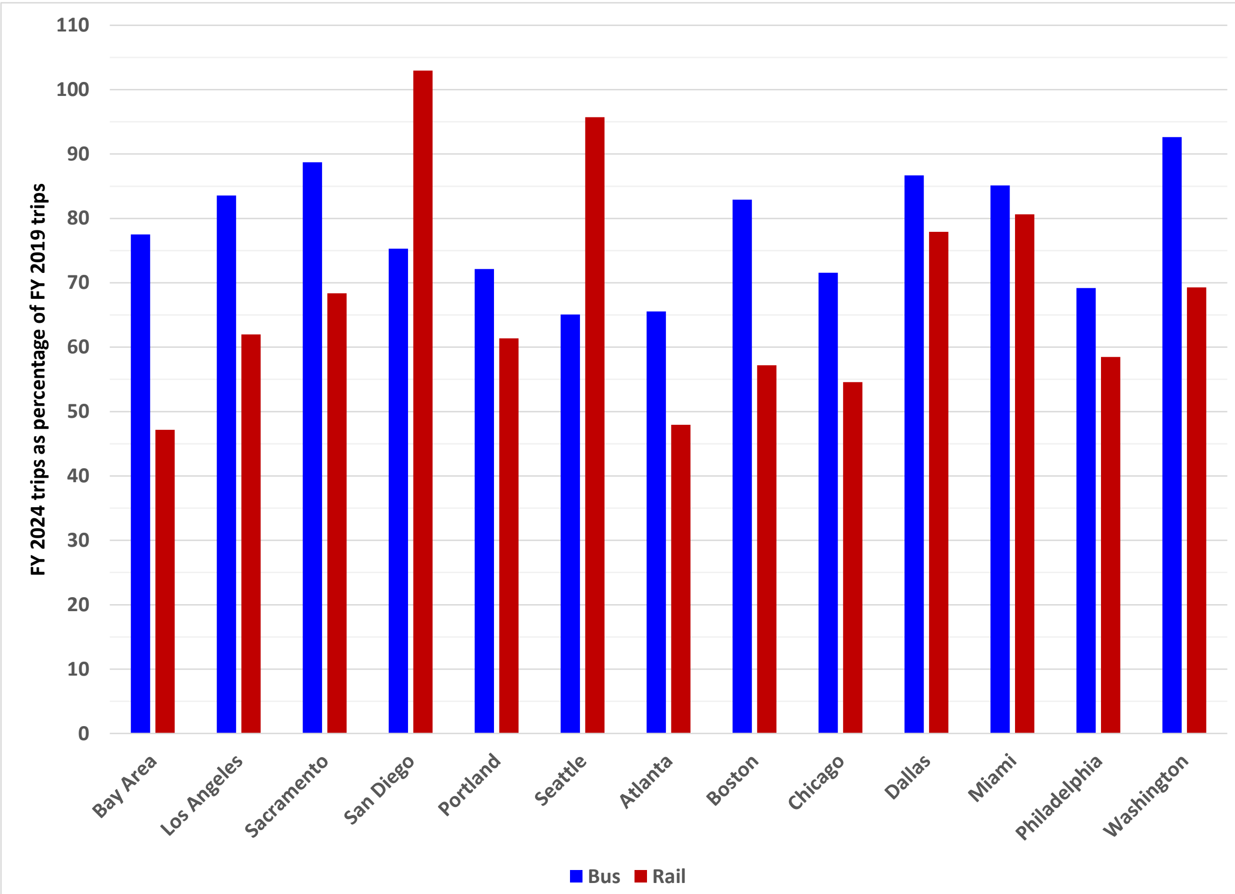
Figure 3.21 summarizes changes in passenger trips between pre-pandemic (FY19) and post-pandemic (FY24) for bus and rail for the metropolitan areas listed above. Note that in general:

- Post-pandemic transit trips are lower than pre-pandemic trips for both bus and rail.[8]
- Rail ridership has recovered much less than bus ridership.

[8] The increase in rail ridership in San Diego and Seattle is very likely due to significant expansion of rail service in both metropolitan areas.

- As noted above, Bay Area rail ridership recovery lags significantly behind other metropolitan areas.

Figure 3.21 Net Change in Passenger Trips by Mode for Major Urban Areas: FY 2019–FY 2024



It is interesting to note that:

- Pandemic and post-pandemic Bay Area bus ridership compared to pre-pandemic levels were generally "middle-of-the-pack" when compared to other metro areas, with the exception of the period during and immediately following the pandemic where the Bay Area ranked among the lowest in terms of bus ridership levels compared to pre-pandemic levels.

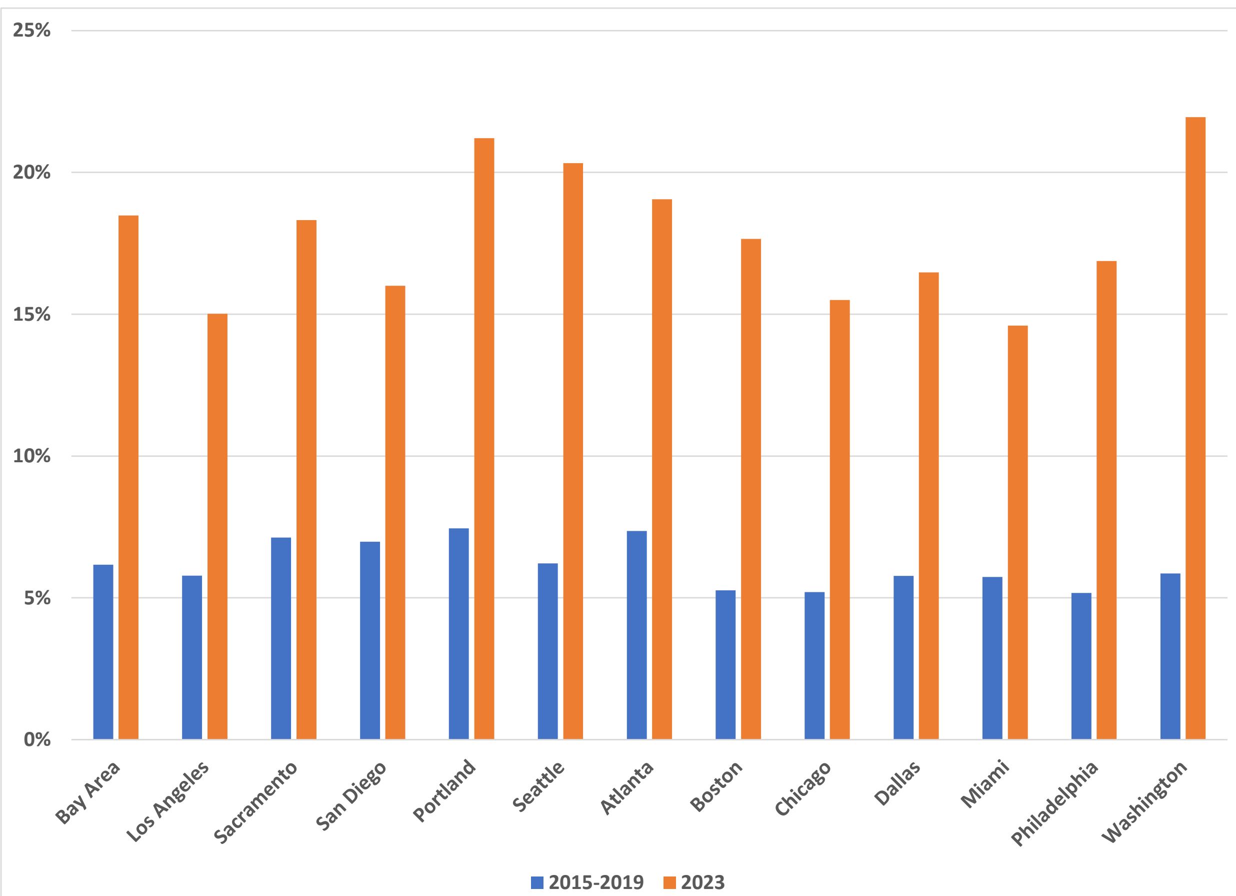
- Pandemic and post-pandemic Bay Area rail ridership compared to pre-pandemic levels were consistently lower than other West Coast metro areas and were typically lower than non-West Coast metro areas, with a few month-to-month exceptions.

3.4.3 Work-at-home – other metro areas

Figure 3.22 shows comparative work-at-home percentages for the Bay Area compared to other metropolitan areas. Note that:

- For all metropolitan areas shown, work-at-home accounts for a significantly higher percentage of workers than it did before the pandemic. Work-at-home percentages have tripled or even quadrupled.
- The Bay Area is among the metropolitan areas with the highest percentage of workers who work at home, although, when margin of error in the American Community Survey tabulations is taken into account, these percentages do not appear to differ significantly.
- As noted above, the Bay Area has a high proportion of workers in occupations and industries where working at home is a feasible alternative to going to the office, especially in view of the high availability of broadband communications in the Bay Area.

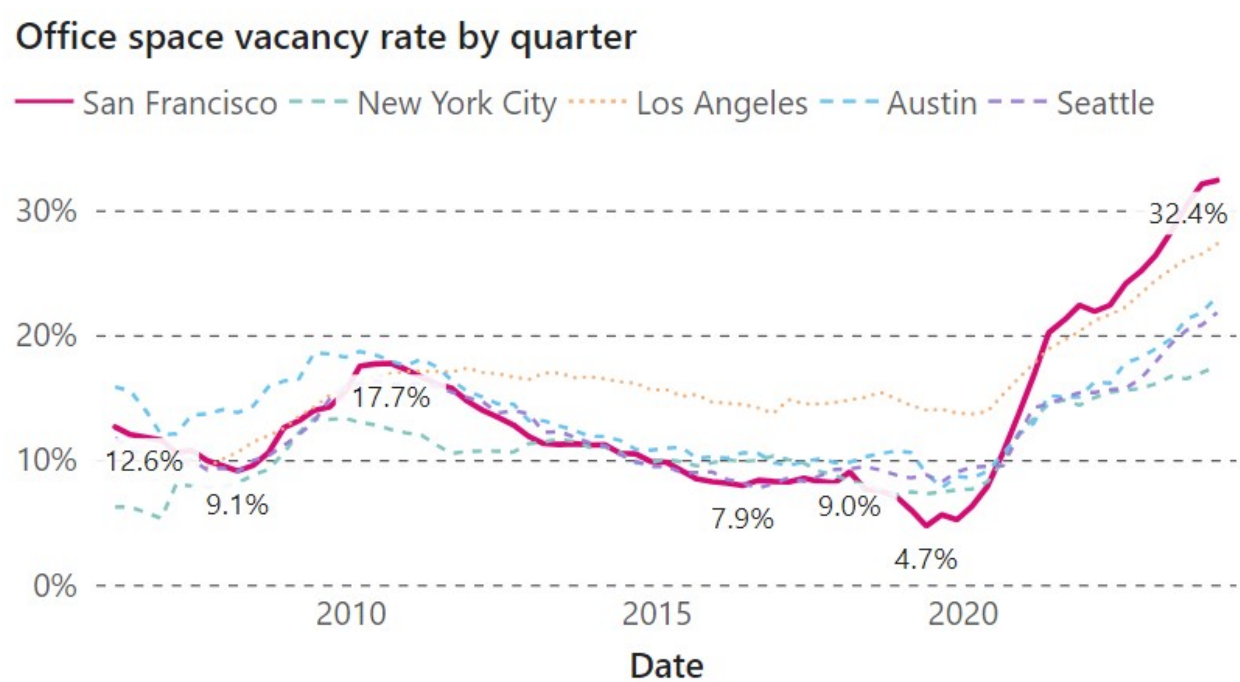
Figure 3.22 Work-at-Home Percentage, Bay Area vs. Other Metros



3.4.4 Office vacancy rates

Office vacancy rates in downtown San Francisco, the major destination market for trips on SFCTA (Muni) and BART, are higher than several other comparable metropolitan areas. Data from the City and County of San Francisco on comparable office vacancy rates are shown in Figure 3.23.[9] Note that San Francisco's vacancy rate was comparable to those of the other metropolitan areas shown here, but then increased sharply with the pandemic.

Figure 3.23 Office Vacancy Rates for Several Major Metropolitan Areas Compared to San Francisco[10]



3.5 Summary

The following are the main findings on transit demand in the Bay Area:

- Bus and rail ridership have shown some recovery since the pandemic but remain substantially below pre-pandemic levels.
    - Bus ridership has recovered faster than rail ridership and is now at about 80 percent of pre-pandemic levels.

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[9] "San Francisco Office Space Vacancy," City and County of San Francisco, 2024, https://www.sf.gov/data/san-francisco-office-space-vacancy.

[10] "San Francisco Office Space Vacancy."

  - Rail ridership has been much slower to recover. Muni and VTA rail ridership is now at about 60 percent of pre-pandemic levels; but ridership on BART and Caltrain is only about 40 percent of pre-pandemic levels.

- During the pandemic, the percentage of workers who worked at home increased dramatically. Although this percentage has declined over time, it still remains well above double its pre-pandemic levels.

- Working at home appears to have drawn from all work modes, but particularly transit. Pre-pandemic transit use appears to be a key indicator of the increase in working at home.

- Persons who work at home show the following characteristics:

  - They have much higher earnings than the work population at large.

  - Workers in management, scientific, professional, and sales occupations are much more likely to work at home than those in other occupations.

  - Workers in information, insurance, professional, and scientific industries are much more likely to work at home than those in other industries.

- The pre- to post-pandemic change in median incomes for transit riders indicates that many high-income transit riders before the pandemic are likely to now be working at home instead.

- Downtown San Francisco vacancy rates remain among the highest of any major metropolitan area in the US, indicating that working at home has sharply reduced the number of trips to this major transit market. Although employers such as Salesforce have recently begun to require workers to spend more days in the office, a large percentage of workers are likely to continue to work on hybrid office/at home work schedules.

Compared to other metropolitan areas in the US:

- Like the Bay Area, other metropolitan areas experienced sharp declines in bus ridership, but have been recovering. Bay Area bus ridership has recovered close to the average rate for other metropolitan areas studied.

- Rail ridership has been much slower to recover than bus ridership for most metropolitan areas. But Bay Area rail ridership has been much slower to recover than most other metropolitan areas.

- Work-at-home percentages for the Bay Area appear to be approximately the same as those in other urban areas studied.

4. Level of Service

4.1 Introduction

This Section discusses the changes in transit and auto levels of service as a result of the pandemic. Section 4.2 begins with a discussion of changes to the major Bay Area transit services; it also includes a more detailed focus on the service changes for the three largest transit operators: SFMTA (Muni), BART, and AC Transit. Section 4.3 provides a brief discussion of changes to auto level of service for the transbay corridor.

4.2 Transit

Transit level of service includes the following:

- Geographic coverage
- Time-of-day coverage (i.e., how early and late service runs)
- Service frequency (headways)

This Section discusses changes to service levels, with a main focus on the "Big 7" Bay Area operators:

- AC Transit
- BART
- Caltrain
- Golden Gate
- SamTrans
- SFMTA (Muni)
- VTA

The final part of this Section presents a more detailed analysis of service changes to the three largest operators: SFMTA, BART, and AC Transit.

4.2.1 Revenue Vehicle Miles

Bus

Monthly bus vehicle revenue miles are shown as absolute values in Figure 4.1 and values indexed to pre-pandemic levels in Figure 4.2. SFMTA and VTA revenue miles are now slightly lower than pre-pandemic levels, while AC Transit, SamTrans, and other operators are providing substantially less service than before the pandemic.

Figure 4.1 Monthly Vehicle Revenue Service Miles – Bus

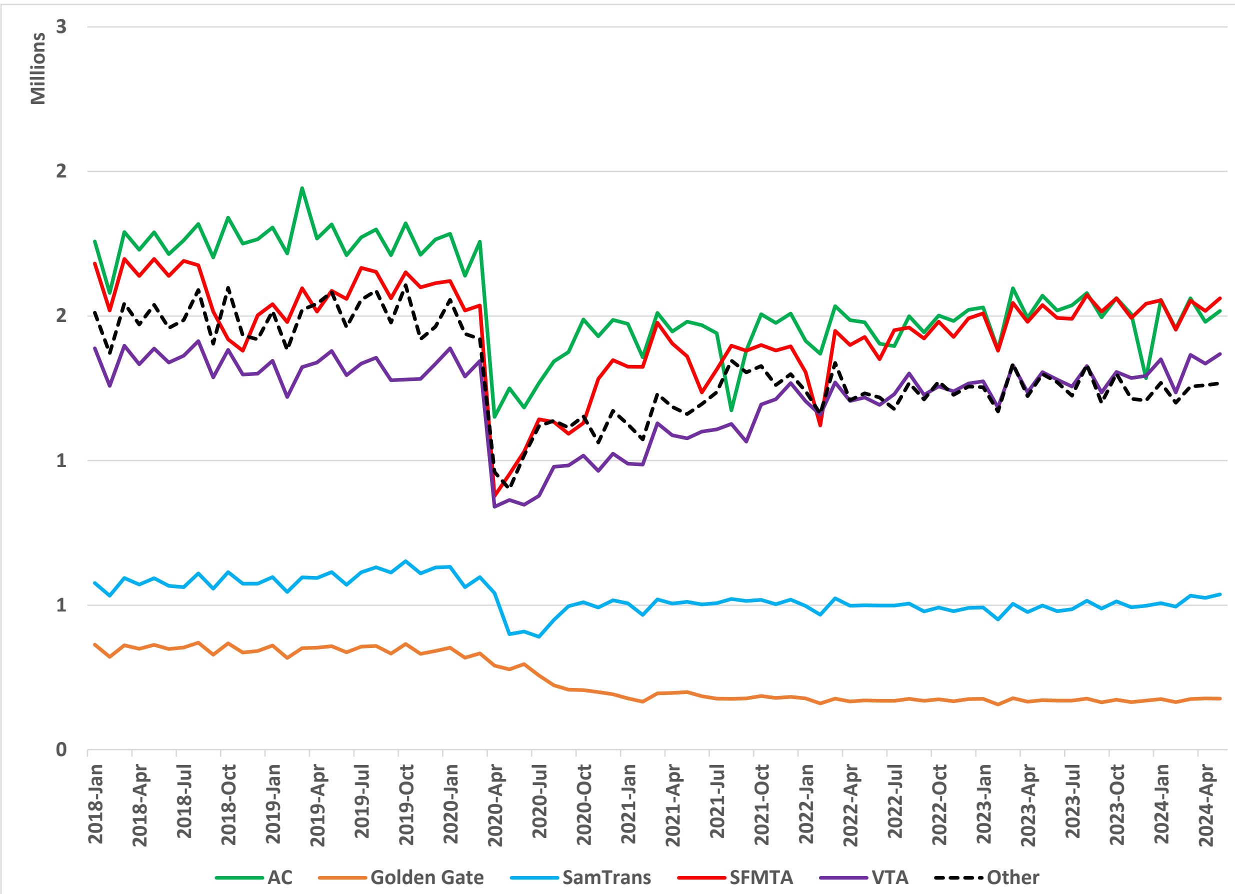
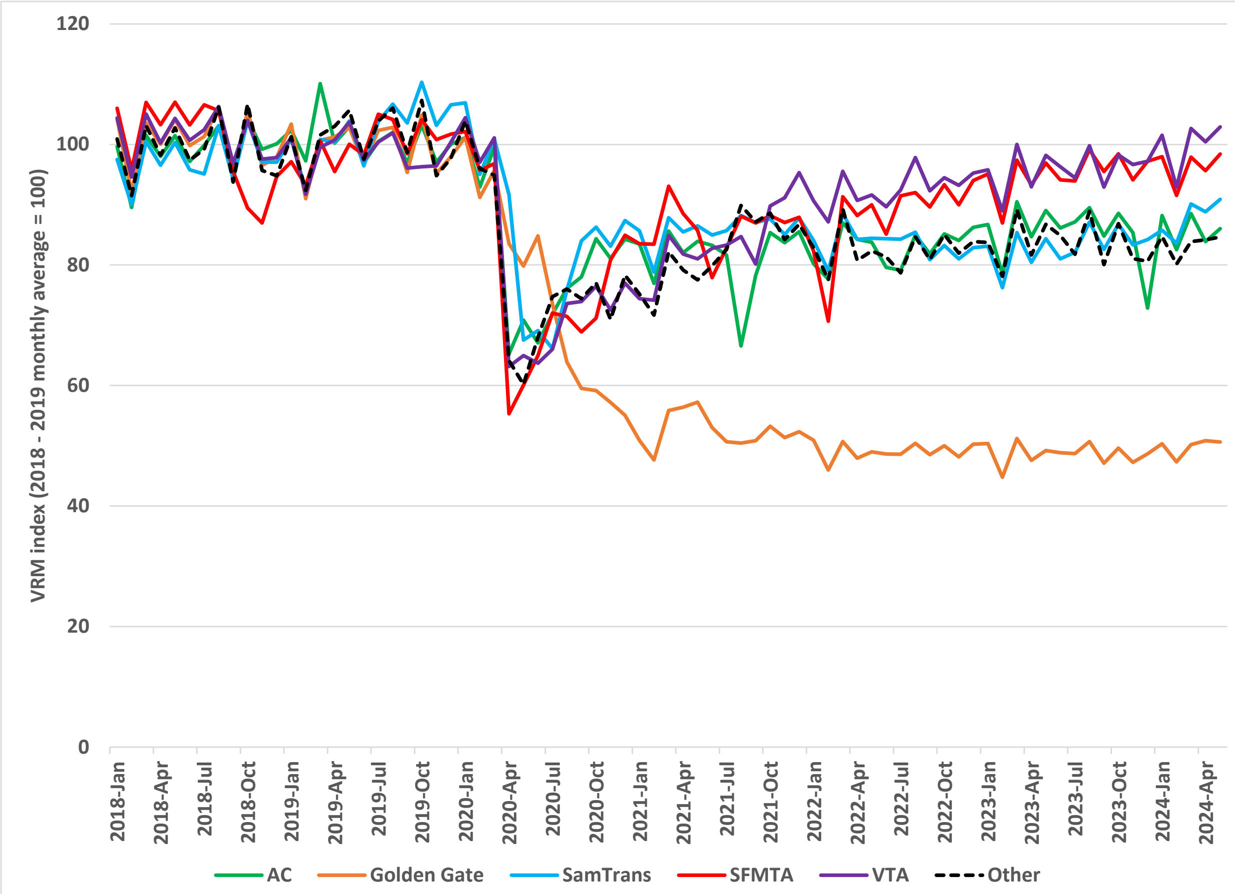


Figure 4.2 Monthly Vehicle Revenue Service Miles – Bus (Index)



The decrease in service in the spring of 2020 reflects the early shutdown of businesses and activities in the Bay Area due to the pandemic.[11] All operators decreased their service during the shutdown; most gradually increased service during 2021 through early 2024.

Note that AC Transit and SFMTA together provide about half the total vehicle revenue miles of bus service in the Bay Area.

The continued decrease in Golden Gate Transit bus service reflects the transfer of ownership of 188 stops to Marin Transit effective October 2022.

Rail

Rail revenue vehicle miles are shown as absolute values and indexed values in Figures 4.3 and 4.4, respectively.

[11] Local officials in the Bay Area issued mandatory stay-at-home orders effective March 17, 2020. The governor of California ordered a statewide stay-at-home order effective March 19, 2020.

Figure 4.3 Monthly Vehicle Revenue Service Miles – Rail

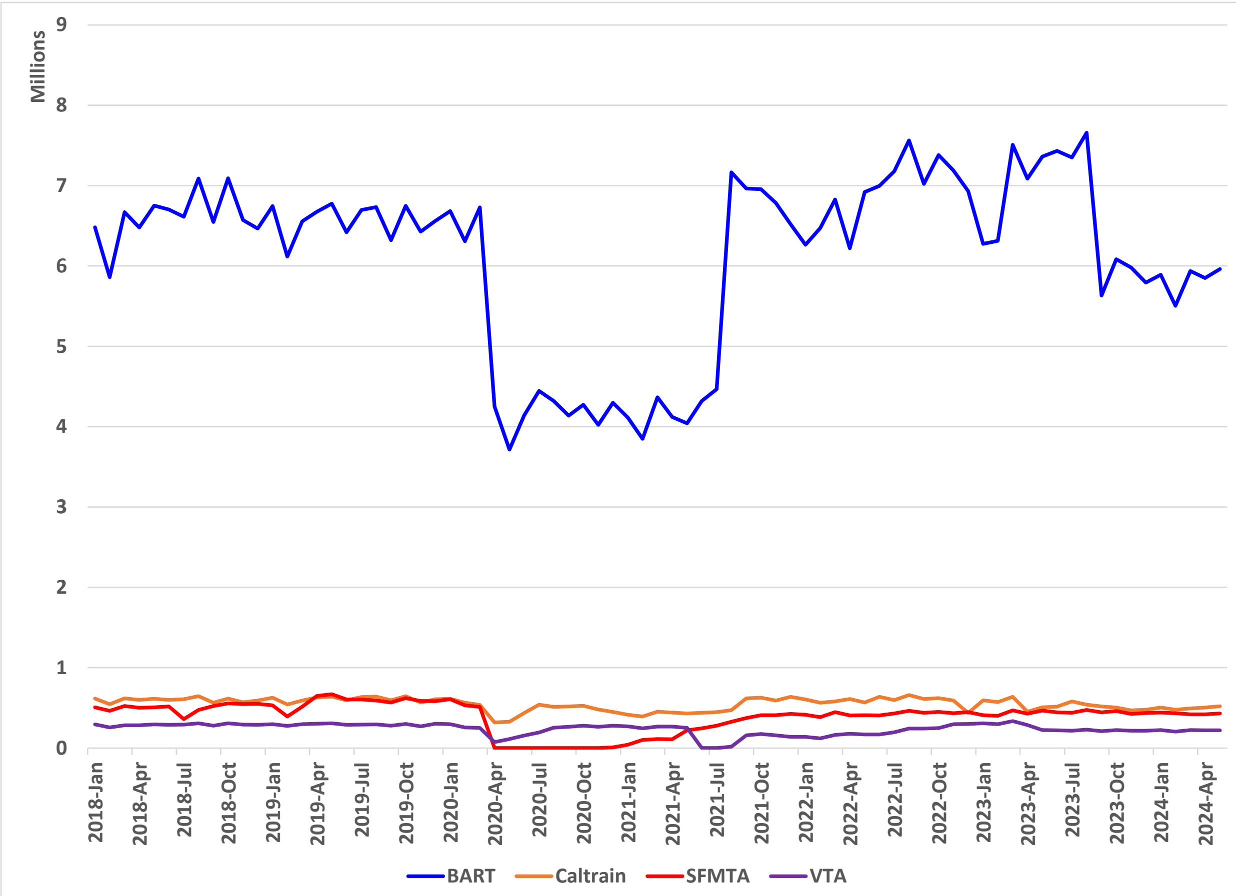
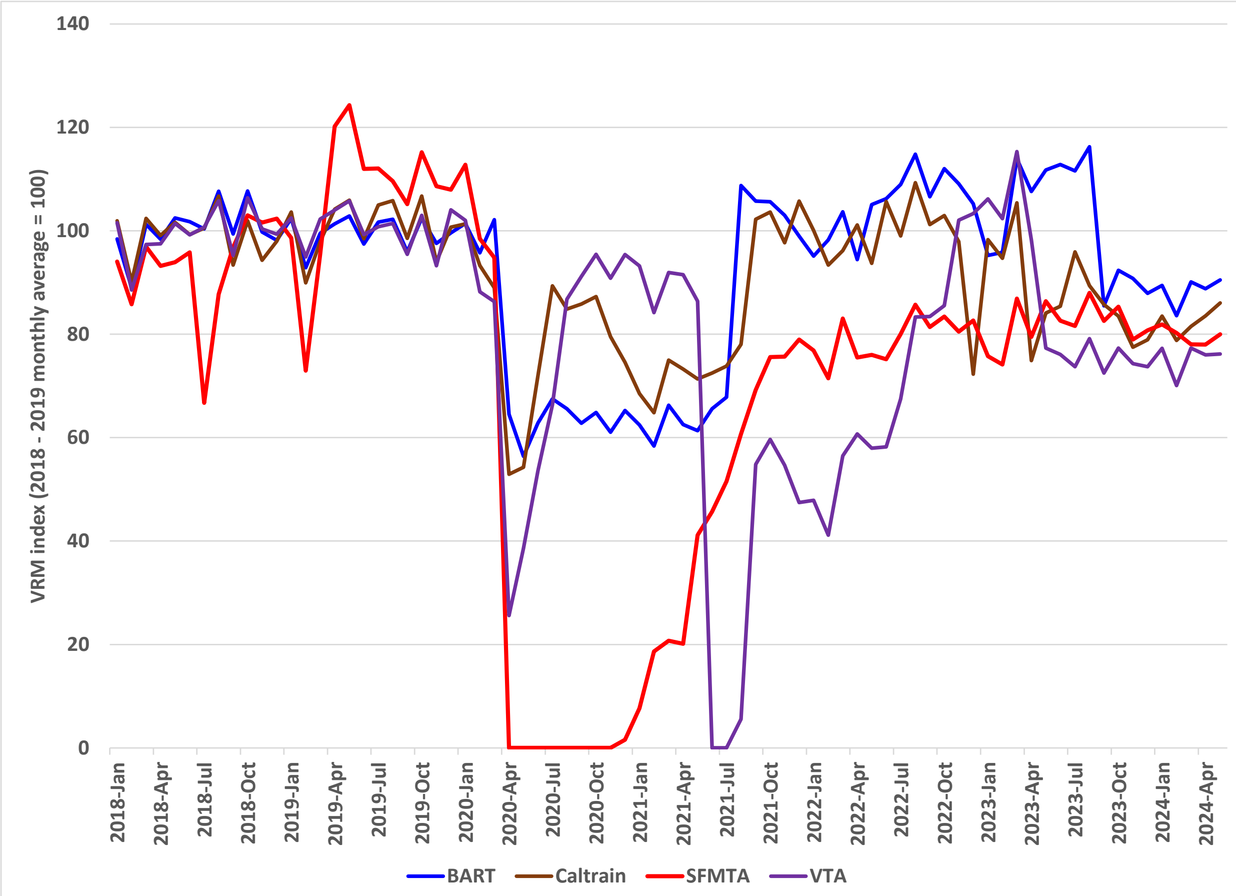


Figure 4.4 Monthly Vehicle Revenue Service Miles – Rail (Index)



The following are the main facts on revenue miles of service:

- BART continues to provide over 80 percent of the rail vehicle revenue miles of service in the Bay Area.
- SFMTA rail service was discontinued beginning with the pandemic shutdown in the Bay Area (March–April 2020) and was resumed beginning in early 2021.
- VTA rail service was discontinued for several months beginning in late May 2021 due to a mass shooting at the VTA rail yard in San José.
- Post-pandemic revenue vehicle miles for the four rail operators varies between 75 and 90 percent of pre-pandemic levels.

4.2.2 Revenue Vehicle Hours

Bus

Vehicle revenue hours of service is another measure of how much service an agency provides. It is also an evaluation measure for standardizing the average cost of providing service. Vehicle revenue hours of service are shown as actual values in Figure 4.5 and as values indexed to each agency's own pre-pandemic levels in Figure 4.6

Figure 4.5 Monthly Vehicle Revenue Service Hours – Bus

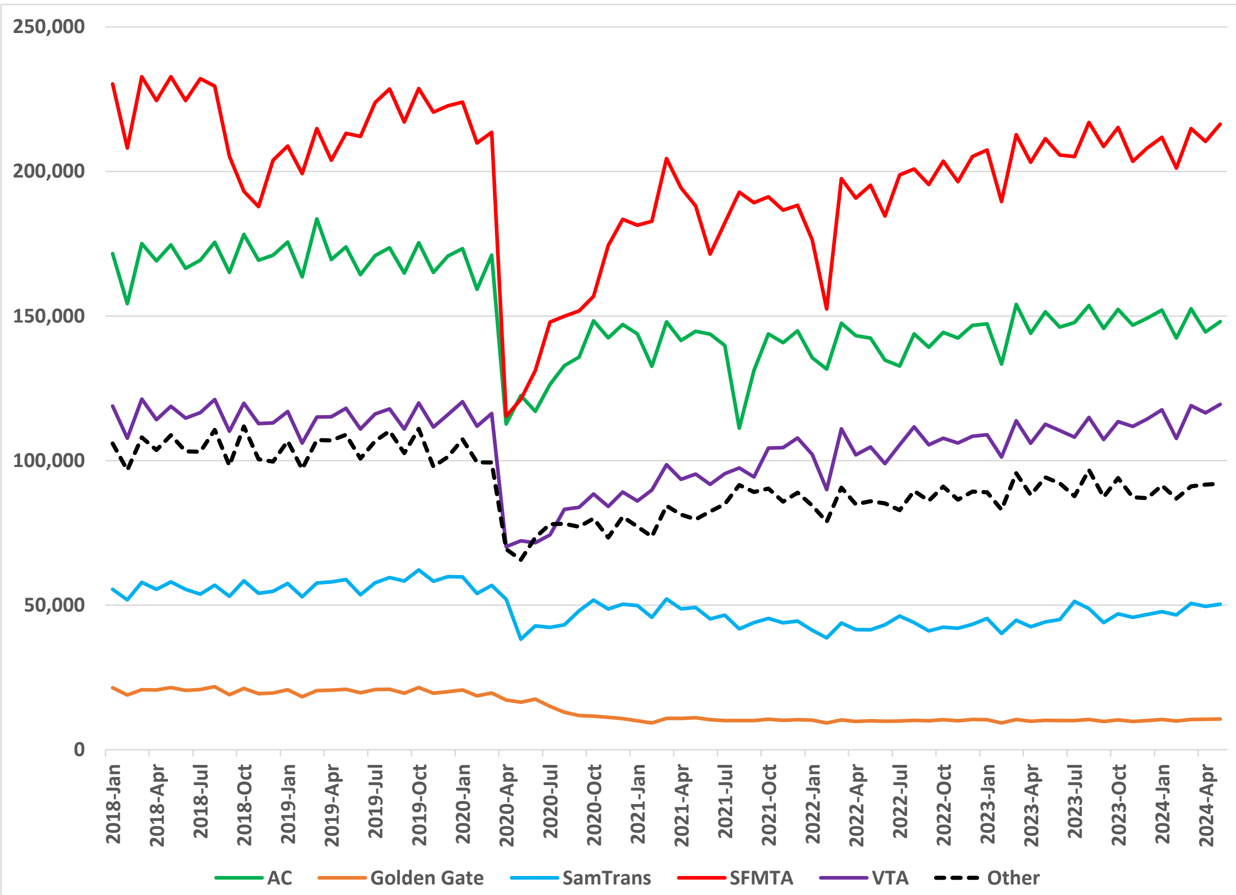
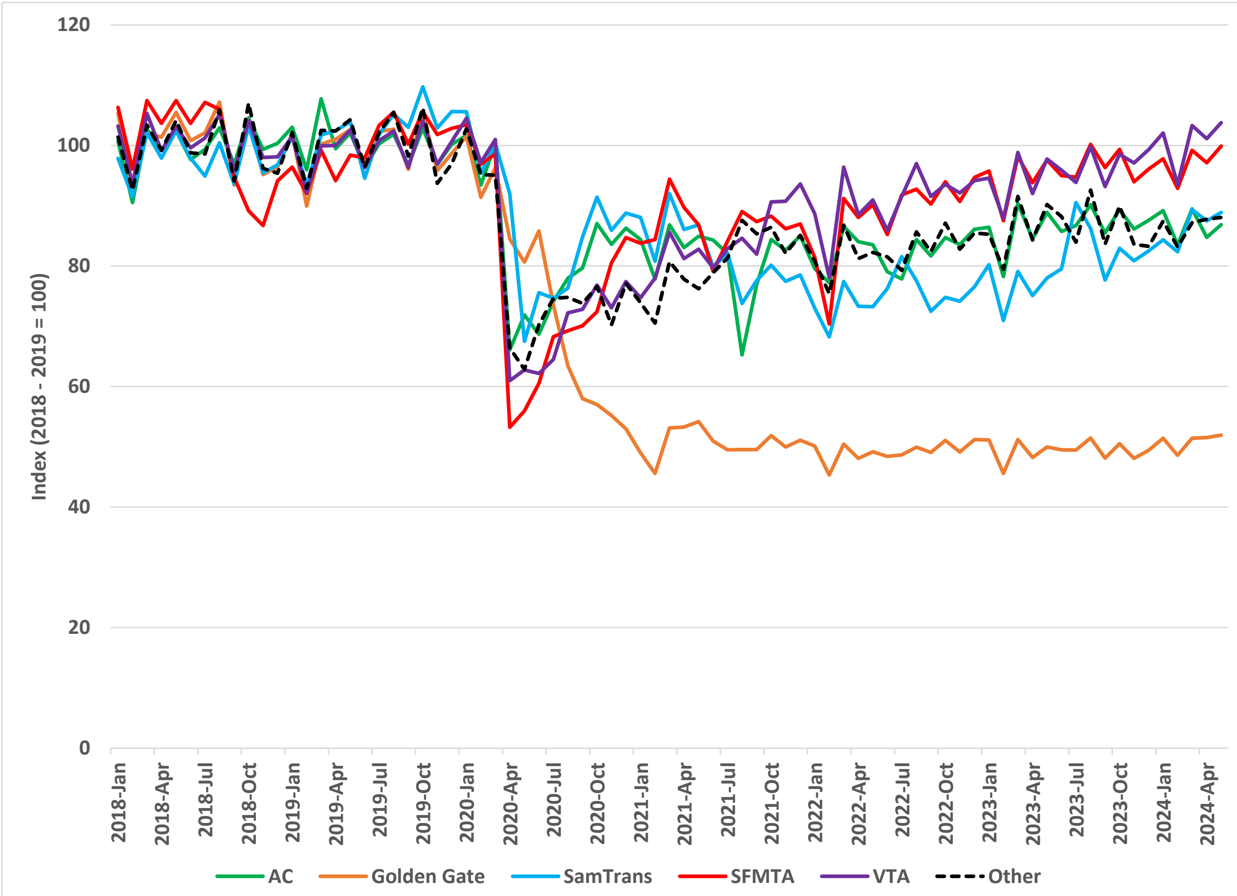


Figure 4.6 Monthly Vehicle Revenue Service Hours – Bus (Index)



SFMTA and VTA are now operating about the same number of service hours as they were before the pandemic. Most other operators' service hours are about 10 percent below pre-pandemic levels.

Rail

Rail revenue service hours are shown in Figure 4.7 and as values indexed to pre-pandemic levels in Figure 4.8. Current vehicle revenue hours of service appear to be approximately the same as they were before the pandemic. The increase in BART revenue vehicle service hours at the height of the pandemic reflects an attempt by the agency to minimize crowding on trains to reduce the health risk from COVID by running longer trains.

Figure 4.7 Monthly Vehicle Revenue Service Hours – Rail

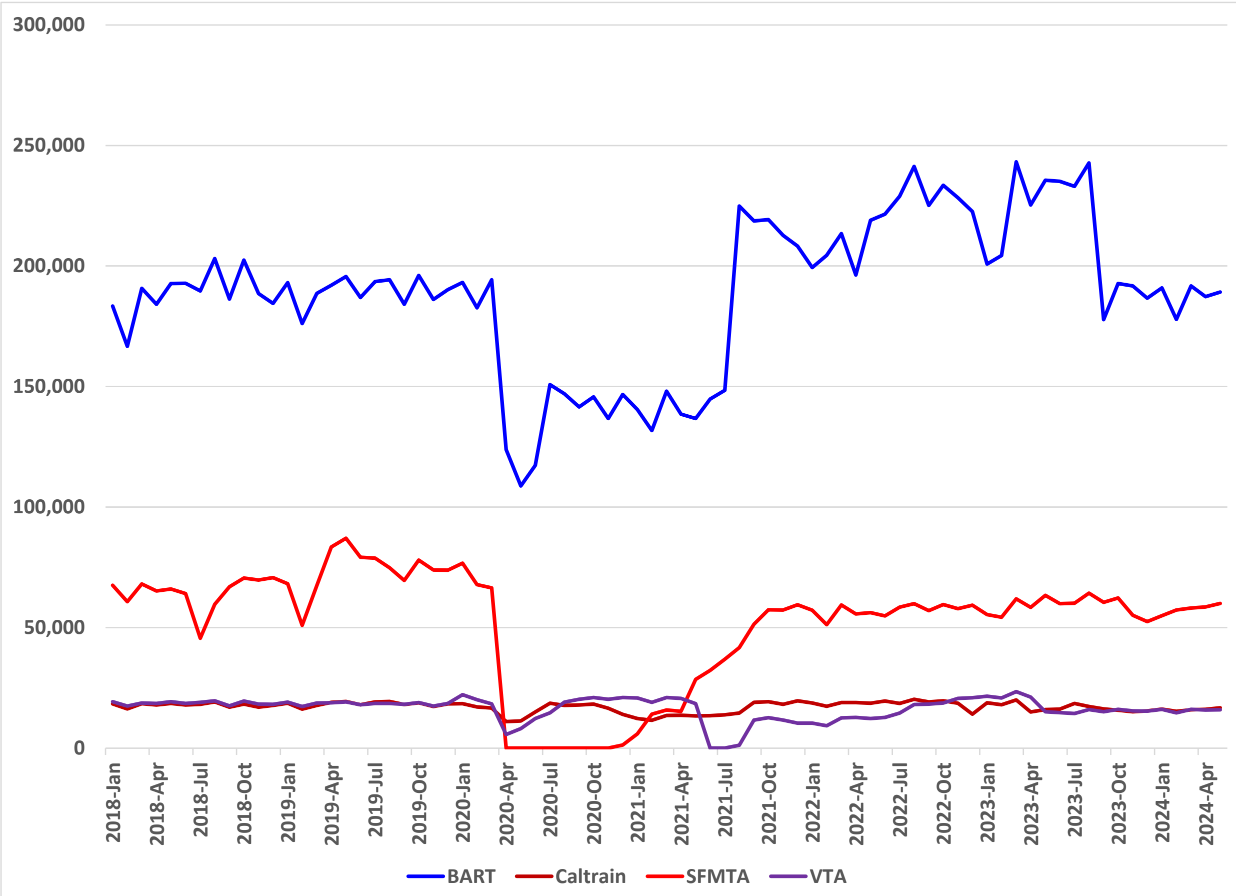
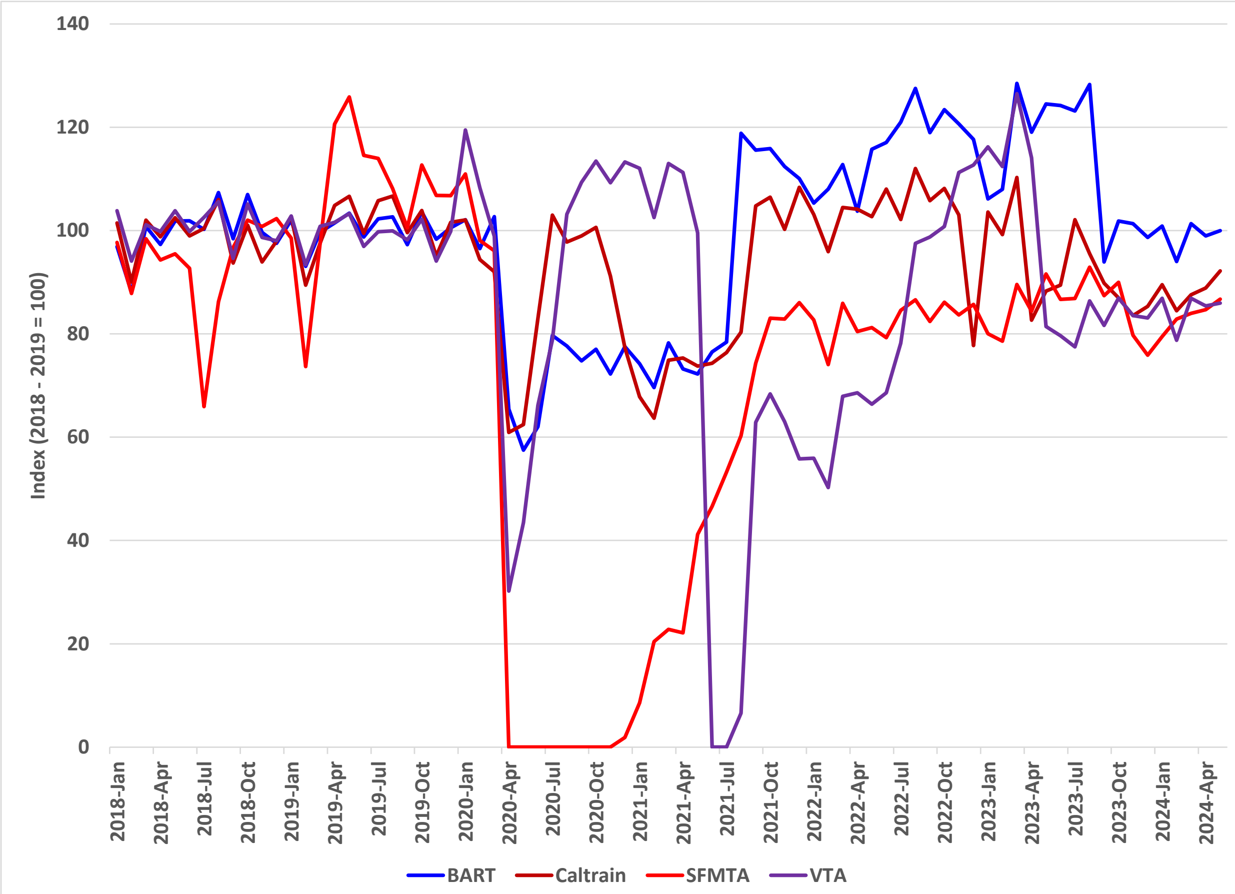


Figure 4.8 Monthly Vehicle Revenue Service Hours – Rail (Index)



4.2.3 Vehicles in Maximum Service

Vehicles in maximum service (VOMS) measure is calculated by identifying the largest number of vehicles an operator deployed at any point during a year (not including special events/days of service).[96] As such, this measure provides a useful indicator of the fleet requirements for each Bay Area operator analyzed here before, during, and after the pandemic.

Bus

The number of vehicles in maximum service are shown in Figure 4.9 and as indexed values in Figure 4.10. Most agencies now operate between 10 and 20 percent fewer vehicles in maximum service than they did before the pandemic. As noted above, the sharp reduction in Golden Gate Transit service reflects the transfer of much of its local bus service to Marin Transit.

Figure 4.9 Monthly Vehicles in Maximum Service – Bus

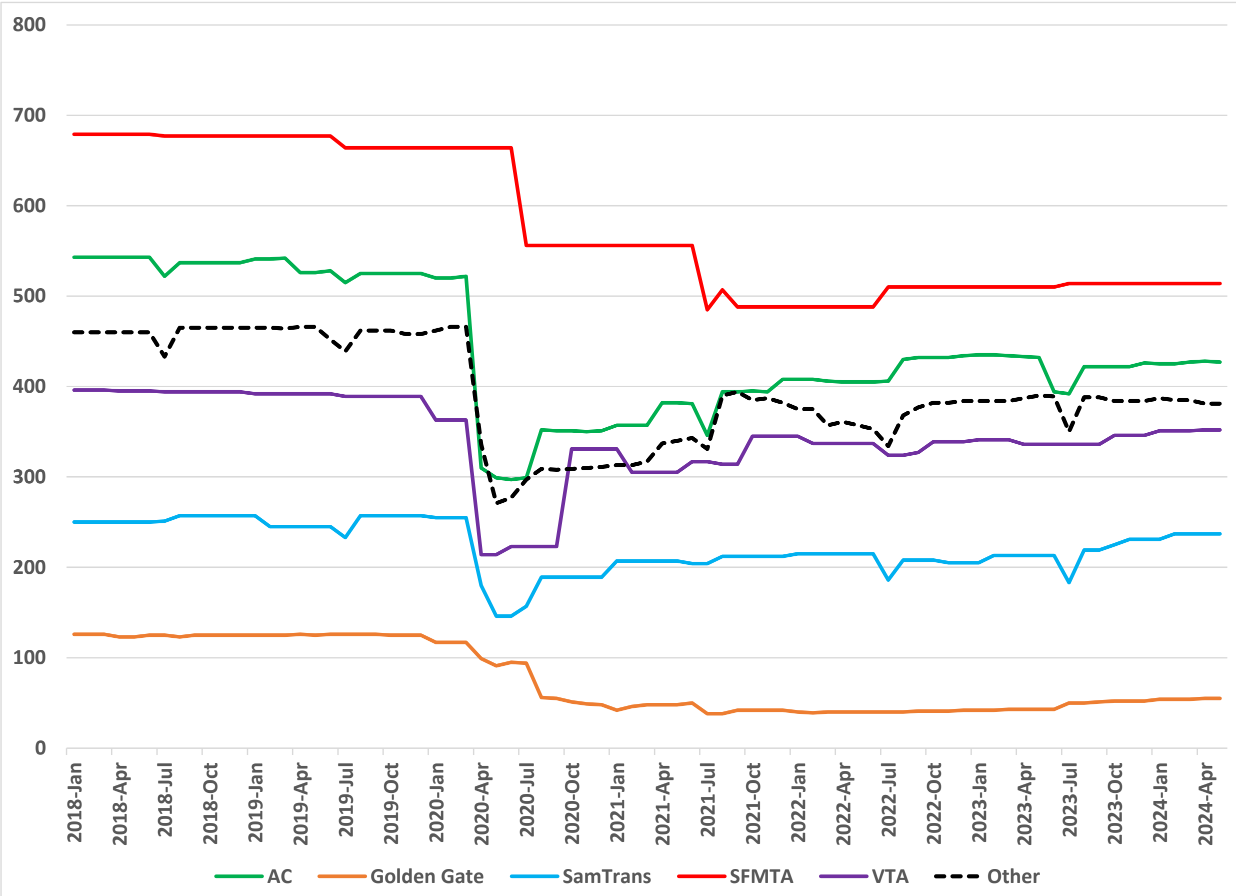
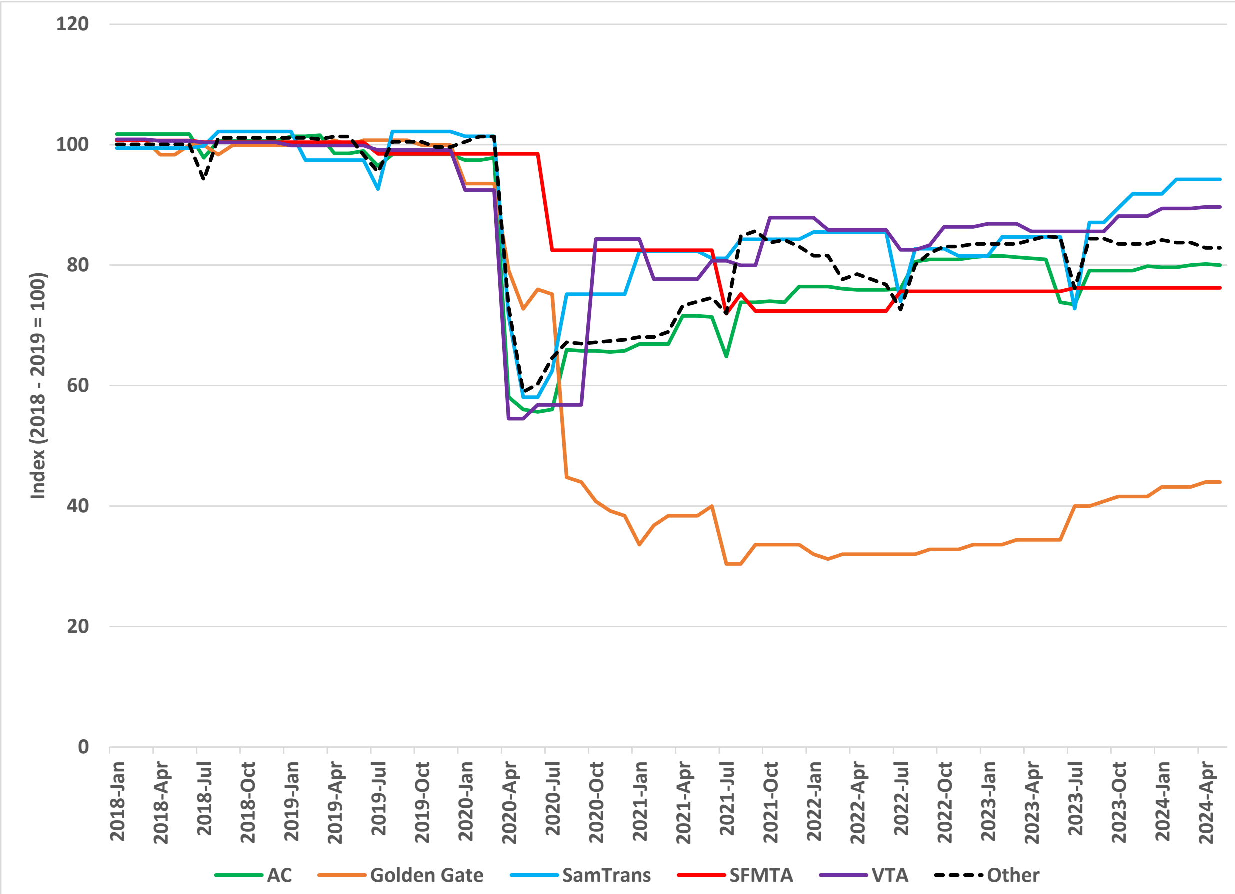


Figure 4.10 Monthly Vehicles in Maximum Service – Bus (Index)



Rail

Rail vehicles in maximum service are shown in Figure 4.11 and as indexed values in Figure 4.12. BART is now running 6-car trains for much of its service, whereas before the pandemic it operated 8- and 10-car trains during peak periods. SFMTA also operated significantly fewer rail vehicles in vehicles in maximum service due to service reductions.

Figure 4.11 Monthly Vehicles in Maximum Service – Rail

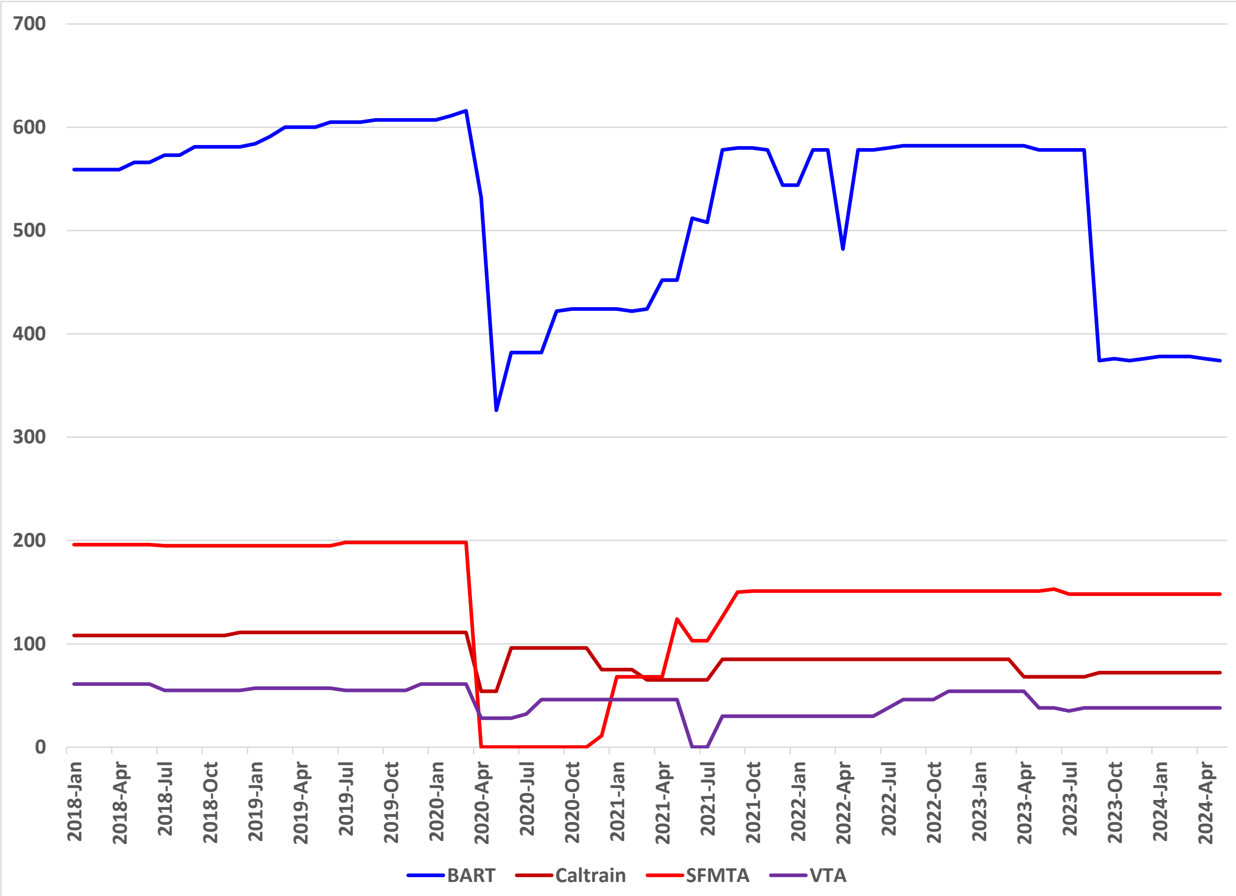
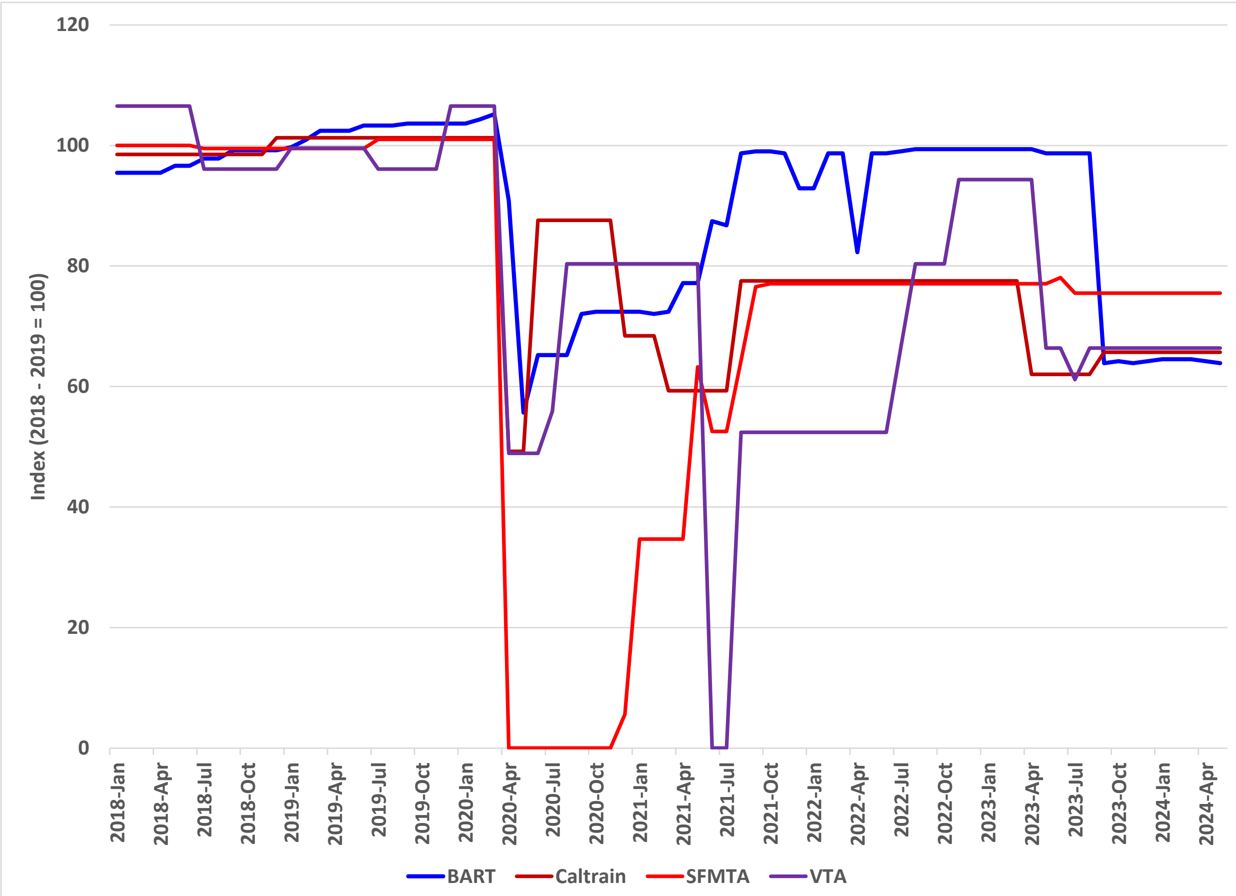


Figure 4.12 Monthly Vehicles in Maximum Service – Rail (Index)



4.2.4 Focus on SFMTA, BART, and AC Transit

This section focuses on the three largest transit operators in the Bay Area: SFMTA (Muni), BART, and AC Transit. These are some of the operators that have experienced the greatest financial effects due to the pandemic.

SFMTA

Bus

Changes to SFMTA bus service are summarized in Table 4.1. The major changes have been to express and rapid bus services, which are oriented toward commuters; two-thirds of express routes have been discontinued. Several local routes were also eliminated, such as Route 47, which operated alongside Route 49 and parallelled Route 45 along Van Ness Avenue.

Table 4.1 SFMTA Summary of Changes to Weekday Bus Service

	Local		Express/rapid	
	Pre-pandemic	Post-pandemic	Pre-pandemic	Post-pandemic
Number of routes	44	38	21	7
Number of stops	2,988	2,696	657	582
Number of bus trips				
Peak	3,276	2,433	1,040	477
Off-peak	4,360	3,627	593	486

Peak headways for local service have in general increased since the pandemic (Figures 4.13 and 4.14). Although headway increases have been small for most routes, there are several routes whose headways have increased significantly.

As shown in Figures 4.13 and 4.14, data points significantly above the red line of the graph are routes where headways have been increased post-pandemic, while data points below the line show routes where peak headways have been reduced (i.e., where service frequencies have been increased) since the pandemic.

Figure 4.13 SFMTA Average Pre- and Post-Pandemic Headways, Local Service (Peak)

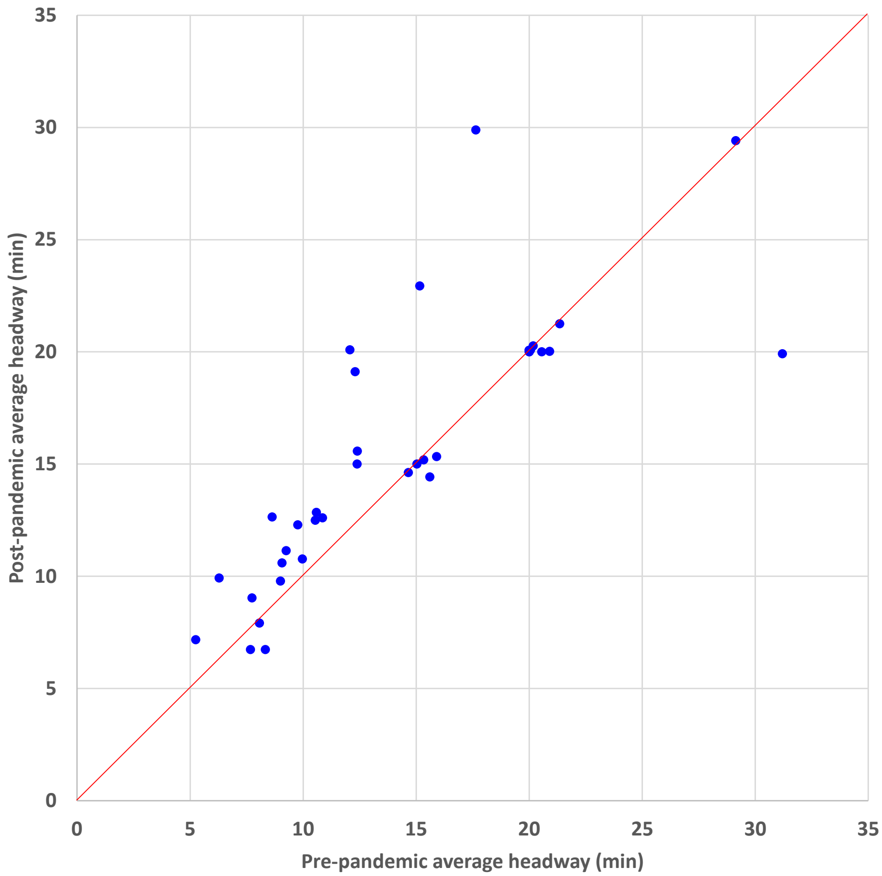


Figure 4.14 SFMTA Average Pre- and Post-Pandemic Headways, Local Service (Off-Peak)

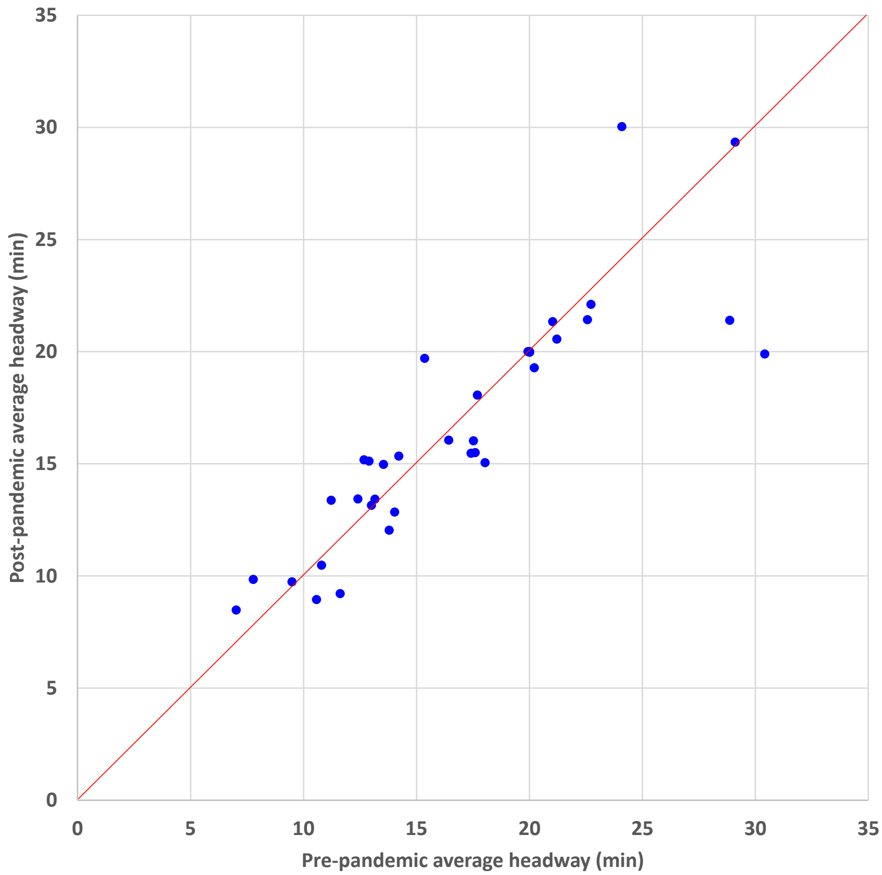
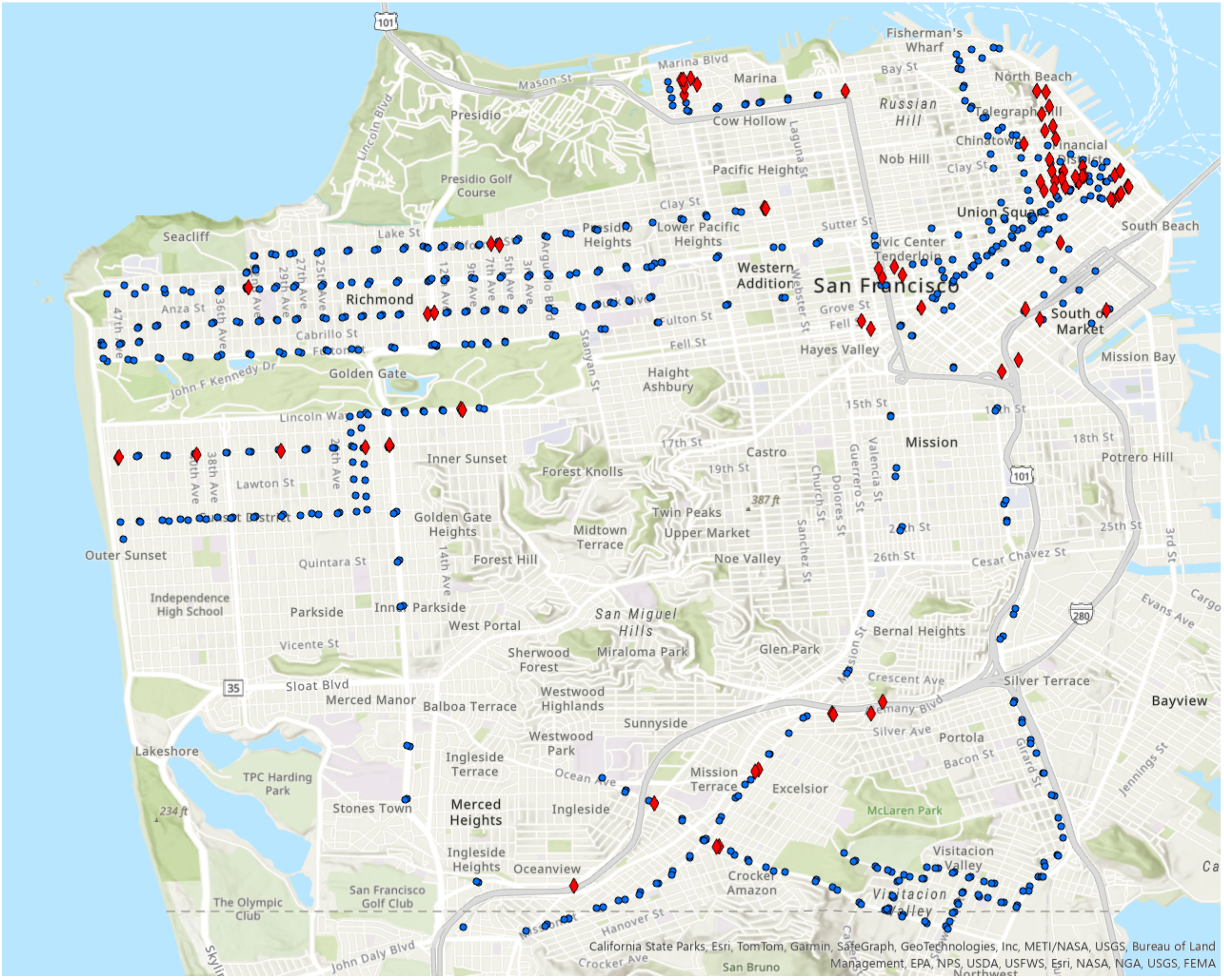


Figure 4.15 SFMTA Rapid/Express Bus Stops



Note: Map shows current stops that also existed pre-pandemic (blue) and pre-pandemic stops that no longer exist (red)

Rail

Current rail headways on Muni reflect the decrease in vehicle revenue hours of service as discussed above and shown in Figure 4.7. Table 4.2 shows the changes in average headways by route. The most significant overall change is that peak service headways are now almost equal to non-peak headways, reflecting the decreasing number of office workers in downtown San Francisco.

Table 4.2 SFMTA Rail Service Headways by Route

Route	Headways (minutes)			
	Pre-pandemic		Post-pandemic	
	Peak	Off-peak	Peak	Off-peak
E Embarcadero	24.9	23.7	Suspended	
F Market	7.9	9.0	13.0	13.1
J Church	9.5	11.8	15.4	15.6
K Ingleside	8.9	11.4	11.1	11.7
L Taraval	9.1	11.6	a	
M Ocean View	9.8	12.8	11.0	12.3
N Judah	7.3	10.4	10.1	11.2

[a] Replaced by bus service due to L Taraval rail improvement project

4.2.5 BART

The basic BART route structure (Figure 4.16) has remained unchanged since the pandemic.[12] Full BART service consists of five routes, with fewer routes during less busy times. Before the pandemic, BART operated in two modes:

- Full service – all five routes in operation.
- Modified X service – three-route operation: Richmond – Warm Springs, Antioch – SFO/Millbrae,[13] and Dublin – Daly City.

Full service was provided during day times on weekdays and Saturdays; modified X service was provided during nights and Sundays. Headways were 15 minutes during weekdays and 20 minutes on nights and weekends.[14]

[12] The exception is the addition of Berryessa Station, which opened June 13, 2020.
[13] Service on the Orange Line was extended to Berryessa station in 2020.
[14] Special "tripper" service at 7 ½ minute intervals was provided on the Concord – SFO line in the peak direction at peak weekday times.

Figure 4.16 BART Service Configuration

BART has made a number of changes since the pandemic. Current (2024) post-pandemic service is shown in comparison to pre-pandemic service in Table 4.3. There have been two major changes:

- Service headways are now 20 minutes at all times, except on the Yellow Line, which operates on shorter headways during weekday peak periods.
- The modified X service that operated during the daytime on Sunday has been replaced with service on all five routes.

Table 4.3 BART Pre-Pandemic and Current Service Headways (Minutes)

Line	Pre-pandemic					Current service	
	Weekday		Saturday		Sunday	Every day	
	Day	Eves	Day	Eves		Day	Eves
Yellow (Antioch – SFO)	15/7.5	20	20	20	20	8/12/20*	20
Red (Richmond – Millbrae)	15	N/A	20	N/A	N/A	20	N/A
Green (Berryessa – Daly City)	15	N/A	20	N/A	N/A	20	N/A
Orange (Richmond – Berryessa)	15	20	20	20	20	20	20
Blue (Dublin – Daly City)	15	20	20	20	20	20	20

*8- and 12-minute daytime headways on weekdays on the Concord – SFO part of the Yellow Line, 20-minute headways on weekends.

In summary, service changes have been relatively minor for daytime weekday service. BART estimates that less than 10 percent of its ridership was affected by the switch from 15- to 20-minute headways.[15]

4.2.6 AC Transit

AC Transit service has made a number of changes to its service since the pandemic. The major changes are summarized in Table 4.4. The most significant changes are as follows:

- Several local routes were eliminated.
- Almost half of transbay routes were eliminated.
- The number of weekday transbay bus trips was reduced by two-thirds.
- The number of stops was reduced by about 10 percent for local service and by almost one-half for transbay service.

[15] For example, passengers going to San Francisco from stations on the Red Line have the option of boarding an orange line train and doing a timed cross-platform transfer to a Yellow Line train at MacArthur. Hence, their effective service headway is about one-half of the red line headway.

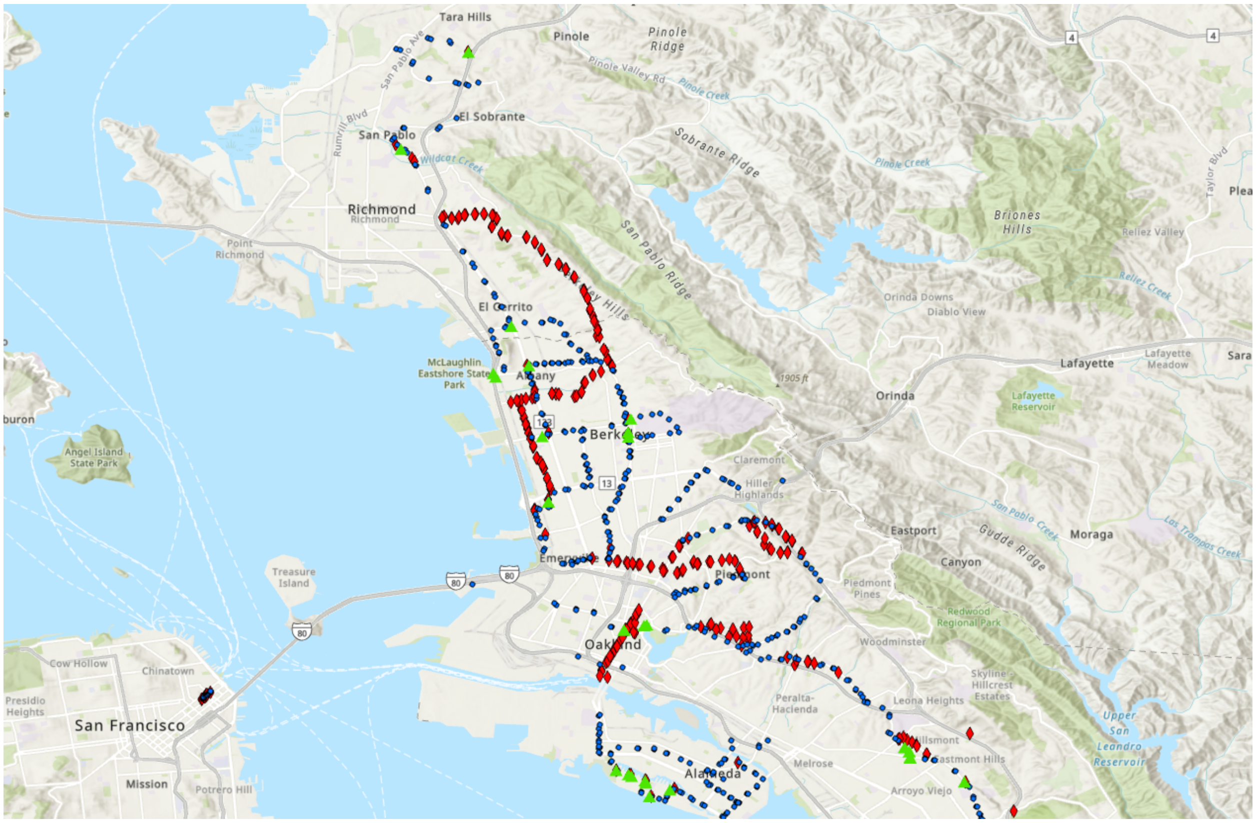
Table 4.4 AC Transit: Summary of Service Changes to Weekday Service

	Local		Transbay	
	Pre-pandemic	Post-pandemic	Pre-pandemic	Post-pandemic
Number of routes	63	58	30	16
Number of stops	4,340	4,086	1,023	548
Number of bus trips				
Peak	2,405	2,013	736	221
Off-peak	3,140	2,841	289	168

The most significant changes have been to transbay service. Figures 4.17 and 4.18 show changes in transbay service stops. In particular:

- Transbay service from the Berkeley hills has been sharply reduced.
- A number of stops in the Oakland hills have been eliminated.
- There is no longer transbay service for most of southern Alameda County, due largely to the elimination of transbay service on the Dumbarton Bridge.

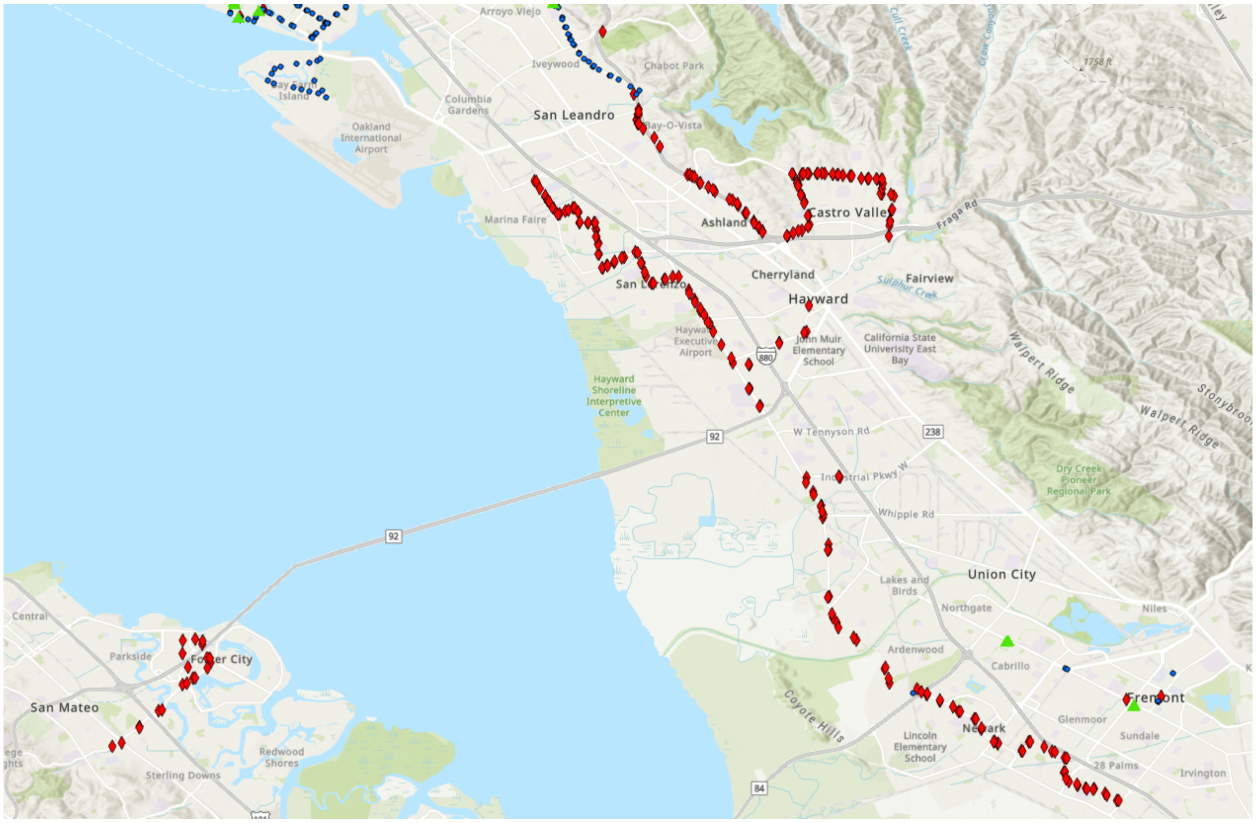
Figure 4.17 AC Transit Transbay Bus Stops, Northern Service Area



Note: Stops are indicated as follows:

- Red diamond = pre-pandemic stops that are no longer in service
- Blue circle = pre-pandemic stops that are currently in service
- Green triangle = new stops added since the pandemic

Figure 4.18 AC Transit Transbay Stops, Southern Region



Service headways have changed significantly for some routes. Figures 4.19 and 4.20 show local service route-by-route headway comparisons for peak and off-peak service respectively.[16] While most routes had very little changes to headways, there are a number of routes where headways were increased significantly.

As shown in Figures 4.19 and 4.20, data points significantly above the red line of the graph are routes where headways have been increased post-pandemic, while data points below show routes where peak headways have been reduced (i.e., where service frequencies have been increased) since the pandemic.

[16] Comparisons are shown only for routes that were in service before and after the pandemic. Southern Alameda County routes are not included, as service on these routes changed very little since the pandemic.

Figure 4.19 AC Transit: Pre- and Post-Pandemic Headways, Local Service (Peak)

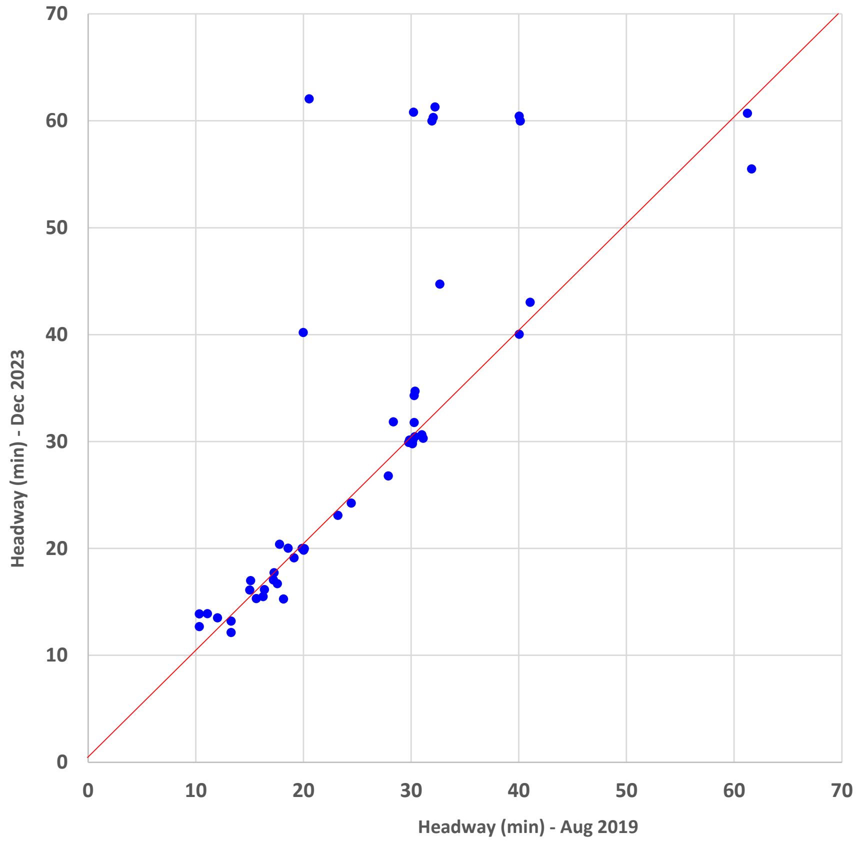
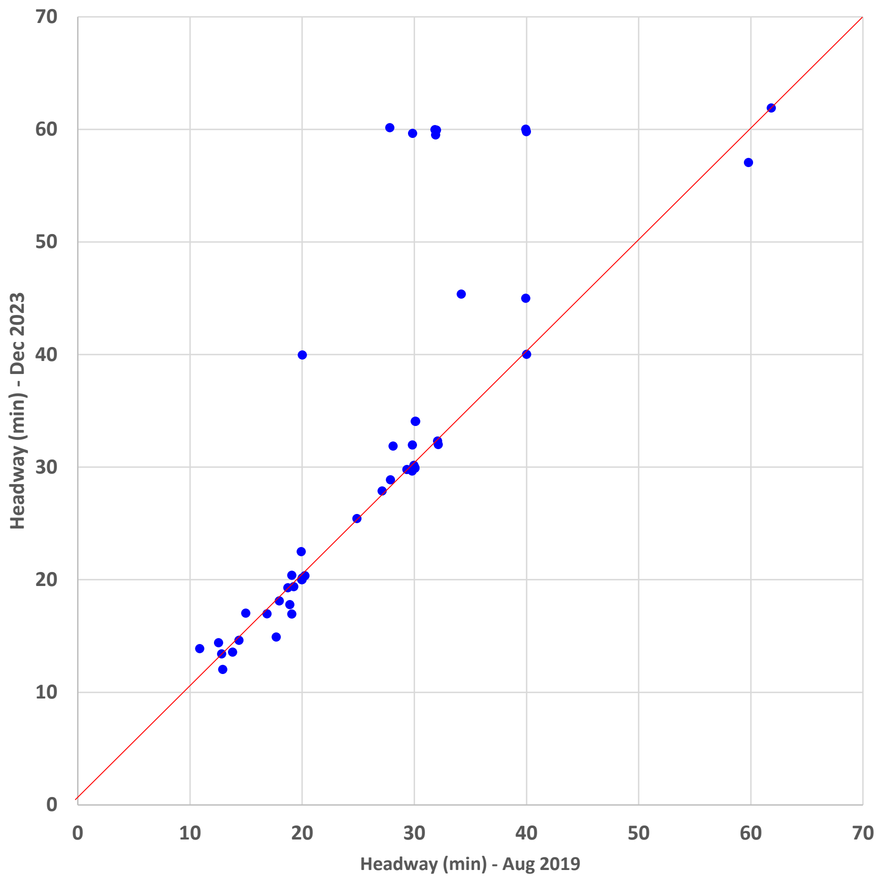


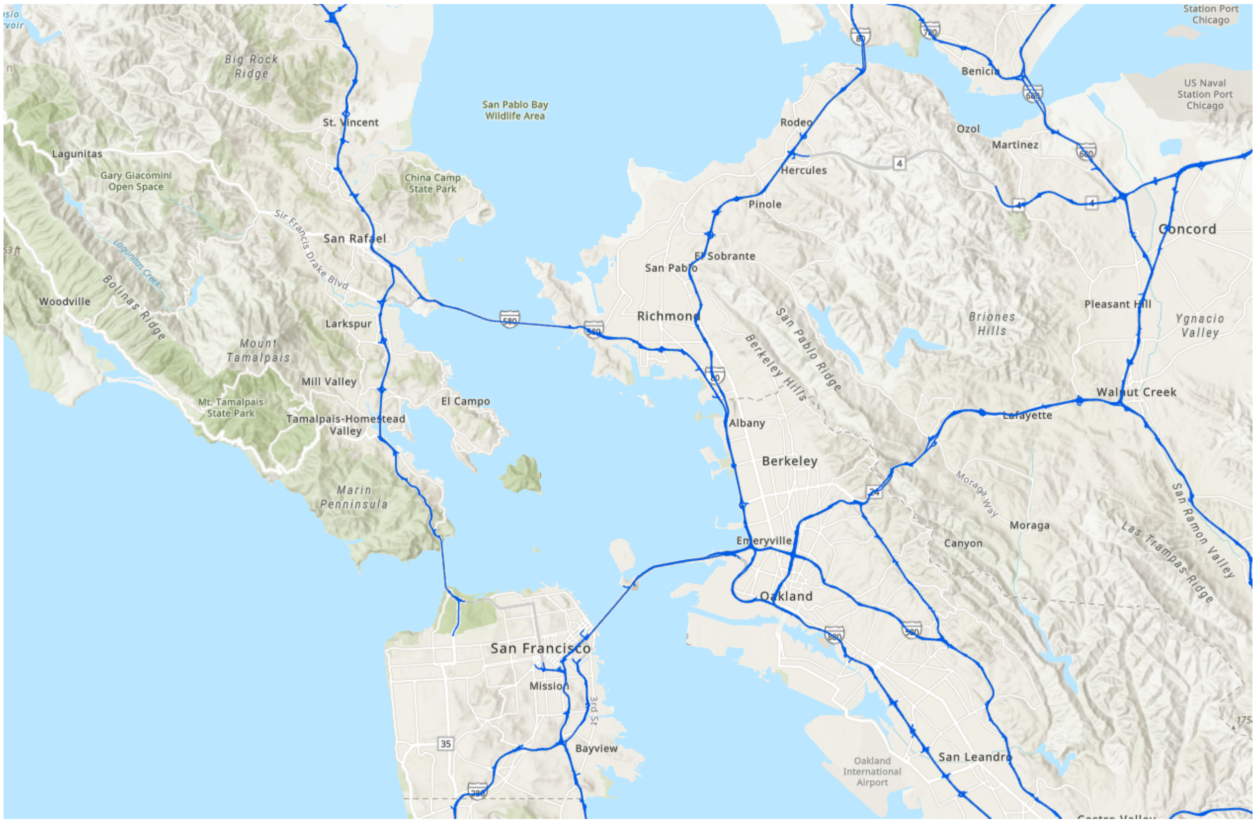
Figure 4.20 AC Transit: Pre- and Post-Pandemic Headways, Local Service (Off-Peak)



4.3 Auto

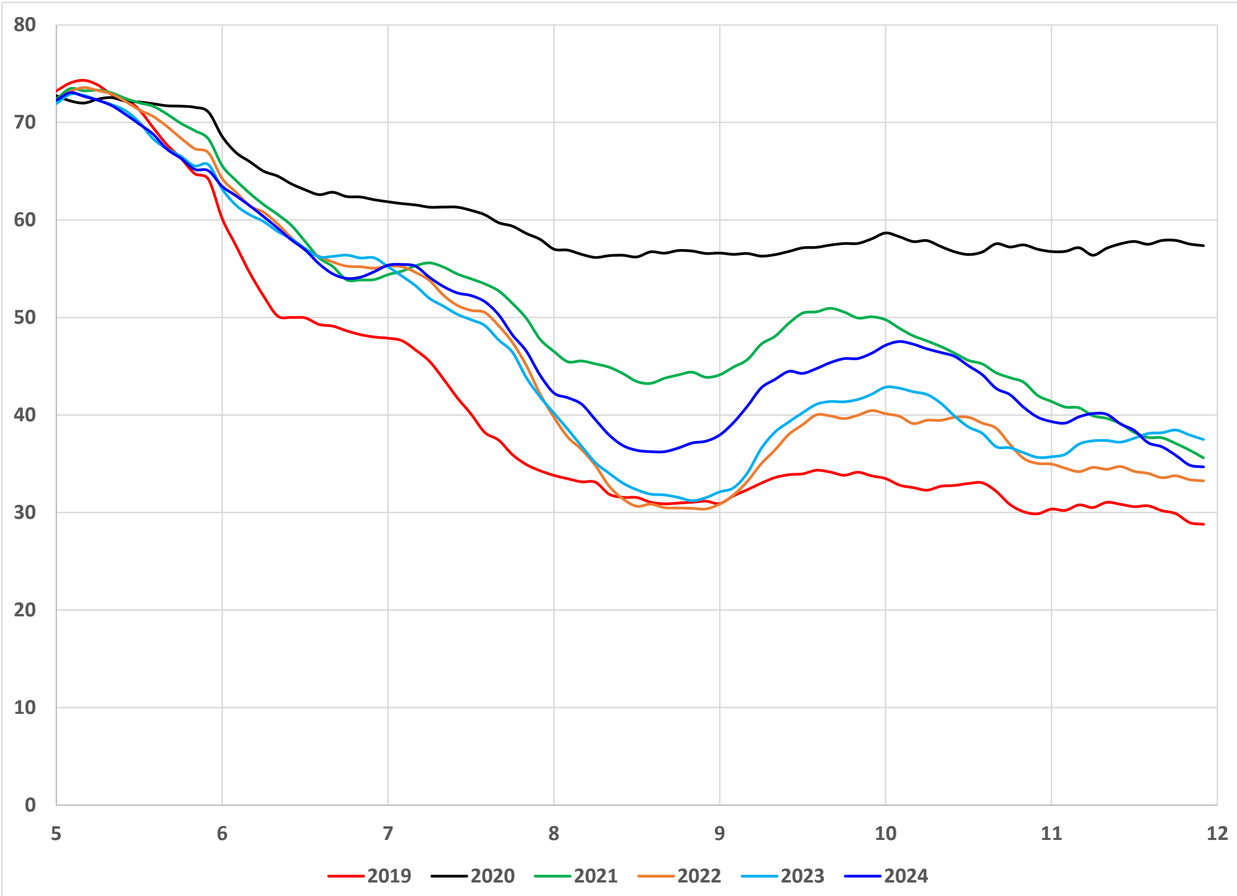
Current weekday AM auto level of service along key corridors appears to be about the same as it was before the pandemic. Data from the Caltrans Performance Monitoring System (PeMS) were collected for several freeways leading to San Francisco (Figure 4.21).

Figure 4.21 PeMS Station Locations for Speed Reporting



The I-80 corridor in the East Bay is one of the major approaches to the Bay Bridge. March – April average weekday AM speeds are shown in Figure 4.22. Current speeds appear to be about the same as they were in the year immediately preceding the pandemic (2019). Speeds in the post-pandemic period appear to be slightly higher than before the pandemic, possibly due to reduced commute auto travel to downtown San Francisco.

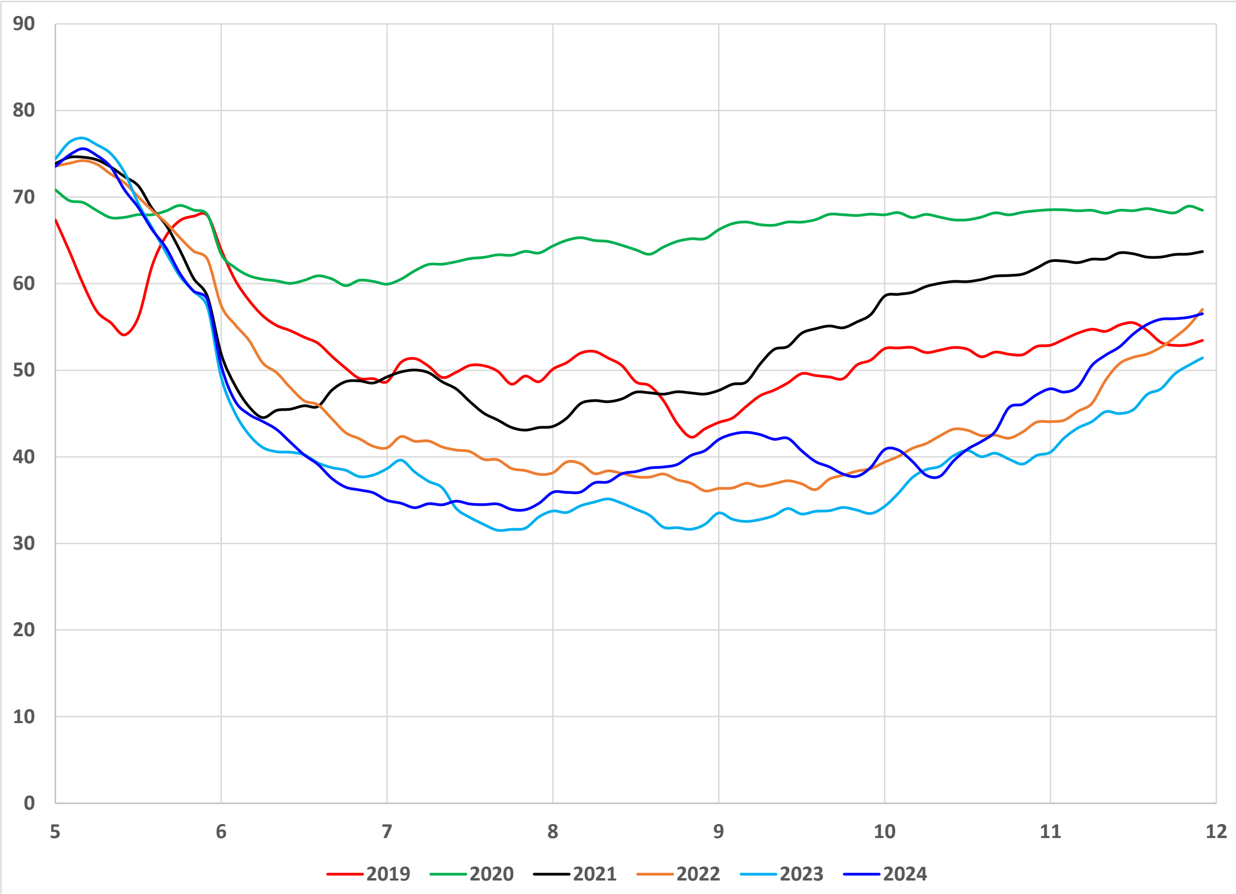
Figure 4.22 Average AM Weekday Speed, I-80 Westbound Near Ashby Ave (March–April)



Traffic speeds on the Bay Bridge (Figure 4.23) were essentially free-flow during the peak of the pandemic (2020). The current speed profile appears to be similar to those in the pre-pandemic year. The latest speed profile (2024) suggests that there is a somewhat sharper peak than before the pandemic, indicating that peak spreading of traffic[17] is somewhat less due to lower numbers of auto commuters traveling to downtown San Francisco.

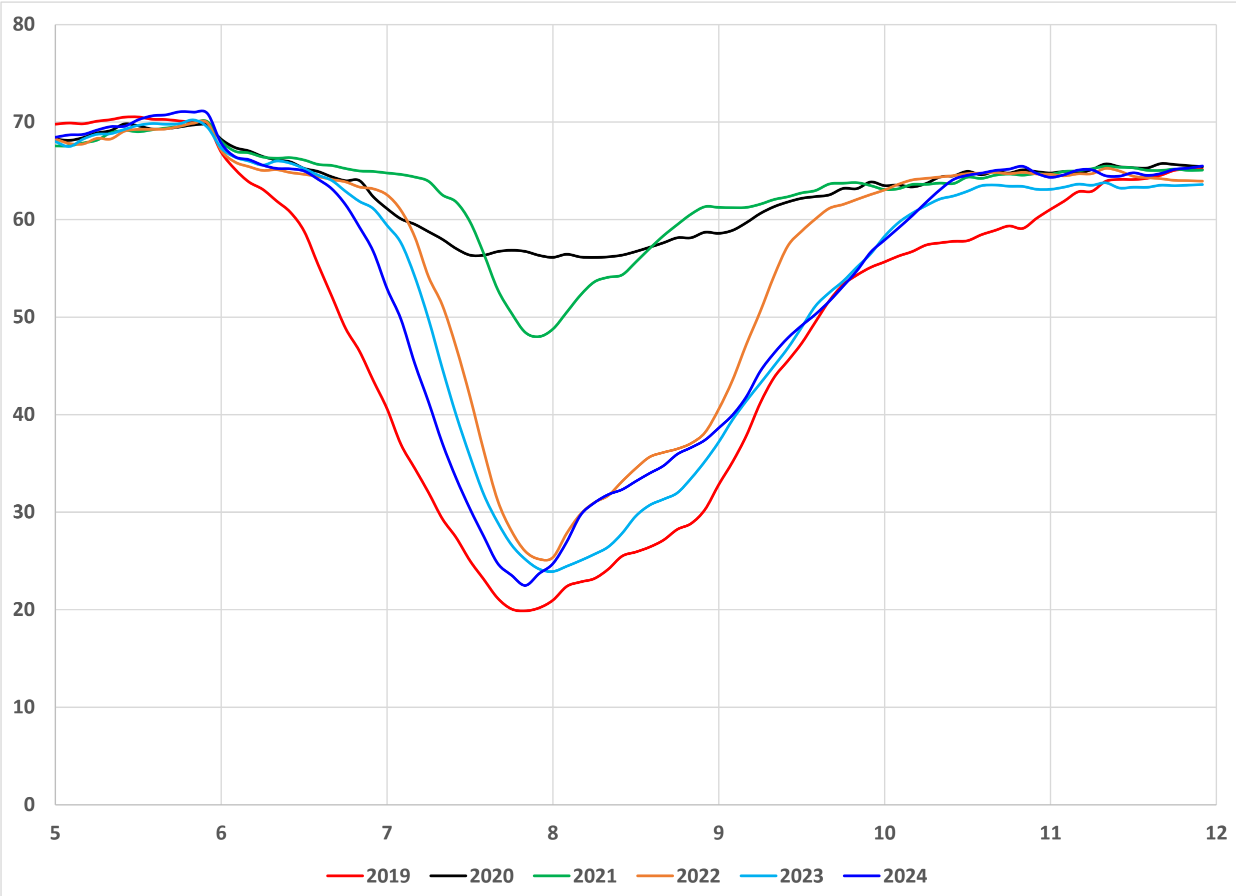
[17] "Peak spreading" refers to the spreading in time of the peak period due to congestion. Capacity restrictions in the facility force some traffic to travel earlier or later, resulting in a longer congested period.

Figure 4.23 Average AM Weekday Speed, Bay Bridge Westbound (March–April)



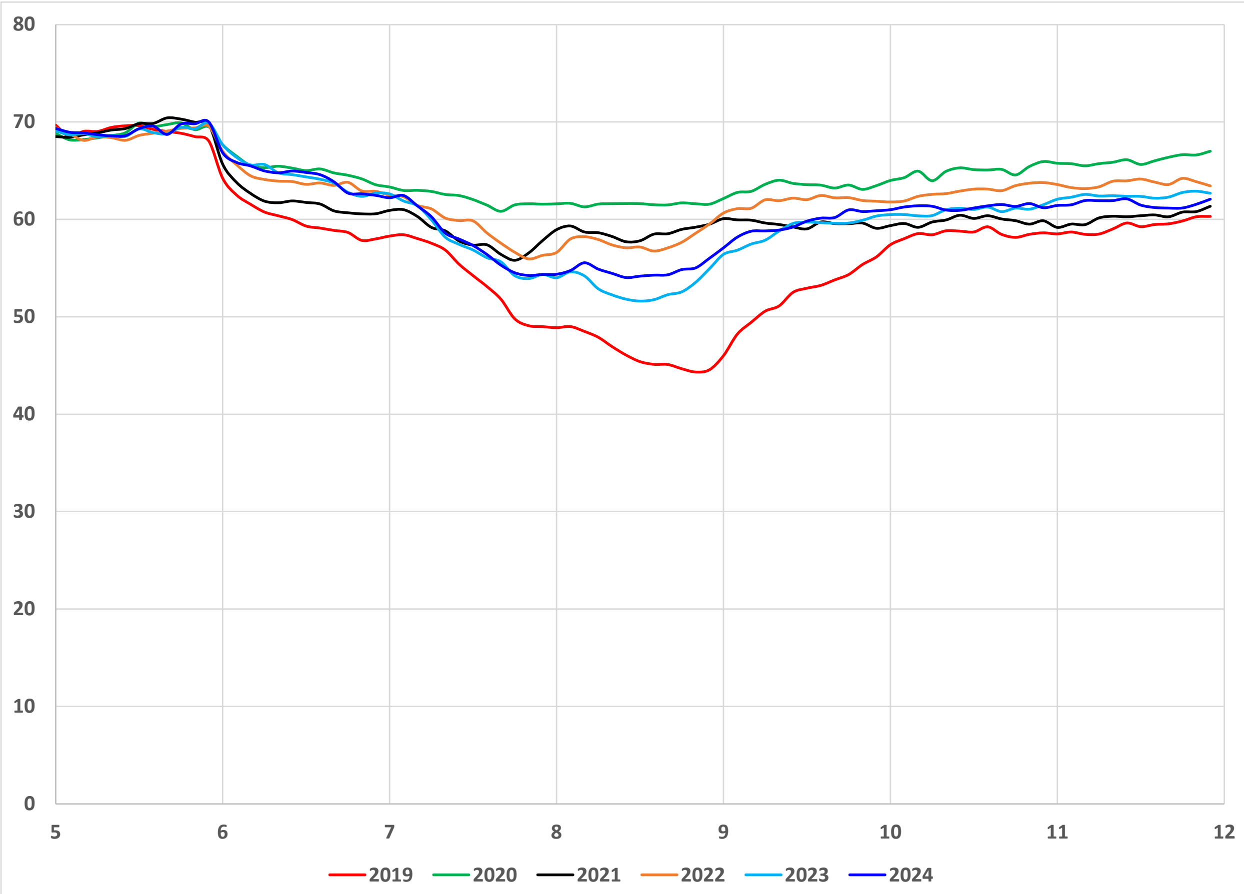
A somewhat similar pattern appears to occur for US 101 southbound during AM peak periods (Figure 4.24). There is a pronounced peak for both pre- and post-pandemic periods. The post-pandemic speed profile indicates a more pronounced peak, indicating a reduction in peak spreading due to fewer auto commuters to San Francisco.

Figure 4.24 Average AM Weekday Speed, US-101 Southbound Near Miller Creek Rd in Marin County (March–April)



US 101 northbound from San Mateo County to San Francisco shows significant changes during the AM peak (Figure 4.25).

Figure 4.25 Average AM Weekday Speed, US-101 Northbound North of San Francisco/San Mateo County Line (March–April)



4.4 Summary

Transit

The total amount of transit service in the post-pandemic era has decreased. Total service, whether measured as vehicle revenue miles, vehicle service hours, or vehicles in maximum service, is 10 to 25 percent below pre-pandemic levels. These service reductions are due to decreased work travel demand as well as attempts by transit agencies to reduce their operating costs.

A closer look at the three biggest operators shows that most of the service reductions were to express and transbay services, which are designed primarily to serve commuters. Express and transbay service reductions consisted primarily of eliminating routes with low productivity. Local service was also reduced: some routes were eliminated, while headways were increased for some local routes.

SFMTA eliminated more than half of its express bus routes in the post-pandemic period. Headways on existing local routes increased somewhat, although most local route headways are less than 30 minutes. Rail service also saw increases in headways and the elimination of one of its surface light rail routes.

Changes to BART service are particularly noteworthy. For almost its entire 50-year service time, BART had operated on 15-minute headways during weekdays. The change to 20-minute weekday headways represents a major departure from this policy. The increase in daytime Sunday service to five routes partially reflects the relatively greater comeback of weekend travel on the system.

AC Transit eliminated a number of its transbay routes, particularly in southern Alameda County. Transbay service on the Dumbarton Bridge was eliminated, as were several lines that originated in the Berkeley and Oakland hills. Several local routes have been eliminated, and headways have increased on most of the remaining local routes.

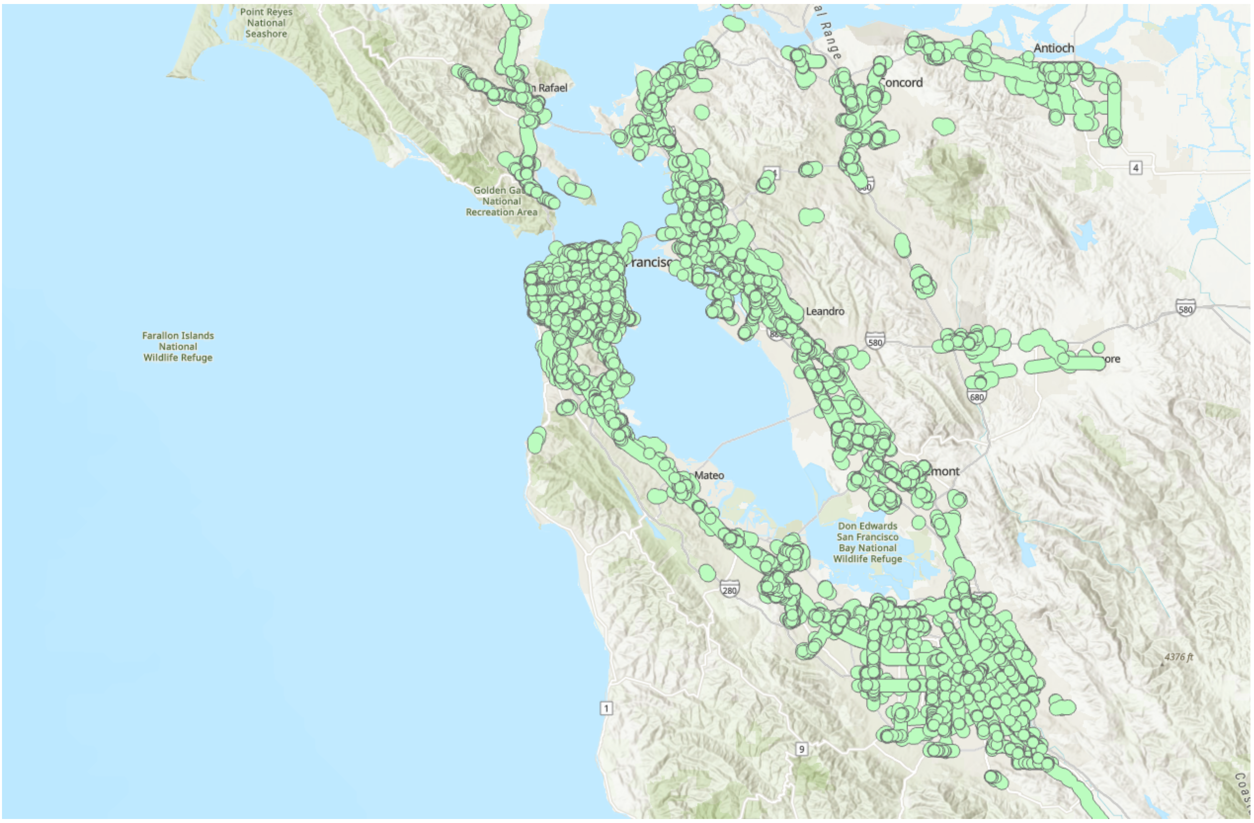
Transit level of service reductions appear to have lagged behind decreases in ridership. In other words, decreased ridership led to decreases in transit service, rather than the other way around.

Although transit level of service in the Bay Area has been somewhat reduced due to budget necessities, overall service levels remain high. Figure 4.26 shows a current map of **high-quality transit areas.**[18] In general, high-quality transit areas are primarily in the following areas:

- San Francisco
- East Bay along the I-80 and I-880 corridors from Richmond to Fremont
- San Jose
- US 101 corridor from San José to San Francisco

[18] California Public Resources Code (PRC) 21155, 21064.3, and 21060.2. Section 21155 defines a high-quality transit corridor as a corridor with fixed route bus service that has service intervals of 15 minutes or less during peak commute hours.

Figure 4.26 High-Quality Transit Areas Around San Francisco Bay



Source: CA.gov state geoportal.

Auto

Overall, auto level of service has changed somewhat from pre-pandemic periods. Post-pandemic weekday AM travel speeds along some of the major corridors into San Francisco appears, in general, to be somewhat higher than pre-pandemic speeds, which may be due to fewer auto trips. The most notable difference between pre- and post-pandemic periods appears to be some sharpening of the peak in the post-pandemic era. In other words, it appears that somewhat reduced auto demand has reduced the spreading of the peak period along these corridors.

5. Economics

5.1 Introduction

The pandemic has brought significant disruption to transit operations across the US. This Section discusses the economics of transit operations in the Bay Area, showing trends from before, during, and after the pandemic. Trends are shown for pre-pandemic fiscal years (2018–2019) through fiscal year 2022, the last year for which financial data were available from the National Transit Database at the time of this writing. This Section consists of several parts:

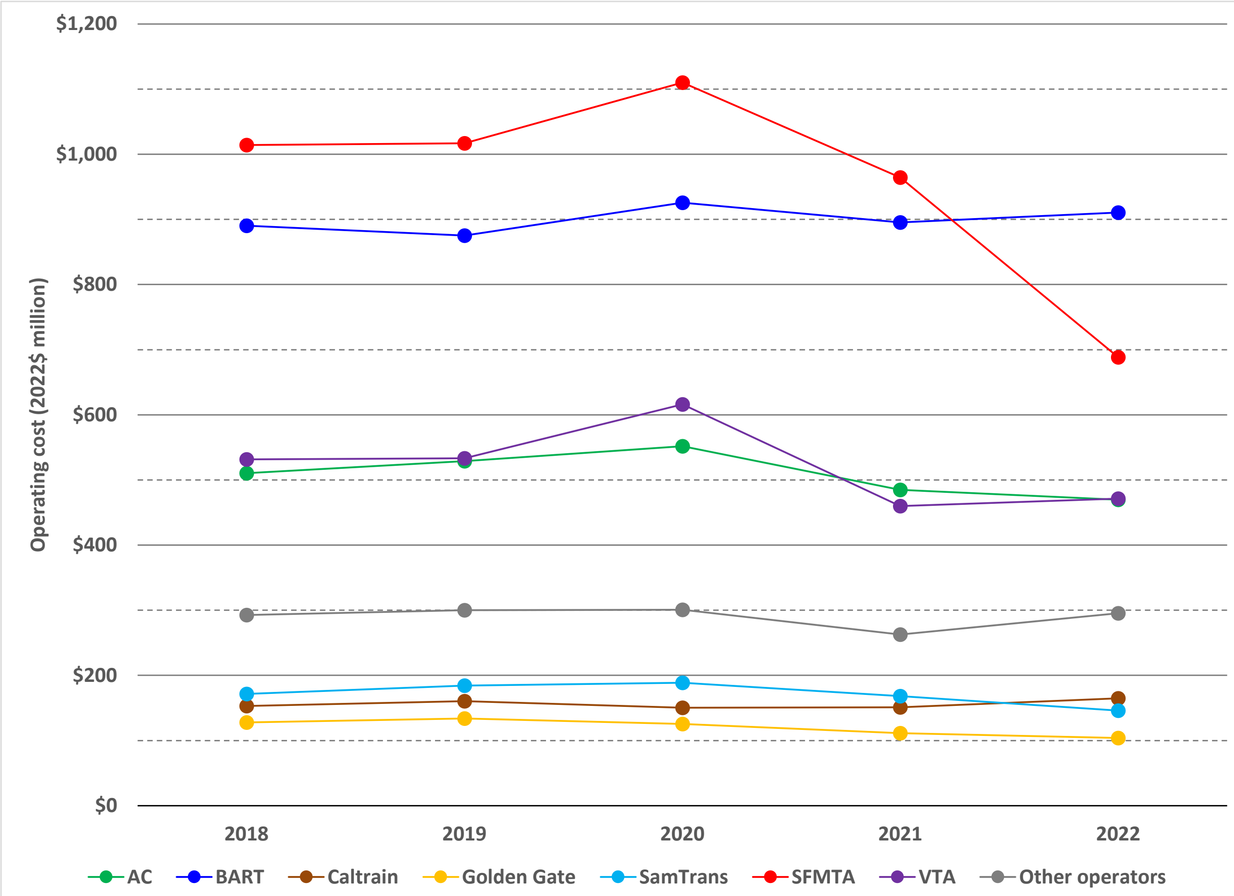
- Section 5.2 discusses operating costs by agency, including costs by mode and sources of operating costs.
- Section 5.3 discusses the same breakdown of capital costs.
- Section 5.4 discusses several types of productivity measures.
- Section 5.5 compares the Bay Area to a sample of other metropolitan areas on several transit economic measures.
- Section 5.6 provides a closer look at anticipated operating budget shortfalls for the three largest transit operators: SFMTA, BART, and AC Transit.

5.2 Operating Costs and Fare Revenues

5.2.1 Operating costs and fare revenues by operator and mode

Figure 5.1 shows total operating costs by agency for the Big 7 transit operators and for other transit operators grouped together; costs are shown in millions of constant (2022) dollars.

Figure 5.1 Annual Operating Costs by Agency (Constant 2022$, Millions)



For most agencies, real operating costs have not changed very much. Overall operating costs have varied by not more than about 5 percent for all agencies except for SFMTA. The decrease in operating costs for SFMTA since the pandemic reflects in part the changes in service that were discussed in Section 4: i.e., the discontinuation of Muni Metro rail service during the pandemic, and post-pandemic bus service reduction, including elimination of a number of parallel routes.[19]

5.2.2 Sources of operating funds

Operating costs for Bay Area transit operators have been funded by a variety of sources: federal, state, local (i.e., either special local taxes or general funds), and other (mainly fares). Sources for operating funds for the Big 7 Bay Area transit operators and other transit operators combined are shown in Table 5.1 through Table 5.4. Figures are in constant (2022) dollars.

[19] See section 4.2 for more details on post-pandemic service reductions.

Table 5.1 Operating Funds – Federal Sources

Operator	Fiscal year (amounts in constant 2022$, millions)				
	2018	2019	2020	2021	2022
AC	$12	$15	$42	$102	$77
BART	$2	$1	$203	$427	$452
Caltrain	$0	$0	$25	$93	$116
Golden Gate	$0	$0	$48	$71	$65
SamTrans	$6	$3	$6	$64	$18
SFMTA	$11	$10	$224	$478	$255
VTA	$5	$5	$84	$80	$173
Other operators	$23	$21	$56	$87	$88
Total	$58	$56	$688	$1,402	$1,244

Most of the special federal funds under the American Rescue Plan (ARP) went to BART and SFMTA, as these were the agencies most affected financially by the decrease in transit ridership and fare revenue. The allocation formula developed by the Metropolitan Transportation Commission (MTC) was intended mainly to make up for losses in transit fare revenue.

State allocations for transit operations, such as special state transit funding measures passed during the pandemic, have increased somewhat over the five-year period from 2018 to 2022 (Table 5.2). There was a significant increase in overall state funding in FY20, followed by a drop in FY21, then another increase in FY22. Overall state funding for transit in the Bay Area in FY22 was 14% higher than in FY18, but 6% and 9% lower than FY19 and FY20, respectively.

Table 5.2 Operating Funds – State Sources

Operator	Fiscal year (amounts in constant 2022$, millions)				
	2018	2019	2020	2021	2022
AC	$66	$83	$90	$75	$78
BART	$32	$44	$68	$0	$54
Caltrain	$6	$5	$13	$14	$10
Golden Gate	$19	$26	$26	$22	$24
SamTrans	$4	$7	$12	$5	$13
SFMTA	$155	$184	$175	$144	$172
VTA	$145	$174	$149	$154	$144
Other operators	$62	$73	$78	$55	$63
Total	$489	$595	$611	$470	$558

BART received almost no state funding in FY21. SFMTA and VTA have been the largest recipients of state funding during the five-year period from FY18–22.

Local sources for operating funds have decreased significantly since 2018 (Table 5.3).

Table 5.3 Operating Funds – Local Sources

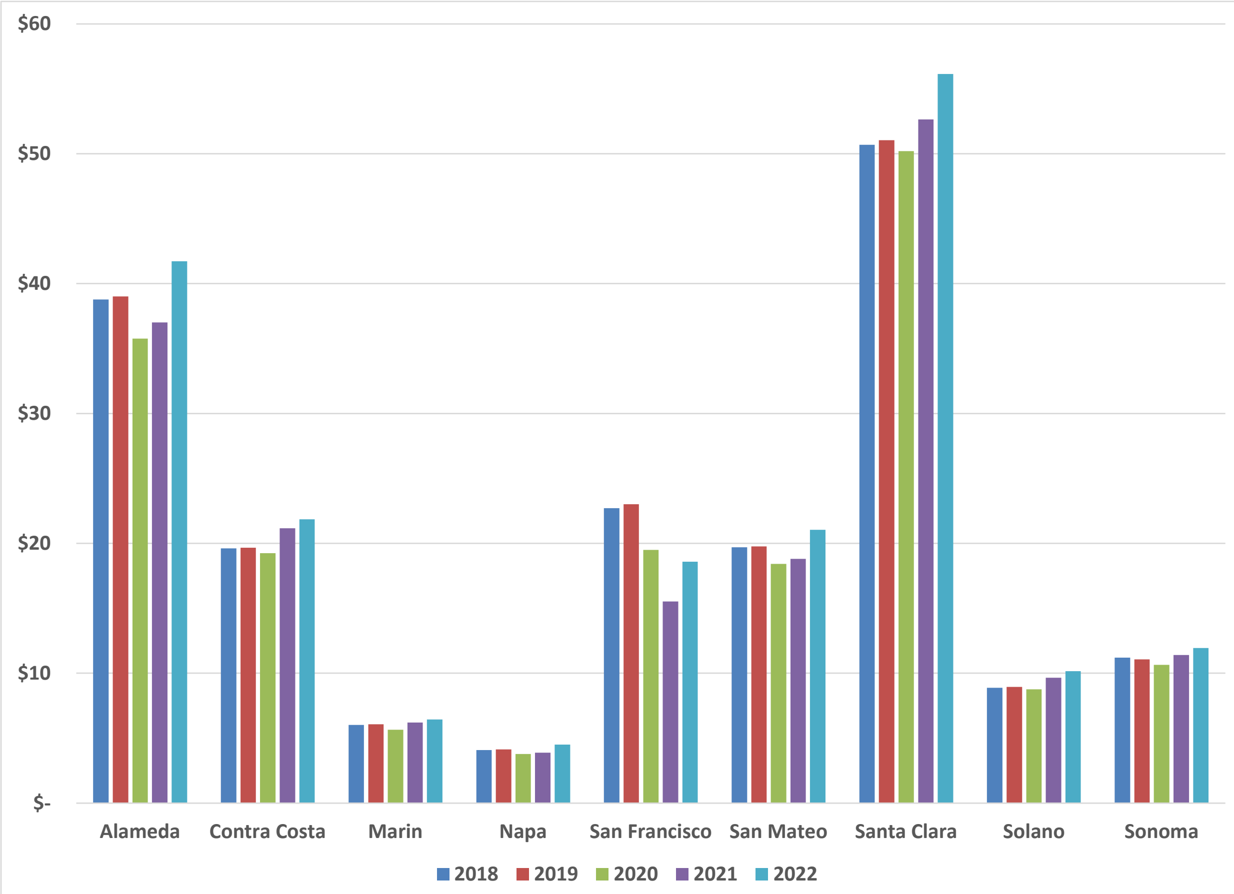
Operator	Fiscal year (amounts in constant 2022$, millions)				
	2018	2019	2020	2021	2022
AC	$347	$344	$343	$278	$274
BART	$231	$227	$208	$372	$239
Caltrain	$22	$27	$20	$6	$0
Golden Gate	$64	$64	$19	$2	$2
SamTrans	$132	$139	$140	$83	$95
SFMTA	$542	$517	$507	$313	$182
VTA	$331	$275	$314	$201	$122
Other operators	$140	$136	$112	$102	$109
Total	$1,809	$1,730	$1,662	$1,358	$1,023

Local funding for BART appears to have remained fairly constant over the five-year period, except for a significant increase in FY21. The largest changes in local funding have been for AC Transit, SFMTA, and VTA:

- Local funding for AC Transit decreased by over 20% between 2018 and 2022.
- Local funding for SFMTA decreased by almost two-thirds from 2018–2019 to 2022.
- Local funding for VTA has decreased by about 60% from 2018 levels.

Part of the changes in local funding are due to changes in sales tax revenues. Figure 5.2 shows taxable sales by county in constant dollars for fiscal years 2018–2022. Most counties show 2022 taxable sales somewhat higher than pre-pandemic levels. But San Francisco has experienced the greatest loss in taxable sales since the pandemic.

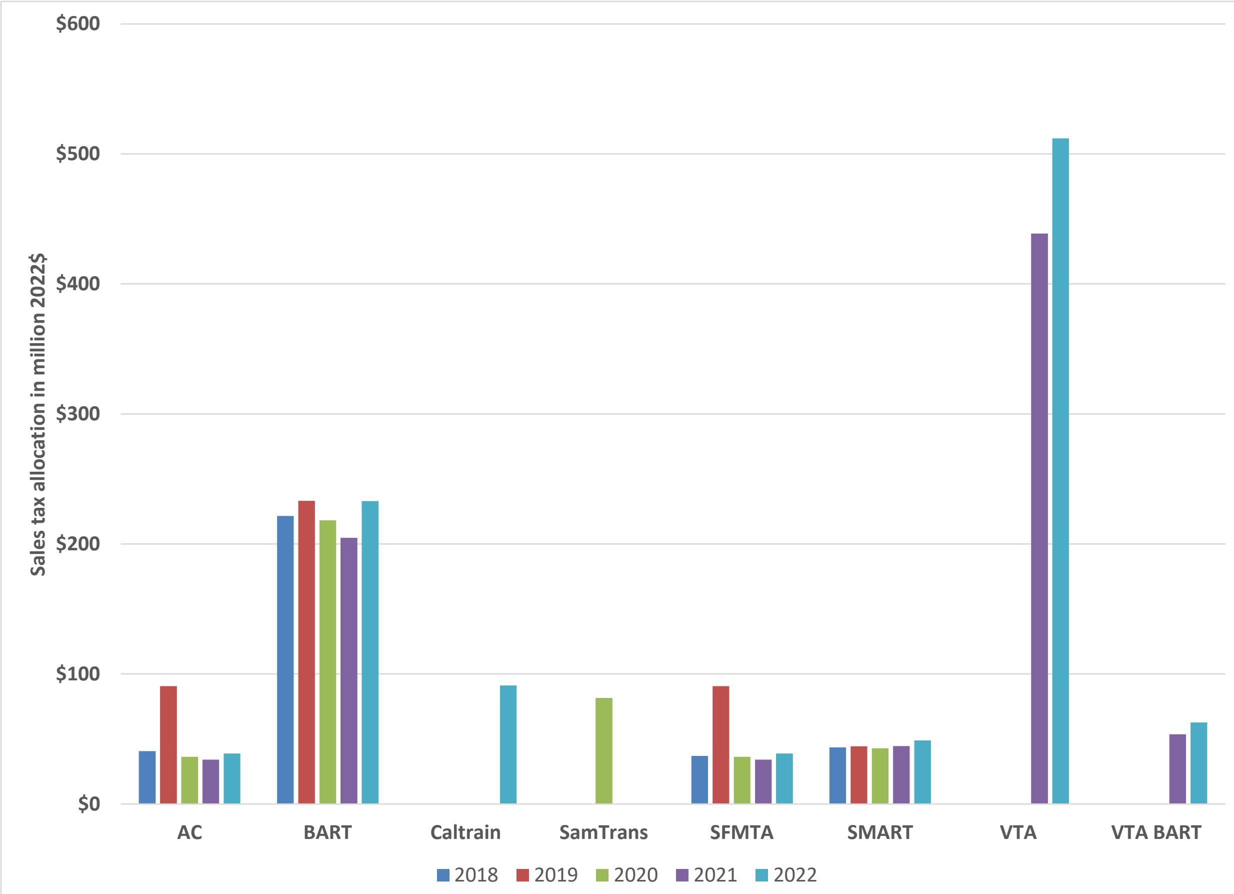
Figure 5.2 Taxable Sales by County in Constant 2022$ (Billions)



Sales tax revenues that go into the city or county general fund are part of local funding for transit. But some transit districts have special sales taxes that are directly paid into the agency. Figure 5.3 shows direct sales tax allocations in constant 2022$ to transit districts for those districts in the Bay Area.[20]

[20] Includes redistribution of BART sales tax revenues: 75% goes directly to BART; the remaining 25% is split evenly between AC Transit and SFMTA.

Figure 5.3 Direct Sales Tax Allocations to Transit Districts in 2022$



Note that real allocations to BART have remained fairly constant over the five-year period. Santa Clara County instituted special taxes beginning in FY21 to fund VTA operations and operating and maintenance costs for BART.

Other operating fund sources are mostly fares, although other self-generated revenue sources such as advertising are included. Table 5.4 shows other revenue sources for the main Bay Area operators in constant 2022$.

Table 5.4 Operating Funds by Operator and Year – Other Sources

Operator	Fiscal year (amounts in constant 2022$, millions)				
	2018	2019	2020	2021	2022
AC	$85	$87	$77	$30	$40
BART	$626	$602	$447	$96	$166
Caltrain	$126	$129	$92	$37	$39
Golden Gate	$46	$43	$32	$16	$13
SamTrans	$29	$36	$31	$16	$20
SFMTA	$306	$305	$203	$29	$80
VTA	$51	$80	$69	$24	$33
Other operators	$67	$70	$56	$19	$36
Total	$1,336	$1,352	$1,007	$268	$425

The decrease in other funding sources between 2022 and 2018 was nearly 70% for all Bay Area operators taken together. BART and SFMTA account for about half the total loss in revenue from other sources and experienced the biggest percentage decrease in local sources: a nearly 75% decrease from 2018 to 2022. Caltrain funding from local sources decreased by nearly 70%. Most other operators saw a nearly 50% decrease in local funding.

Fare revenues are the main component of other funding sources. Figure 5.4 shows the loss in fare revenue by operator for bus and rail; Figure 5.5 shows the fare revenue losses as percentages.

Figure 5.4 Dollar Loss in Fare Revenue, Bay Area Operators

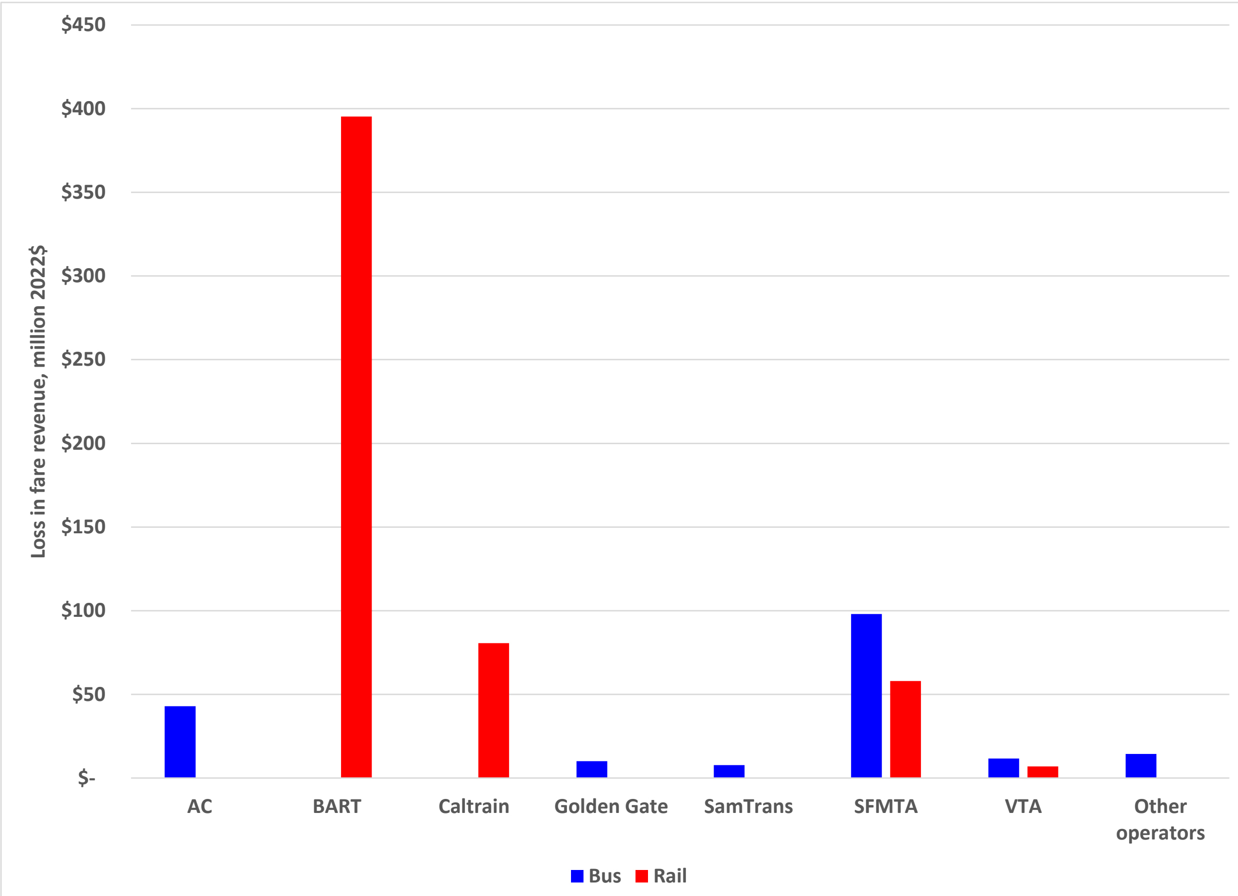
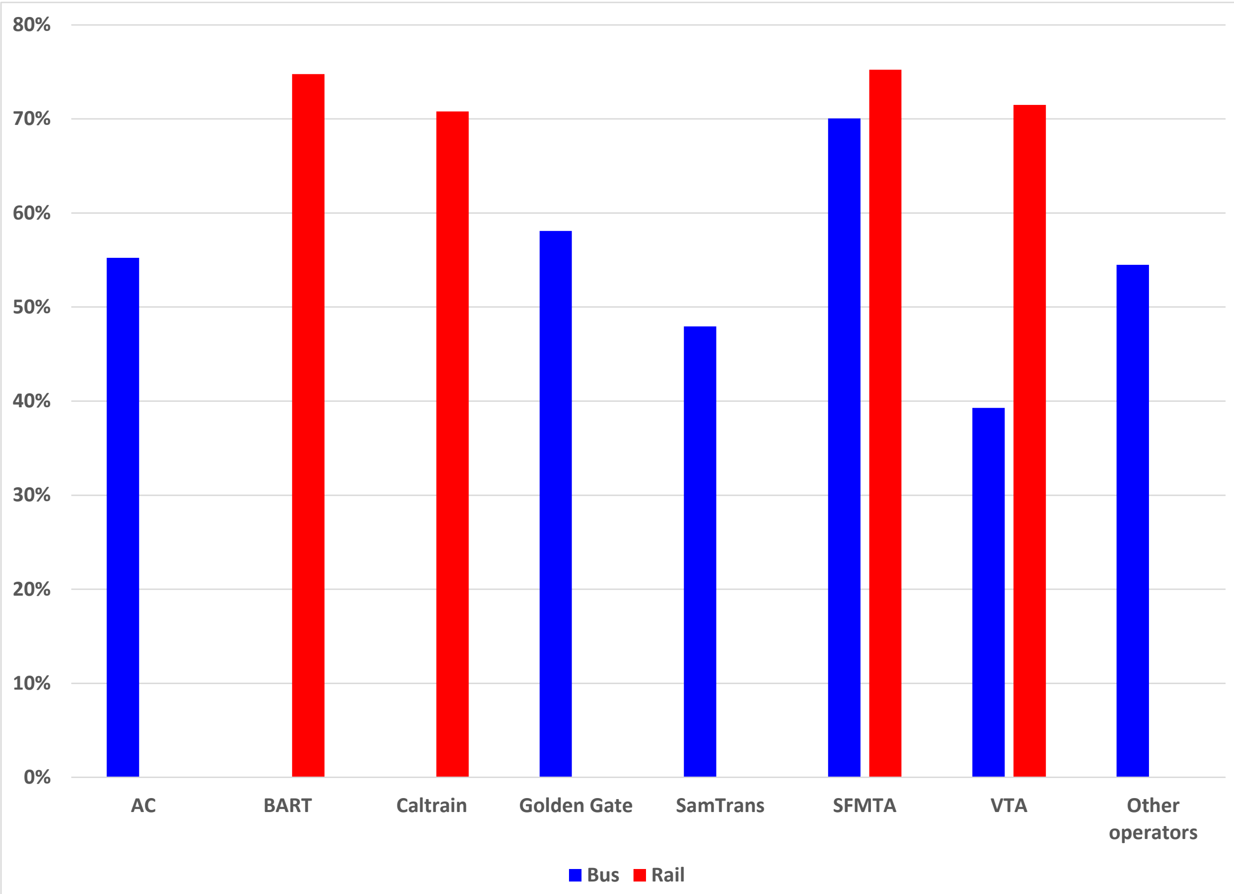


Figure 5.5 Percentage Loss in Fare Revenue 2019 to 2022, Bay Area Operators



The most significant conclusions that can be drawn from these figures are the following:

- Taken together, total fare revenue loss for BART and SFMTA accounts for over three-quarters of the total fare revenue loss in the Bay Area. **This fact is the most significant financial finding for the future of Bay Area transit operations.**

- Fare revenue loss for BART accounts for 73% of total loss in rail fare revenue, and 54% of total loss in fare revenue for both bus and rail.

- Rail has experienced the greatest percentage loss in fare revenue.

- The loss in fare revenue is particularly acute for BART and Caltrain, as fare revenues accounted for over 60% of their operating funds before the pandemic.[21]

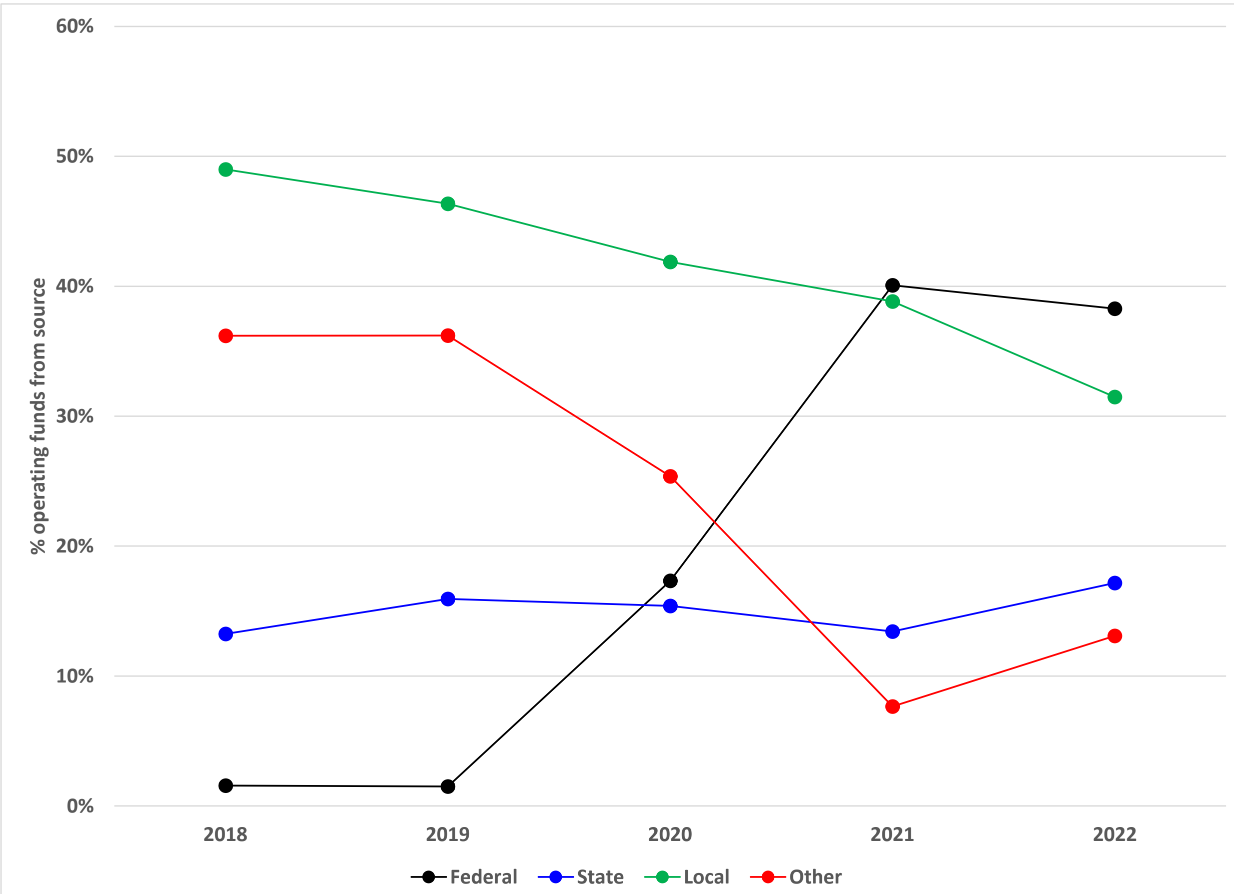
- SFMTA experienced the second highest percentage loss in rail fare revenue and the highest percentage loss in bus fare revenue. This indicates a severe problem for SFMTA in the

[21] See section 5.4.3 for a discussion of farebox recovery for Bay Area transit operators.

future, as it is the largest transit operator in the Bay Area and the amount of fare revenues before the pandemic was second in the region only to BART.

Another perspective on operating funds by source is to view the percentage of operating funds provided by each source. Figure 5.6 shows the percentage of operating costs by source for all Bay Area transit operators.

Figure 5.6 Percent Operating Funds by Source, All Bay Area Transit Operators



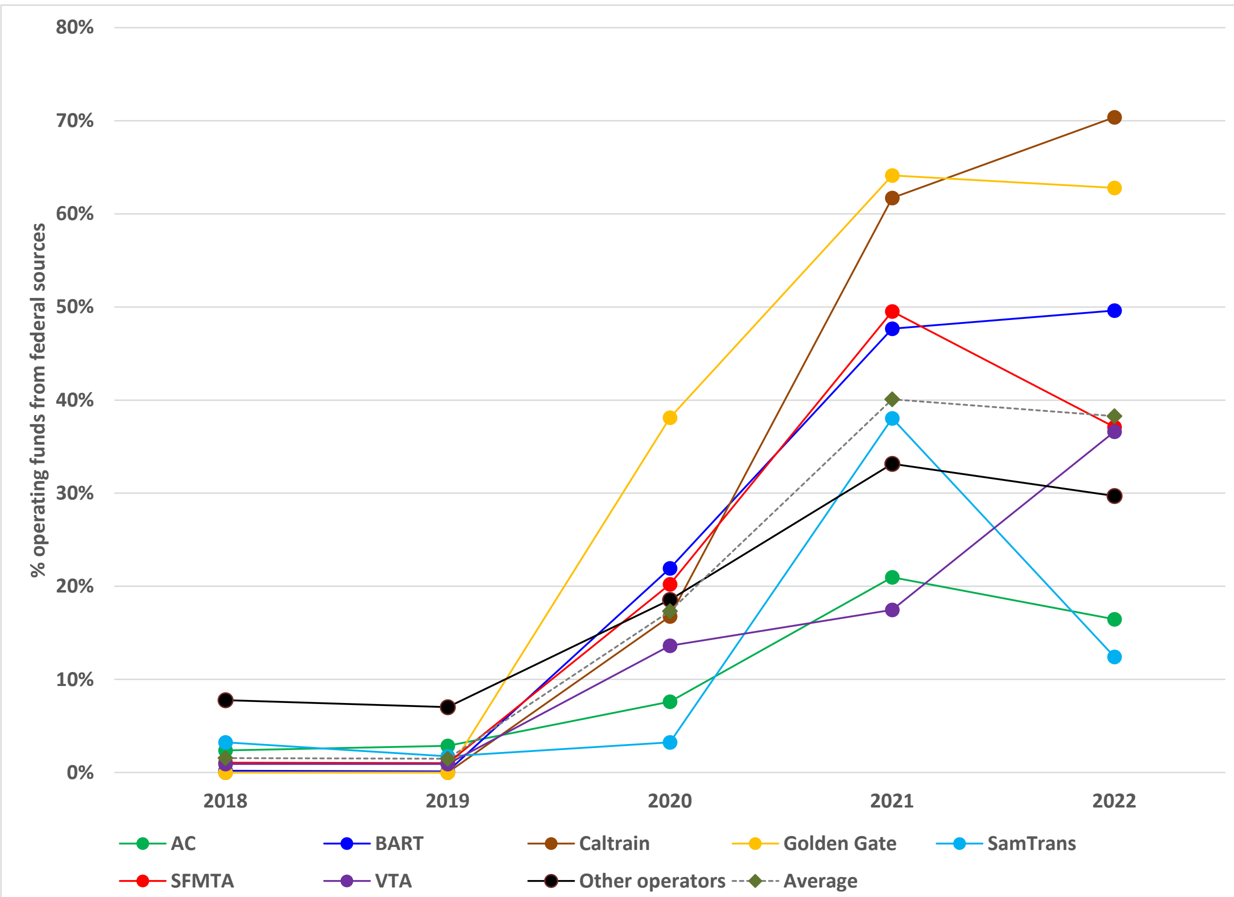
The large increase in the federal share of operating funding is due to emergency measures from the pandemic, including the American Rescue Plan Act (ARP) of 2021. Funding under the ARP ended on September 30, 2024.

The state funding share of transit operations has increased slightly over the five-year period from about 12% to 17%.

Before the pandemic, Bay Area transit operators averaged about 36% farebox recovery. This percentage has dropped dramatically due to sharp decreases in ridership, as discussed in Section 3 above. In 2022, the average farebox recovery for all Bay Area operators combined was 13%.

Figures 5.7–5.10 show the percentage of operating funds for each operator by source. Federal sources (Figure 5.7) formerly accounted for less than 10% of operations funding. Since the pandemic and passage of federal pandemic recovery programs including ARP, federal funds now make up 40% overall of operations funding for Bay Area transit. BART, Caltrain, SFMTA, and Golden Gate Transit have had the greatest dependency on federal funding.

Figure 5.7 Percent Operating Funds from Federal Sources

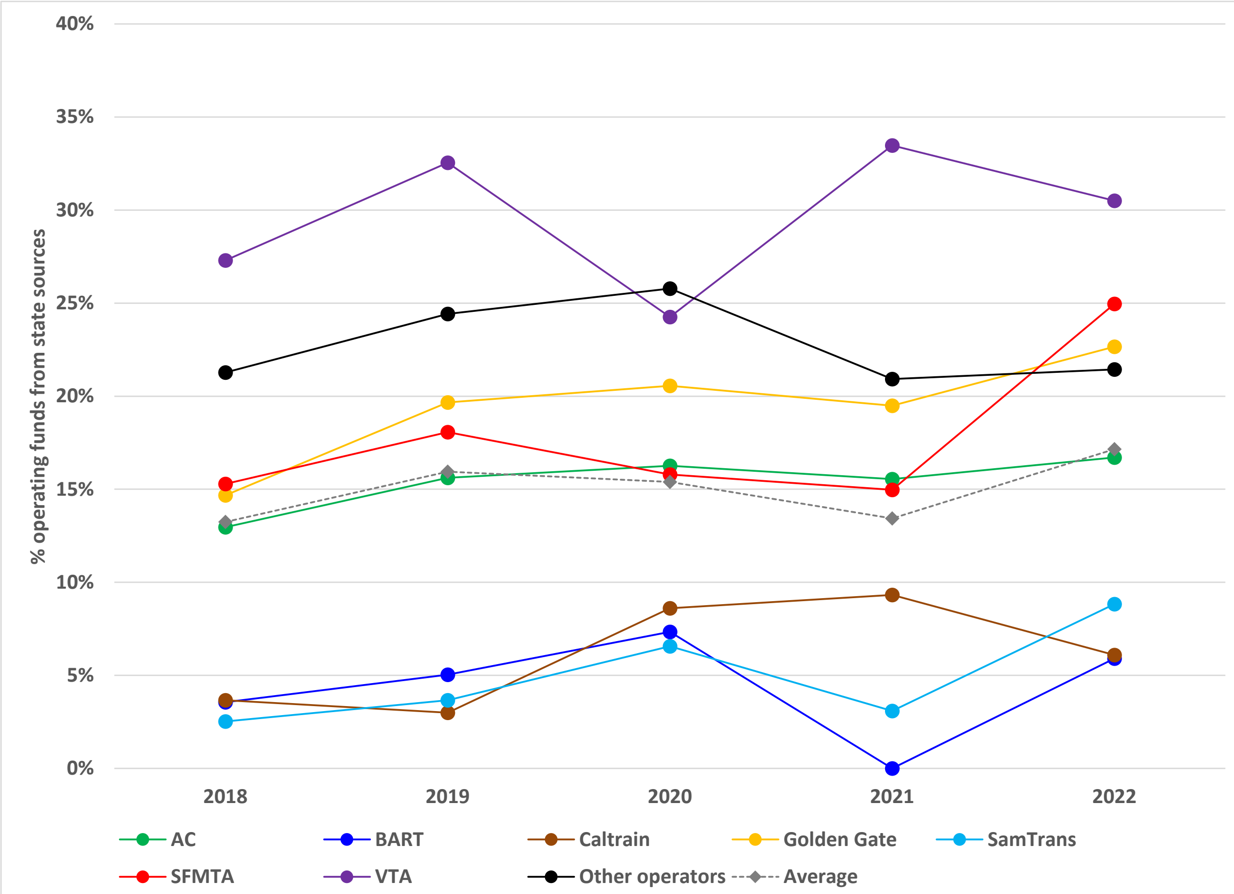


The large dependency on federal funding is a particularly acute problem for Caltrain, Golden Gate Transit, BART, and SFMTA, as operating funding under ARP expired as of October 2024.

Figure 5.8 shows percentage of funding sources from state sources. Note that these separate into two groups:

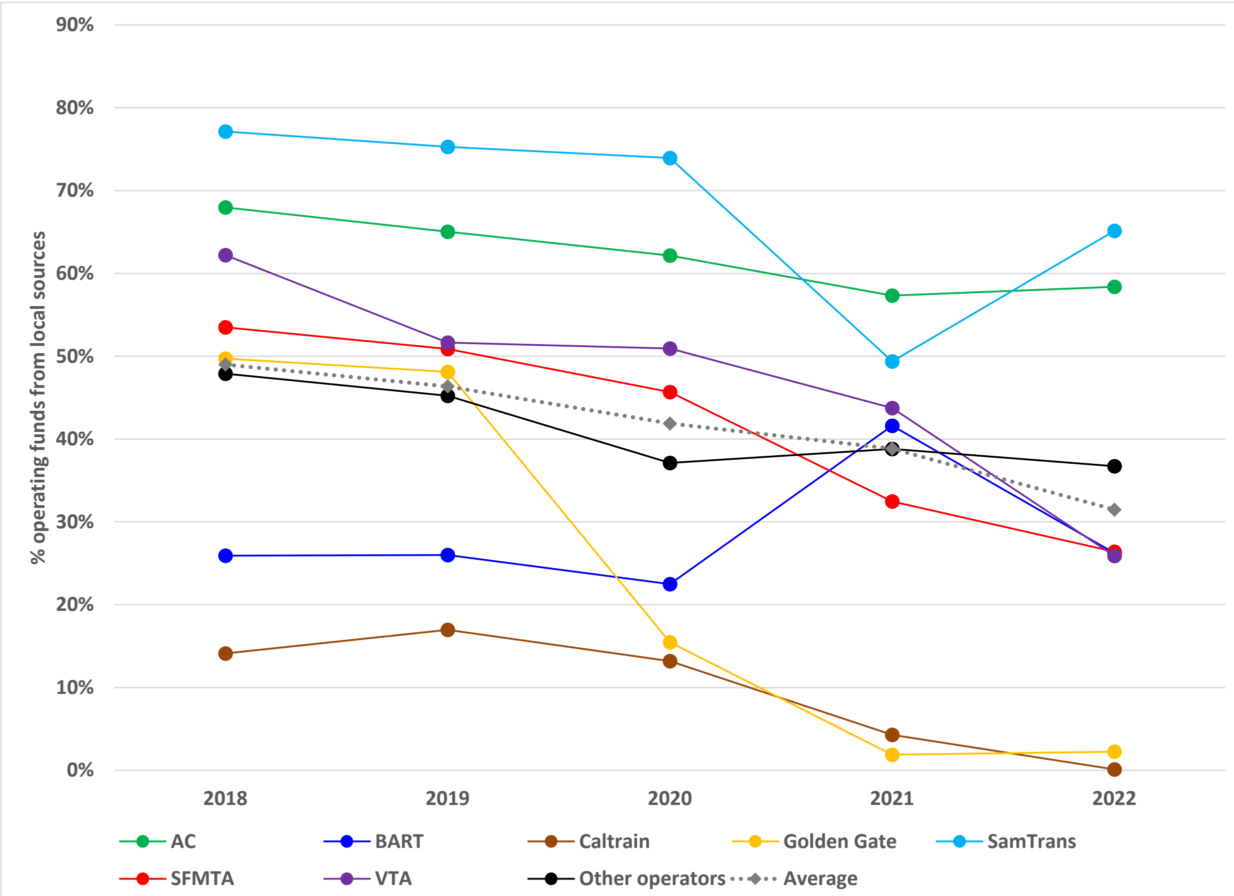
- VTA, SFMTA, other operators, and AC Transit have depended the most on state funding for operations. State sources accounted for 15%–35% of operating for these agencies.
- BART, SamTrans, and Caltrain have received less than 10% of their operating funds from state sources.

Figure 5.8 Percent Operating Funds from State Sources



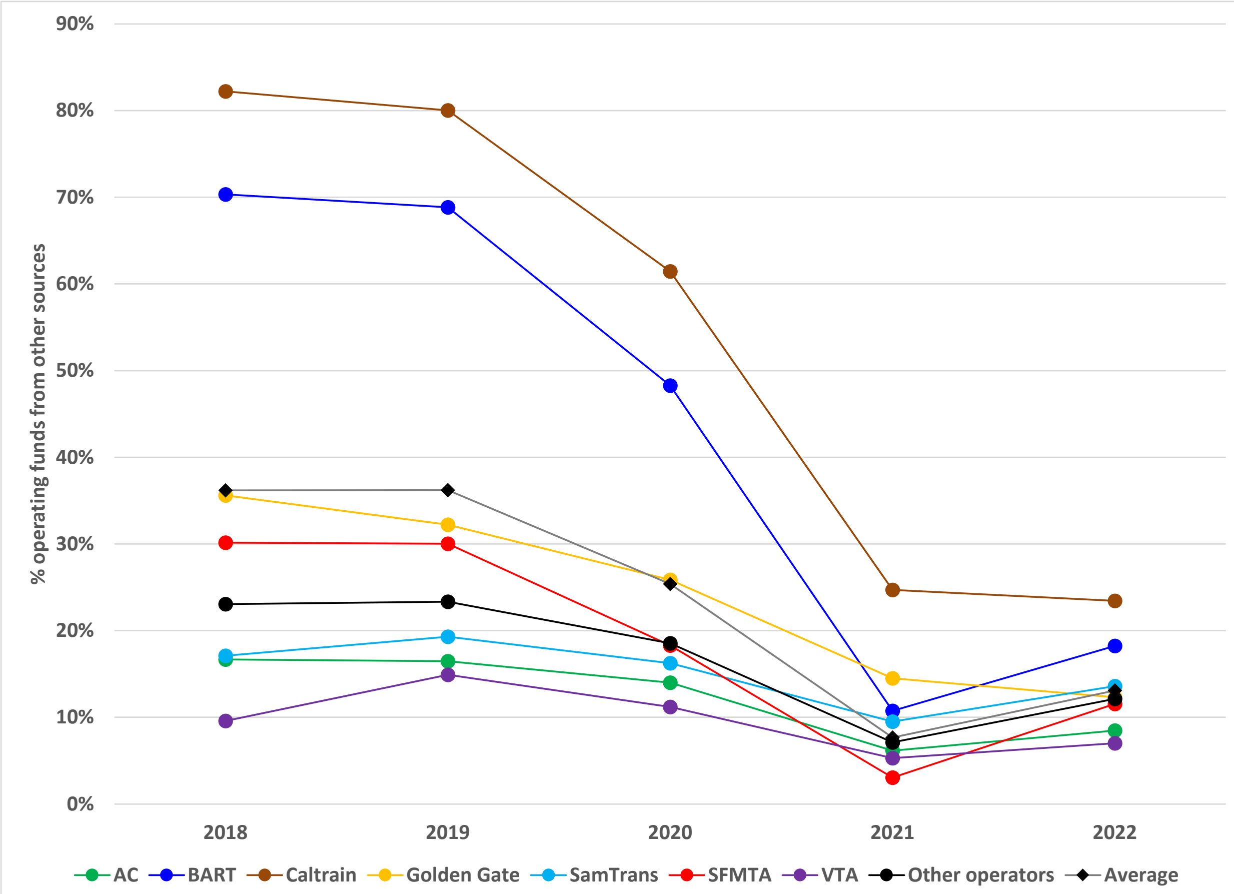
The percentage of funding from local sources (Figure 5.9) has decreased over the five-year period. This is in large part due to the large increase in federal funding for transit operations due to ARP and other measures passed during the pandemic.

Figure 5.9 Percent Operating Funds from Local Sources



Percentages of operating cost funding from local sources (Figure 5.10) has decreased significantly over the five-year period due primarily to the loss in fare revenue from the loss in transit ridership.

Figure 5.10 Percent Operating Funds from Other Sources



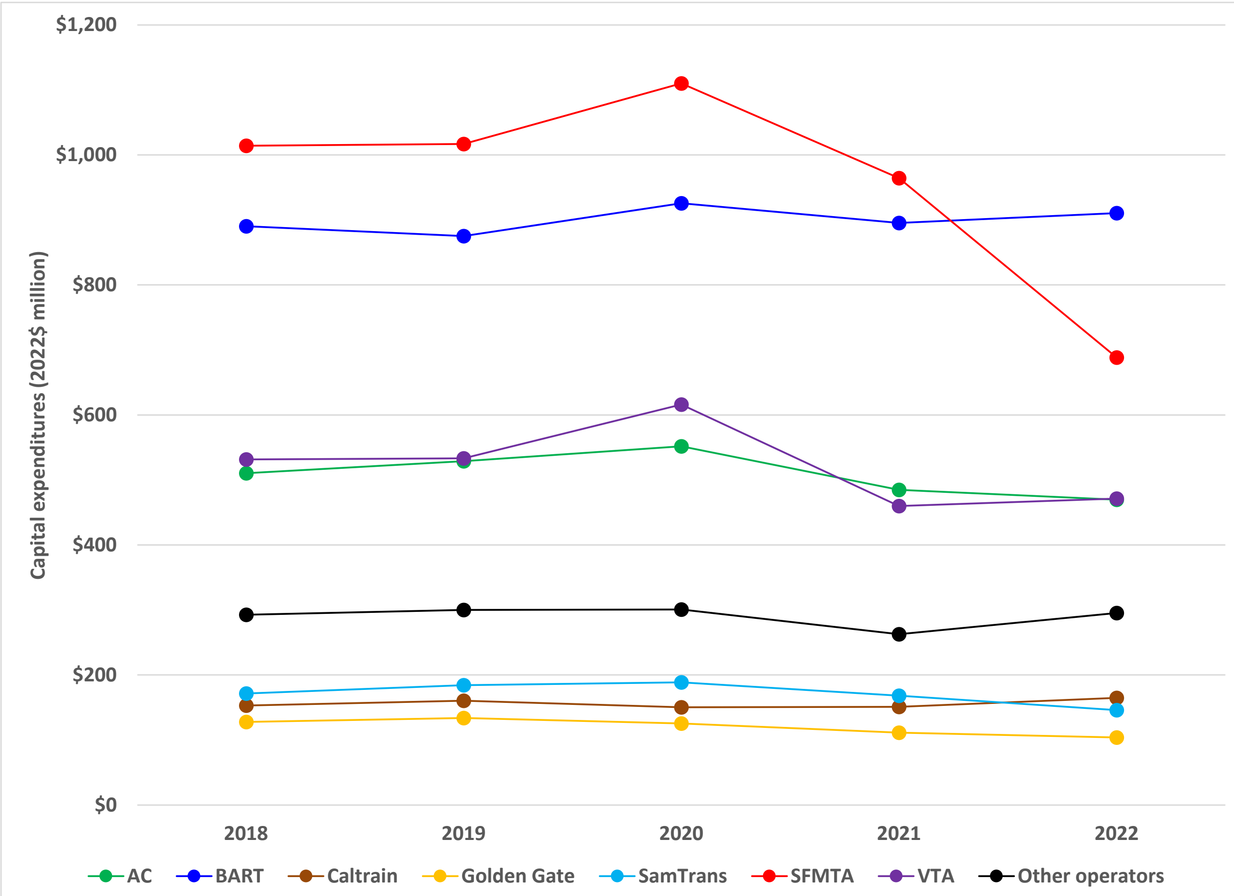
5.3 Capital Funding

5.3.1 Capital costs by agency

Capital costs include costs for new and replacement vehicles and facilities; rehabilitation and retrofitting has constituted a large part of capital costs for BART.[22] Capital costs in constant (2022) dollars are shown in Figure 5.11 for the Bay Area Big 7 operators and other operators combined. The Big 7 operators typically account for 90%–97% of all transit capital costs in the Bay Area. Capital costs for BART are mostly for system upgrades that were made possible due to the $3.5 billion bond measure passed by voters in 2016. Except for SFMTA, real capital expenditures for most transit operators in the Bay Area remained fairly constant over the five-year period from 2018 to 2022.

[22] In 2016, voters in the BART counties approved a $3.5 billion bond issue for system rehabilitation.

Figure 5.11 Annual Capital Expenditures by Agency



Note: Costs are in constant 2022$.

5.3.2 Sources of capital funds

Annual capital funding by source (federal, state, local) in constant (2022) dollars is shown in Tables 5.5–5.7.[23]

[23] Capital funding from other sources (fares, other operator self-generated revenues) is not shown because it was *de minimis*, amounting to less than five percent of all capital expenditures over the five-year period.

Table 5.5 Capital Funds by Operator and Year – Federal Sources

Operator	Fiscal year (amounts in constant 2022$, millions)				
	2018	2019	2020	2021	2022
AC	$44	$48	$10	$6	$6
BART	$120	$86	$146	$238	$224
Caltrain	$202	$170	$186	$189	$282
Golden Gate	$3	$54	$32	$18	$8
SamTrans	$10	$4	$41	$3	$0
SFMTA	$388	$361	$270	$124	$63
VTA	$133	$82	$85	$41	$21
Other operators	$64	$68	$41	$15	$22
Total	$965	$871	$811	$634	$625

Overall, federal funding for transit capital expenditures in the Bay Area decreased by about one-third between 2018 and 2022. Most of this decline is due to reduced capital expenditures by SFMTA, with completion of the Stockton Street subway. The increase in funding for BART was mainly for completing purchase of BART's new vehicle fleet as well as some funding for system rehabilitation.

Total state funding for capital expenditures (Table 5.6) decreased by about 20% over the five-year period. Almost all operators saw decreases in state funding for capital expenses; the one notable exception is Caltrain, which saw increased funding from the state for system electrification.

Table 5.6 Capital Funds by Operator and Year – State Sources

Operator	Fiscal year (amounts in constant 2022$, millions)				
	2018	2019	2020	2021	2022
AC	$12	$5	$6	$3	$15
BART	$89	$99	$24	$96	$41
Caltrain	$33	$206	$162	$200	$142
Golden Gate	$5	$6	$4	$2	$0
SamTrans	$2	$5	$13	$2	$2
SFMTA	$66	$69	$34	$15	$17
VTA	$16	$46	$16	$15	$8
Other operators	$85	$73	$47	$28	$21
Total	$309	$511	$306	$361	$246

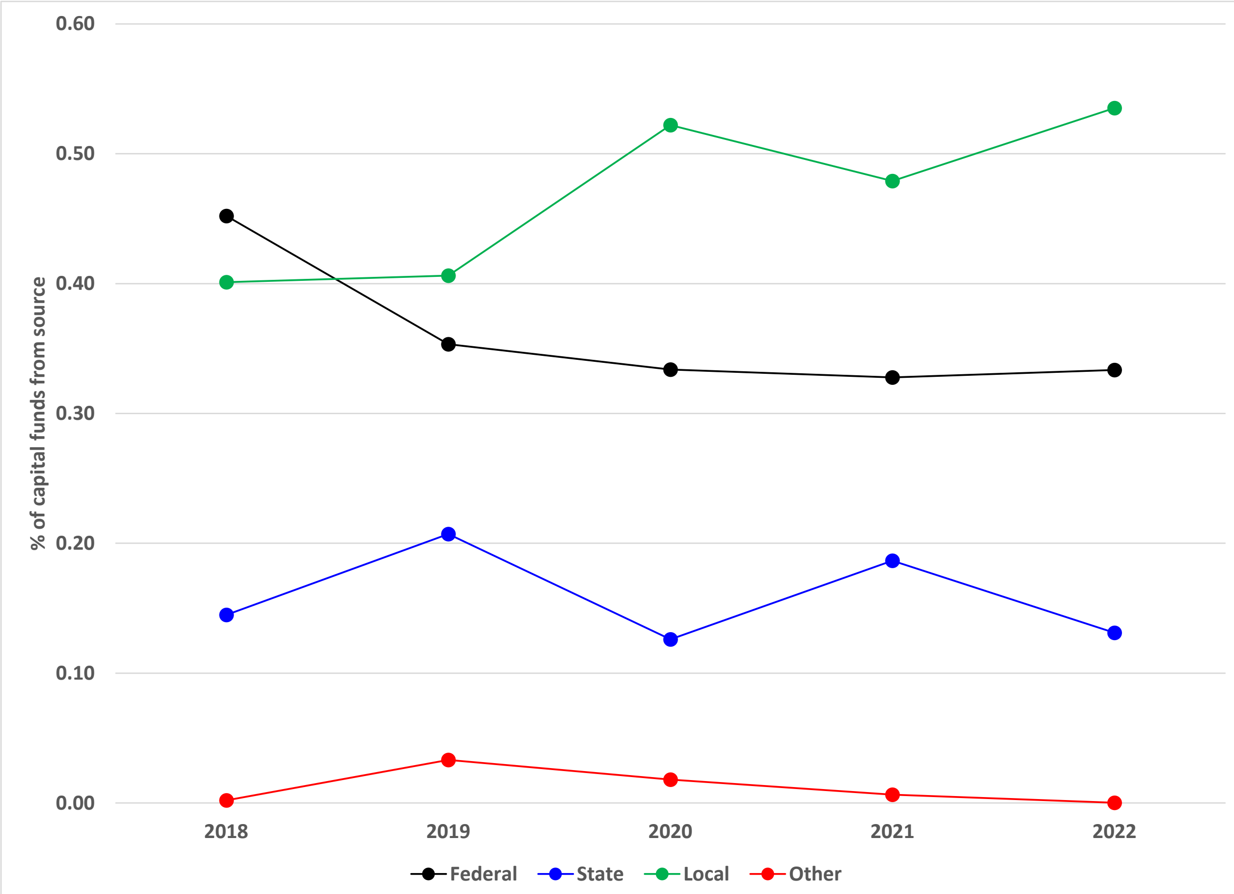
Capital funding for Bay Area transit operators from local sources increased by about 20% over the five-year period. Most of the increase was for BART. Much of this increase is due to funds from the $3.6 billion bond passed by voters in 2016, which was for system rehabilitation.

Table 5.7 Capital Funds by Operator and Year – Local Sources

Operator	Fiscal year (amounts in constant 2022$, millions)				
	2018	2019	2020	2021	2022
AC	$29	$27	$48	$17	$16
BART	$352	$498	$920	$629	$464
Caltrain	$134	$86	$44	$65	$188
Golden Gate	$12	$20	$11	$0	$2
SamTrans	$8	$6	$0	$7	$8
SFMTA	$133	$148	$61	$63	$114
VTA	$117	$165	$151	$128	$196
Other operators	$73	$50	$34	$18	$14
Total	$857	$1,001	$1,268	$926	$1,004

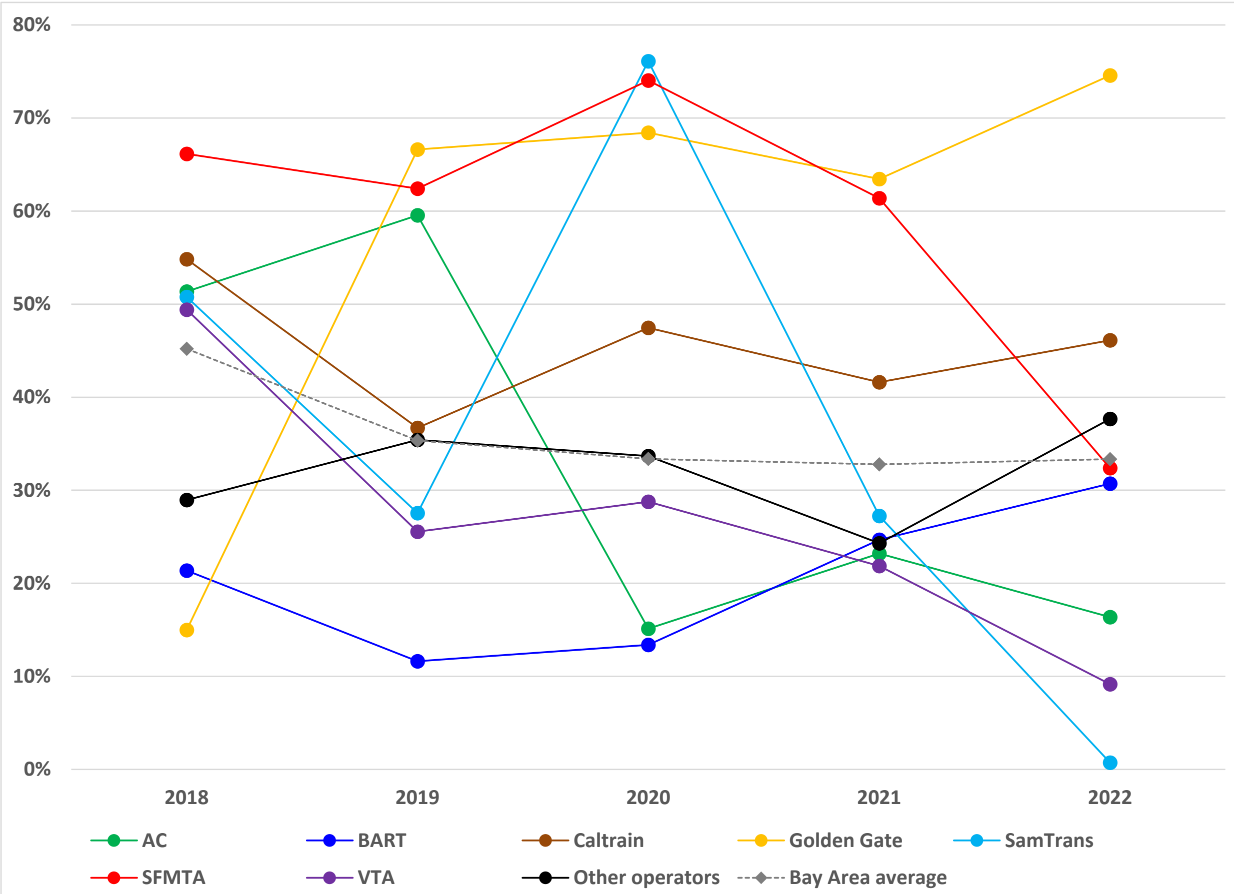
Figure 5.12 shows sources of capital funds as percentages of capital expenditures for the Bay Area as a whole. Federal funds as a percentage decreased from about 45% to 33% due in part to the project schedules of several large system expansion projects (e.g., the SFMTA Central Subway project). State funding varied somewhat, but accounted for almost the same percentage in 2022 as it did in 2018. The large increase in local funding percentage is due to the BART bond issue for rehabilitation, as noted above.

Figure 5.12 Percent of Capital Funding by Source, All Bay Area Transit Operators



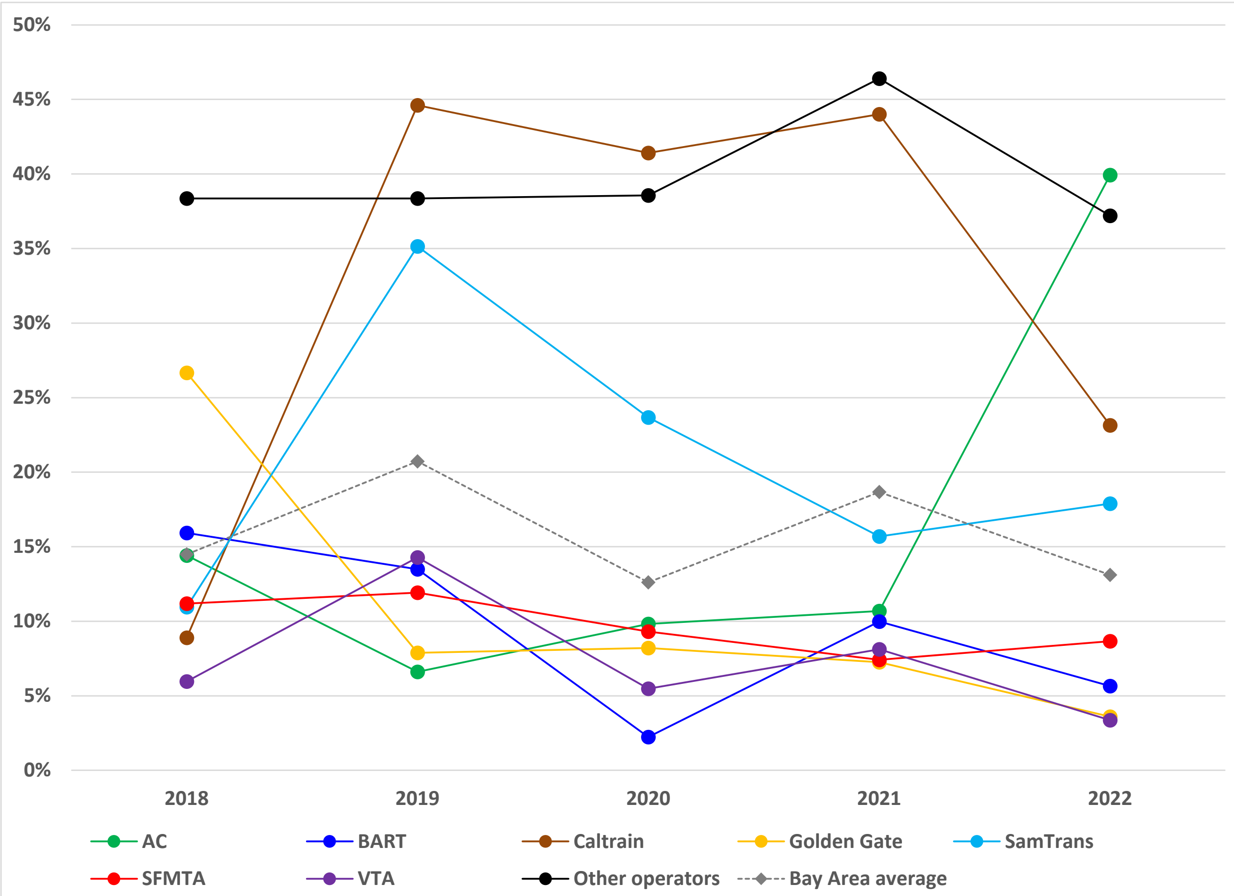
Capital funding percentages from federal sources are shown by operator in Figure 5.13. SFMTA received between 65% and 73% of its capital funding from federal sources between 2018 and 2020, but this percentage declined sharply with completion of the SFMTA Central Subway. Caltrain has received significant funding for its electrification program.

Figure 5.13 Percent Capital Funding from Federal Sources



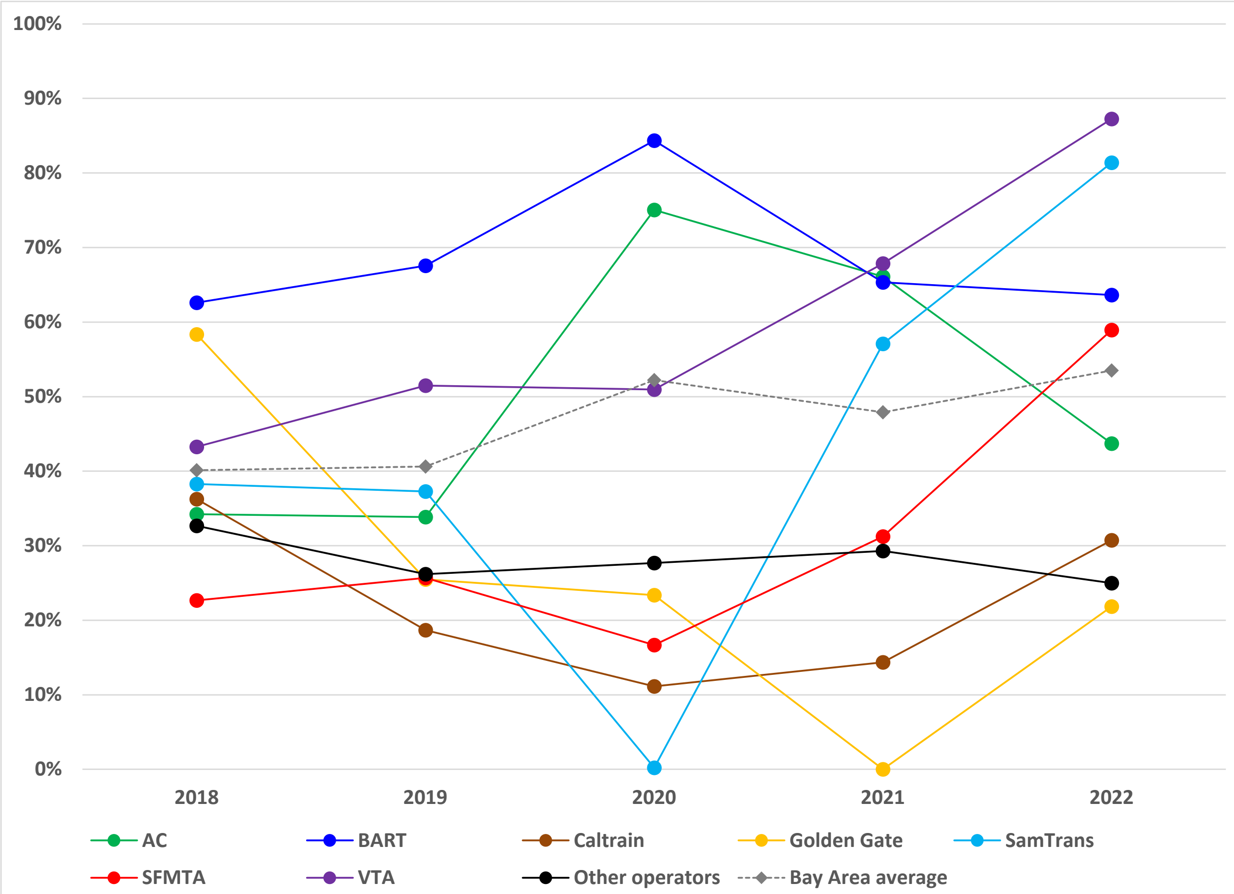
State sources have accounted for 37%–47%of capital funding for smaller operators (Figure 5.14). The large share of Caltrain's capital funding from the state includes funding from the High-Speed Rail Project. Overall, state funding accounted for less than 20% of capital funding for most of the major Bay Area transit operators.

Figure 5.14 Capital Funding from State Sources



Local sources for capital expenses made up over half of expenditures for several of the major operators: BART, VTA, and SamTrans (Figure 5.15). Some of these sources were due to special taxes or, in the case of BART, special bond measures to support system rehabilitation.

Figure 5.15 Capital Funding from Local Sources



5.4 Productivity and Efficiency

In general terms, *productivity* is defined as the amount of output per unit of input. For transit service this can imply a number of different measures including:

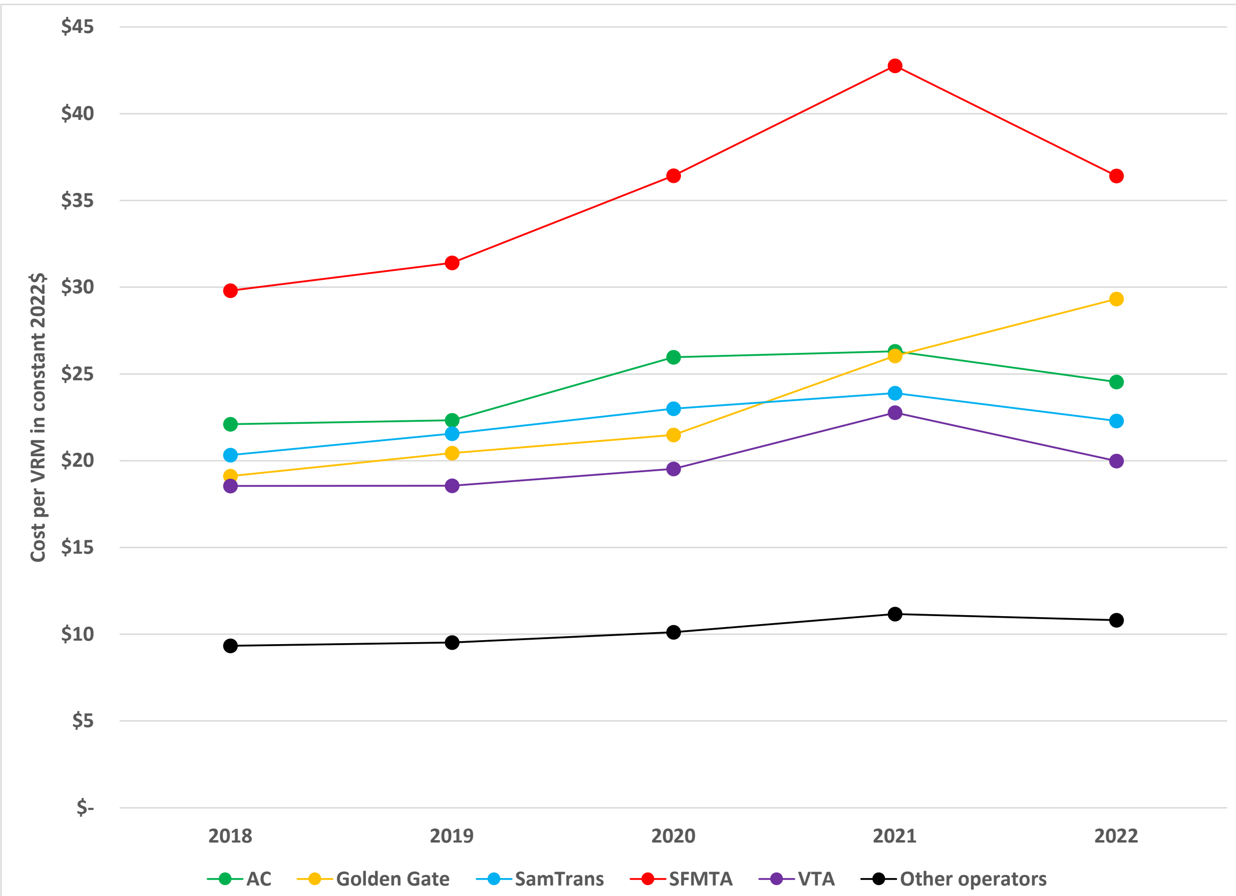
- Cost per amount of service delivered (e.g., revenue vehicle miles, revenue vehicle service hours) per dollar.
- Patronage-related costs per service unit (e.g., cost per passenger trip).
- Farebox recovery ratio, or operating ratio: the percentage of operating costs that is covered by passenger fare revenue.

This Section presents various productivity and efficiency measures for Bay Area transit operators for pre- and post-pandemic periods. The discussion focuses on the Bay Area Big 7 operators, as not all types of measures are available for all agencies in the Bay Area.[24] Rail and bus operations are treated separately, as these modes have substantially different operating cost functions.

5.4.1 Service delivery measures

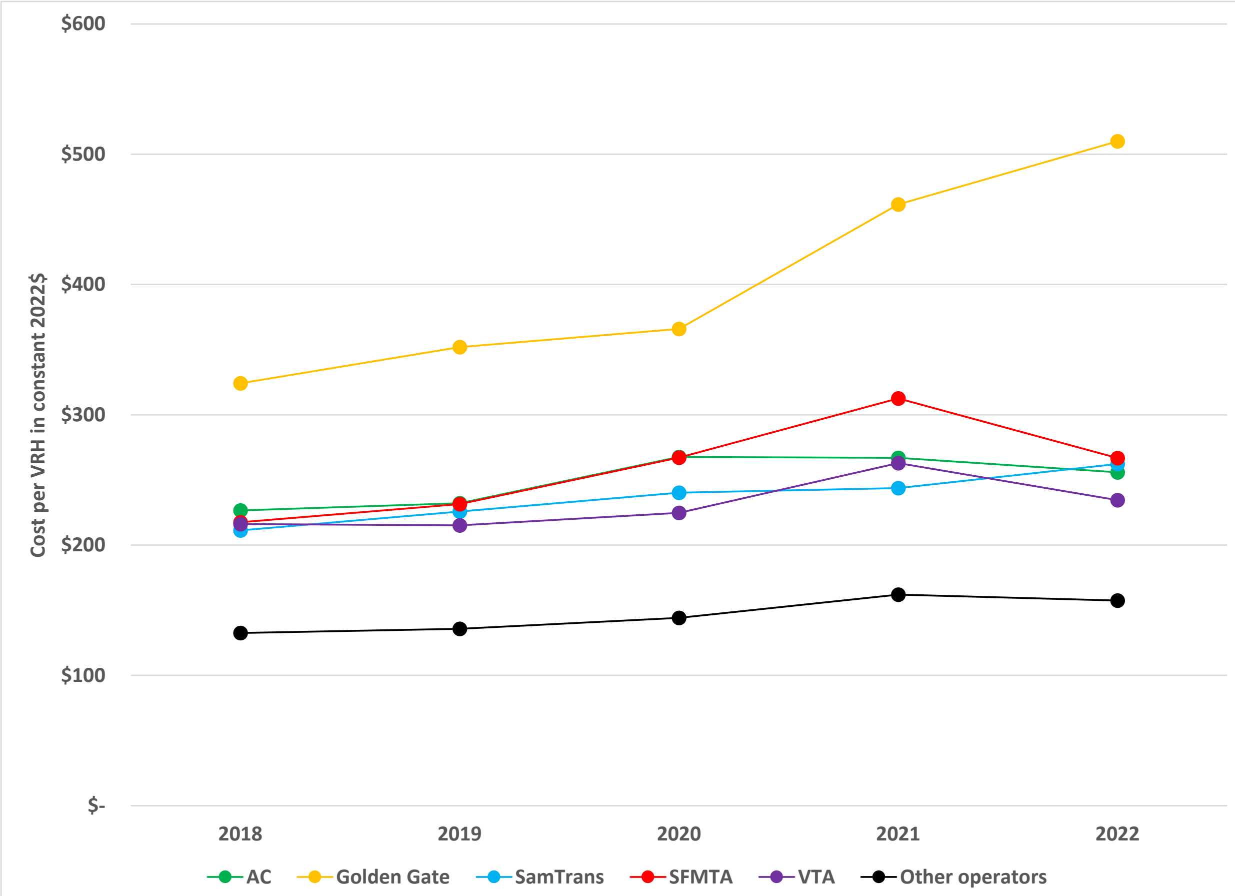
Two commonly used measures of service delivery are vehicle revenue miles and vehicle revenue hours. Figures 5.16 and 5.17 show operating cost in constant 2022$ per vehicle revenue mile and per vehicle service hour respectively for buses.

Figure 5.16 Operating Cost per Vehicle Revenue Mile – Bus



[24] Some smaller agencies are not considered "full reporting" agencies for purposes of the NTD. Agencies that are not full reporting agencies are not required to report estimates of passenger miles.

Figure 5.17 Operating Cost per Vehicle Revenue Service Hour – Bus



Bus service costs per vehicle revenue mile for the large operators generally fall within the $20 to $35 range. There has been some increase in service delivery costs because, although some operators have scaled back bus service to reduce some operating costs due to the pandemic, the fixed operating costs have remained fairly constant over time. Costs per vehicle revenue hour have increased somewhat for most operators, with Golden Gate Transit being the exception: its bus service costs have risen to over $500 per hour from their pre-pandemic level of around $325 in 2018.

Unit service costs (per revenue hour, per revenue mile) for smaller operators are substantially below those for large operators, ranging from one-third to one-half those for large operators. There are two reasons for this:

- All small operators in the Bay Area, with the exception of CCTA, Santa Rosa, and SMART, contract out all their service, as shown in Table 5.8. Taken together, 99% of operating costs for large operators (excluding Caltrain) are for directly operated service.[25]

[25] Caltrain service is contracted through TransitAmerica, Inc., a private operator.

Contract service provided by private operators is generally less expensive for small transit operations.

- Small operators that operate their own service directly have lower driver wage rates than large operators.

Table 5.8 Directly Operated vs. Purchased Service Operating Expenses
Bay Area Transit Operators (2022)

Bay Area Big 7			Other operators		
	Directly operated	Purchased		Directly operated	Purchased
AC	99%	1%	CCCTA	99%	1%
BART	99%	1%	Fairfield	0%	100%
Caltrain	0%	100%	LAVTA	0%	100%
Golden Gate	100%	0%	Marin Transit	0%	100%
SamTrans	85%	15%	Napa	0%	100%
SFMTA	100%	0%	Petaluma	0%	100%
			Rio Vista	0%	100%
			Santa Rosa	99%	1%
			SMART	100%	0%
			Solano	0%	100%
			Sonoma County	0%	100%
			Tri Delta	0%	100%
			Union City	0%	100%
			Vacaville	0%	100%
			WestCAT	0%	100%
			WETA	0%	100%

Figures 5.18 and 5.19 show operating cost in constant 2022$ per vehicle revenue mile and per vehicle revenue hour, respectively, for rail.[26]

[26] Rail costs for SFMTA are not shown for FY21 as rail operations were suspended for most of that fiscal year. Similarly, rail costs for VTA are not shown for FY22 because VTA rail service was suspended from May through August 2021.

Figure 5.18 Operating Cost per Vehicle Revenue Mile – Rail

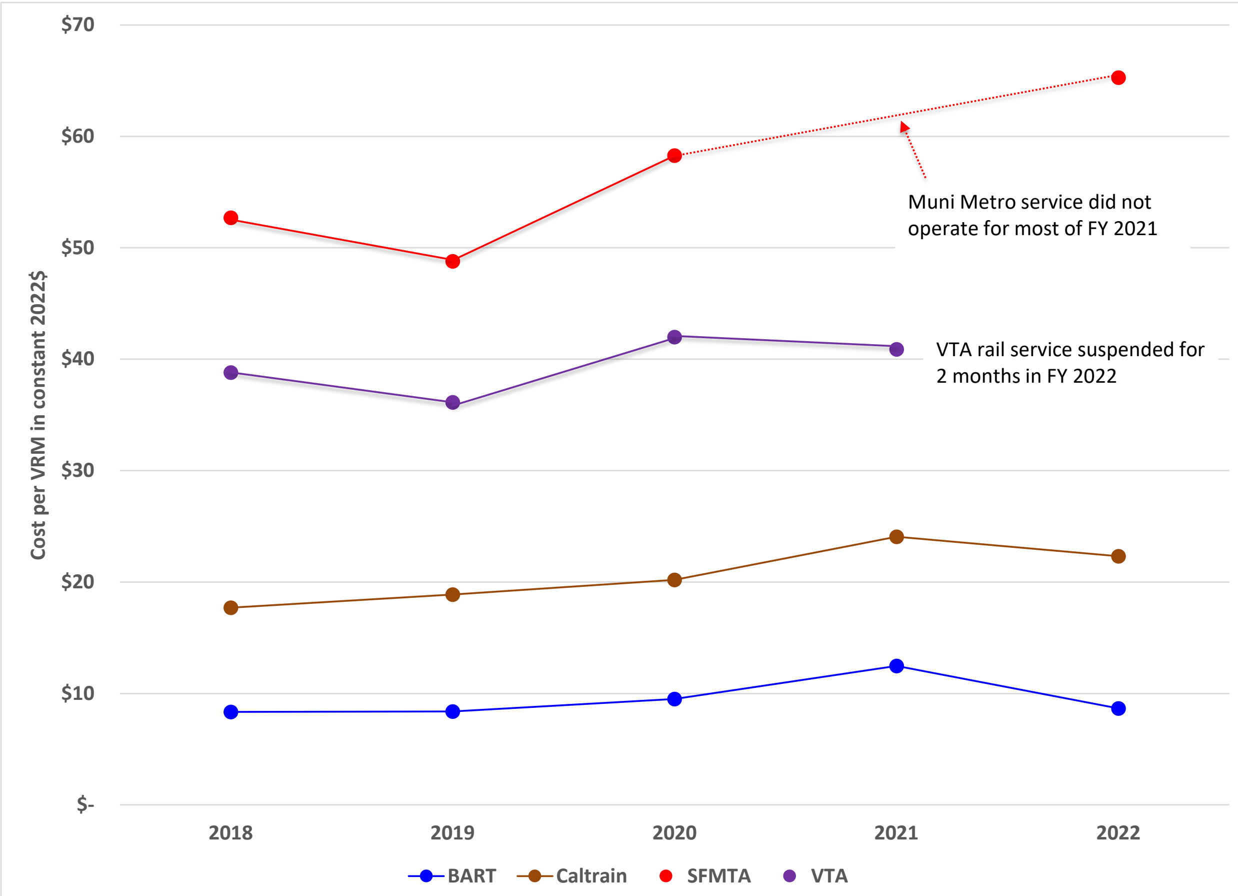
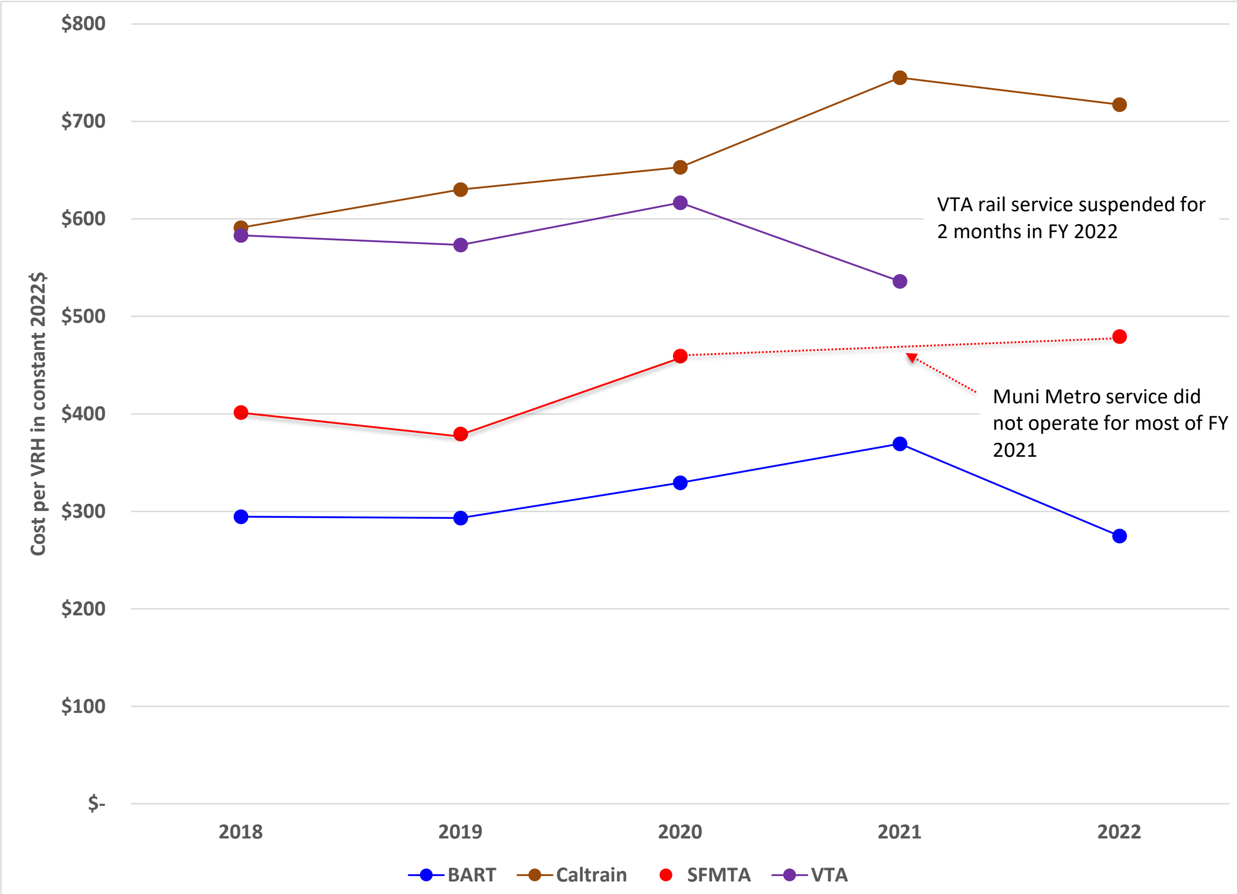


Figure 5.19 Operating Cost per Vehicle Revenue Service Hour – Rail



BART unit costs have been consistently the lowest among all rail systems in the Bay Area, in part due to its long station spacings and high train speeds, especially in the transbay tube.

5.4.2 Measures related to patronage

Bus cost per passenger trip is shown in Figure 5.20. The high cost per trip for Golden Gate Transit during and after the pandemic is due to its high unit operating cost combined with a sharp decrease in ridership. Costs per trip for smaller operators are high because, although they have lower unit operating costs than the larger operators, this advantage is more than offset by the lower demand on these systems.

Figure 5.20 Cost per Passenger Trip – Bus

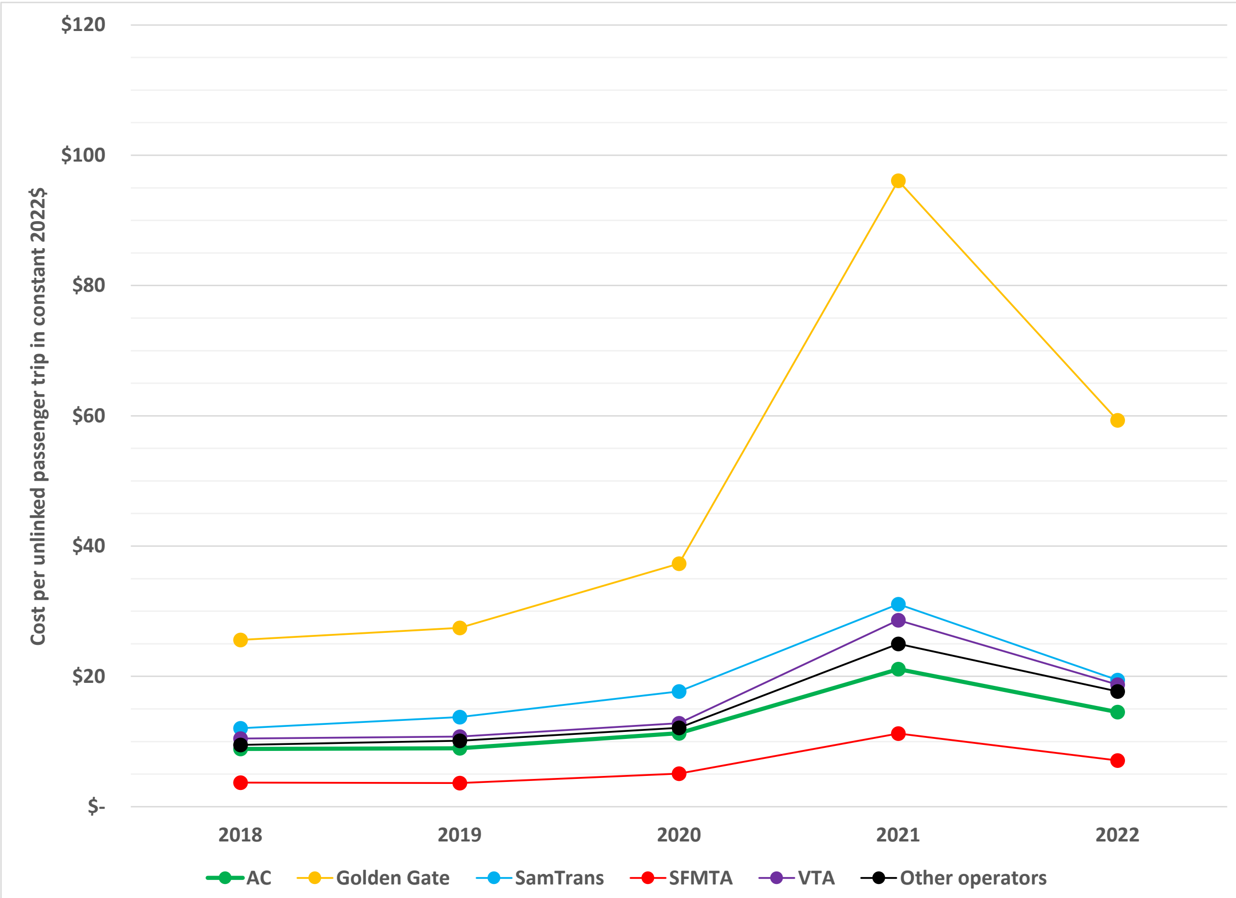
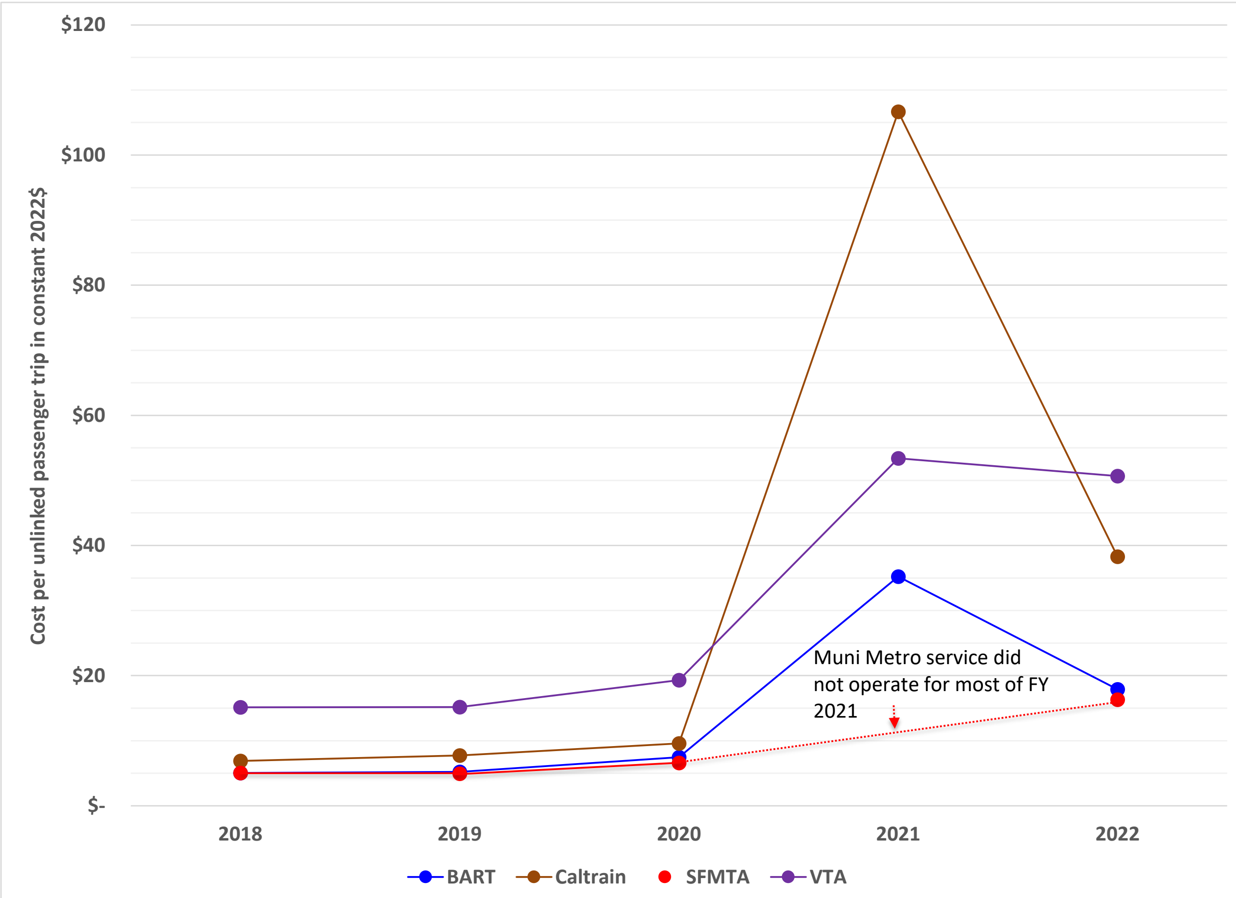


Figure 5.21 shows average cost per passenger trip for the major rail systems in the Bay Area. The high cost per trip for Caltrain in 2021 was in part due to a large decrease in demand (see the discussion of demand in Section 3) without a corresponding decrease in costs. Except for FY21, average cost per trip on BART and SFMTA was less than $20 in 2022, although this is more than three times its pre-pandemic level.

Figure 5.21 Cost per Passenger Trip – Rail



Cost per passenger mile is shown for buses in Figure 5.22 and for rail in Figure 5.23.[27]

[27] Bus cost per passenger mile is not shown for small operators because most of these agencies are not full reporters to NTD; hence, they are not required to keep track of passenger miles. Rail cost per passenger mile is not shown for SFMTA for 2021 because service did not operate for most of that fiscal year.

Figure 5.22 Cost per Passenger Mile – Bus

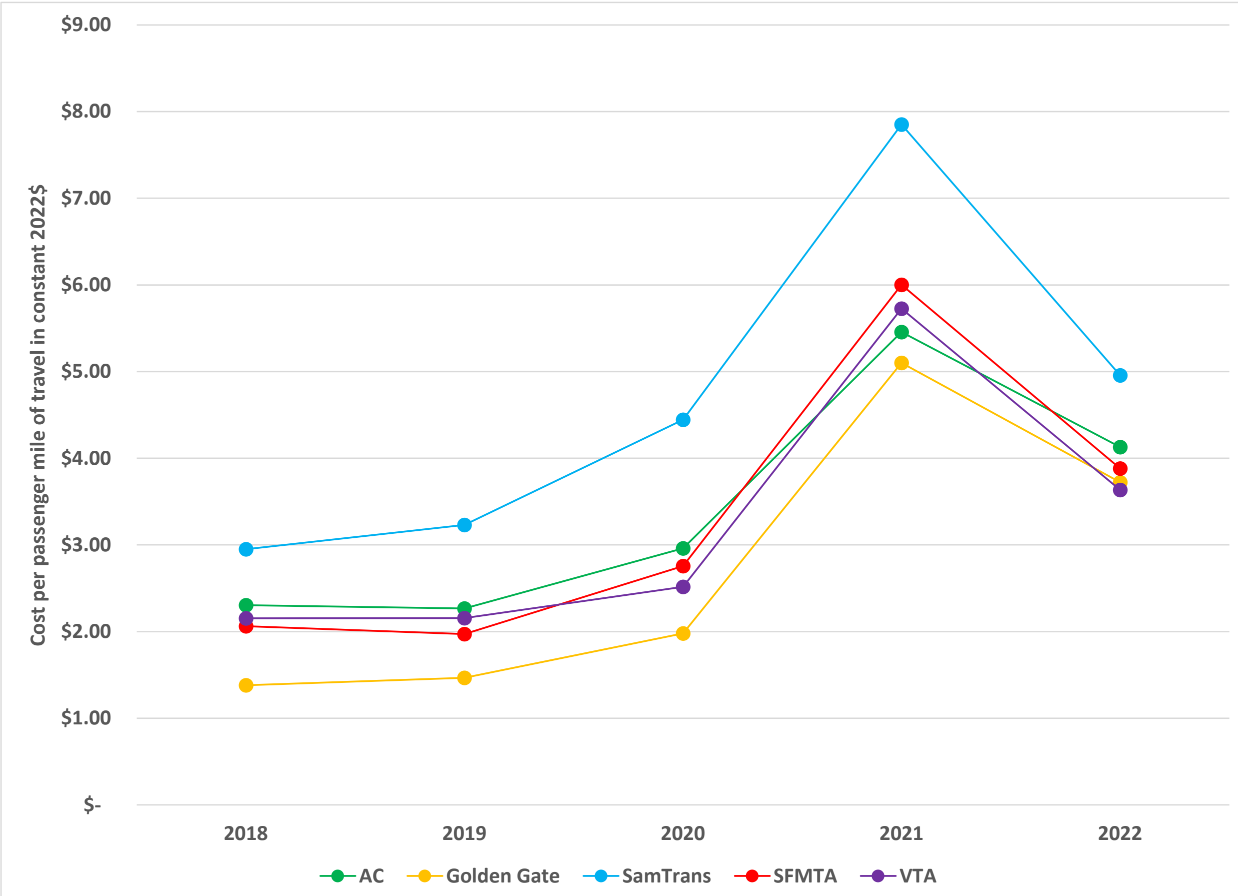
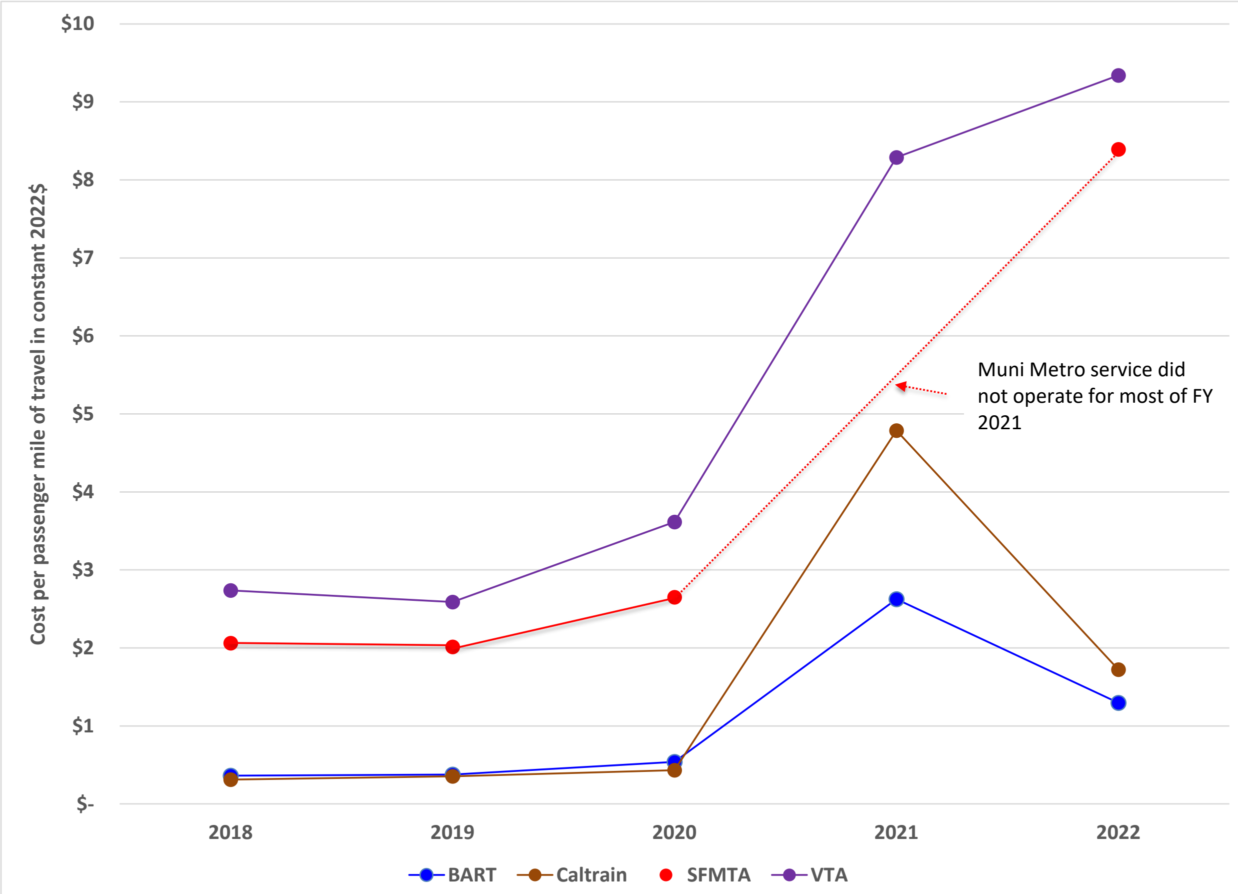


Figure 5.23 Cost per Passenger Mile – Rail



Cost per passenger mile for bus centers around $4 per mile for most operators; SamTrans has somewhat higher operating costs.

BART and Caltrain have consistently had the lowest costs per passenger mile of travel, due in part to the longer average trip distances on these systems. VTA and SFMTA have significantly higher costs because of their shorter trip distances and, in the case of VTA, a higher operating cost per vehicle revenue mile of service.

5.4.3 Farebox recovery

The State of California requires annual transit performance audits. Farebox recovery ratio is one of the key measures that these audits are required to report on. Farebox recovery ratio is defined as fare revenues divided by operating costs. Figures 5.24 and 5.25 show farebox recovery ratios for bus and rail respectively.

Figure 5.24 Farebox Recovery Ratio – Bus

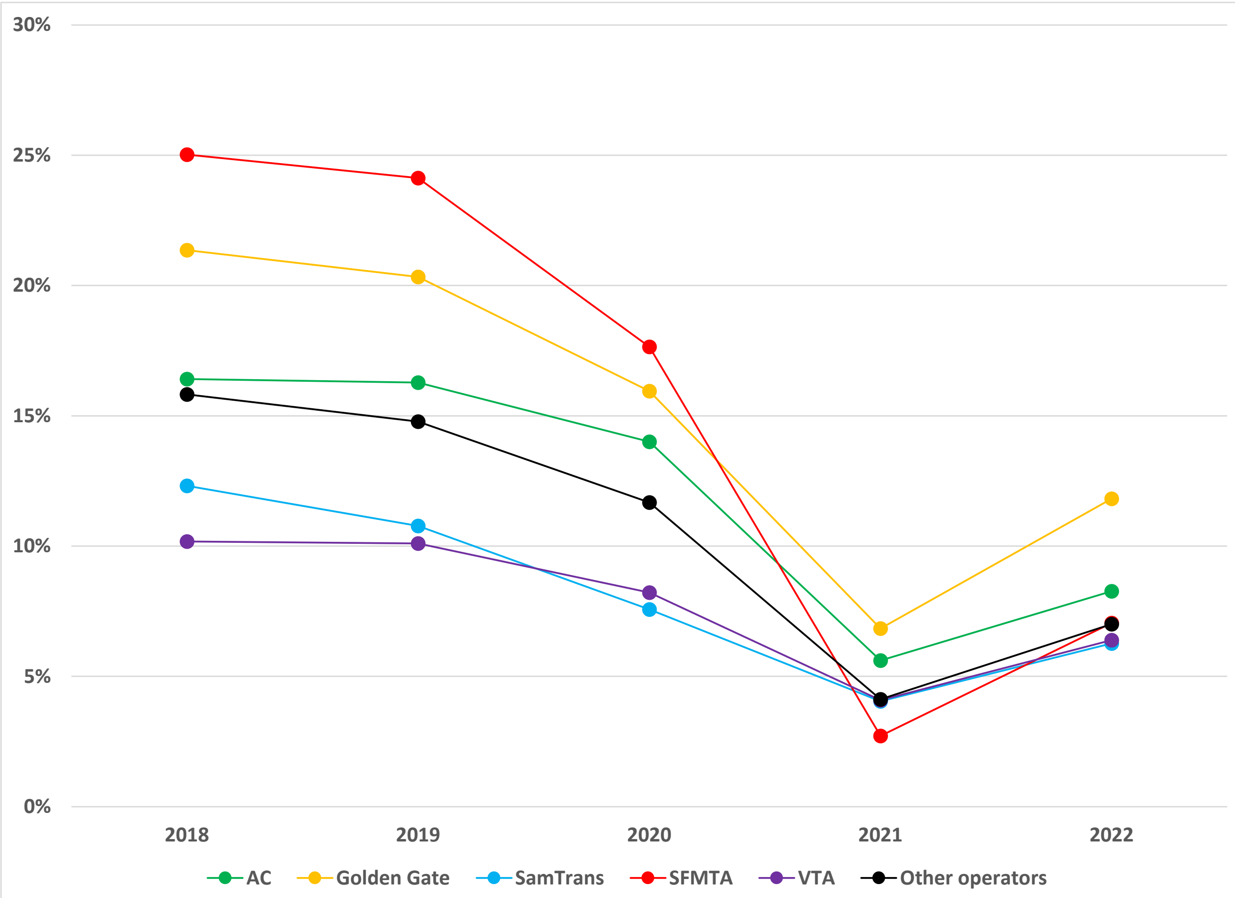
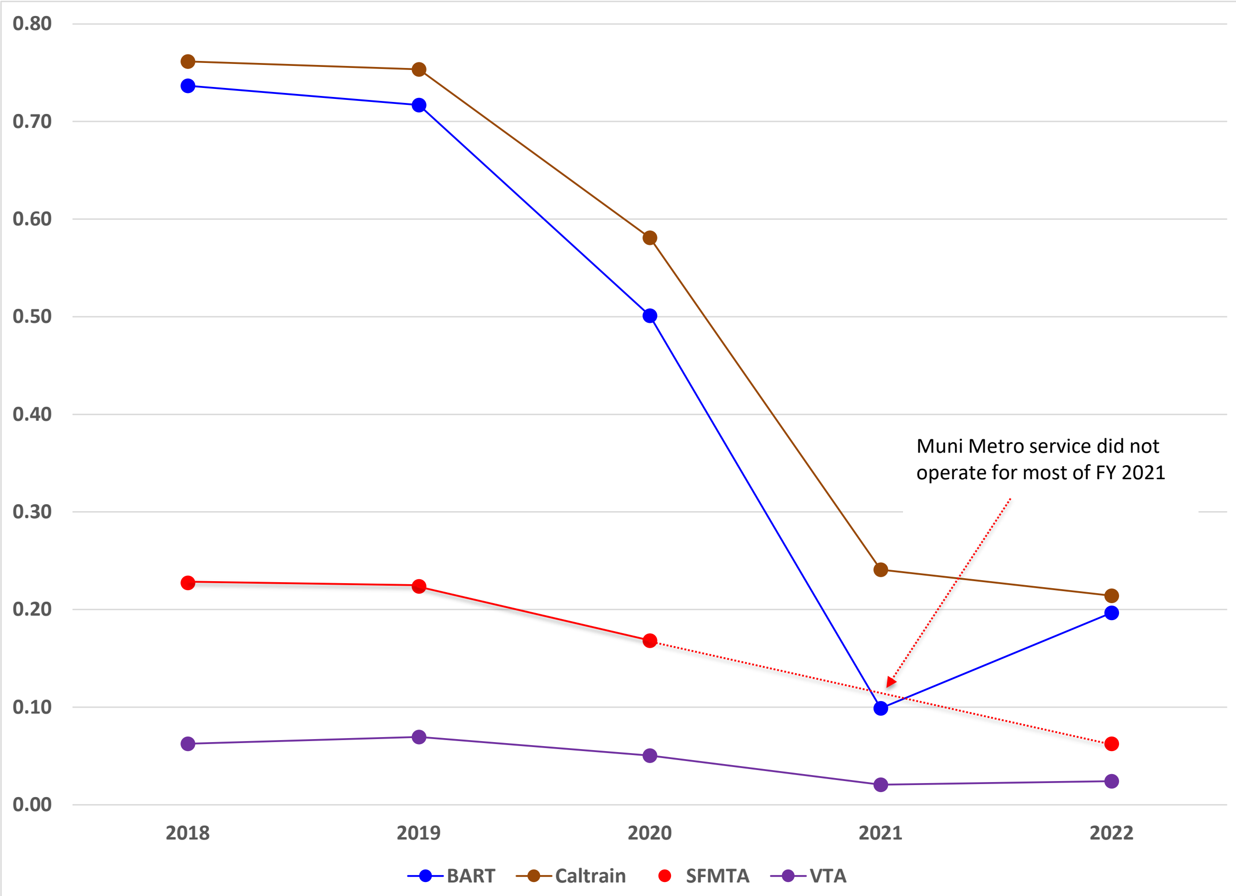


Figure 5.25 Farebox Recovery Ratio – Rail



Bus farebox recovery before the pandemic ranged from 10% to 25% for the large operators. Farebox recovery for small operators was roughly in the middle of this range: about 15%. Post-pandemic farebox recovery is less than half that of pre-pandemic levels.

Rail farebox recovery figures present some stark contrasts among the large rail systems:

- Rail farebox recovery rates have been and continue to be consistently higher than bus farebox recovery rates.

- Before the pandemic, BART and Caltrain received most of their operating funds from fares. During and after the pandemic, farebox recovery for these two systems is less than one-third of what it was previously.

- The drop in fare revenues (Figure 5.4), and therefore farebox recovery rates, remains the single most important financial issue for Bay Area transit operations.

5.5 Comparisons to Other Metropolitan Areas

This Section presents a comparison of Bay Area transit to transit in twelve other metropolitan areas on changes in several key transit economic measures. These include the following:

- Service delivery costs: cost per vehicle revenue hour
- Cost per passenger trip
- Cost per passenger mile (rail only)
- Farebox recovery ratio

Pre-pandemic measures are for FY19; post-pandemic measures are for 2022.

5.5.1 Service delivery costs

Costs per vehicle revenue hour for the Bay Area compared to 12 other metropolitan areas are shown in Figure 5.26 and Figure 5.27 for bus and rail respectively. Costs are shown in constant 2022$. To put some of these changes in context, changes in vehicle revenue hours between 2019 and 2022 are shown in Figure 5.28.

Figure 5.26 Bus Cost per Vehicle Revenue Hour Pre- and Post-Pandemic – Bay Area vs. Other Metropolitan Areas

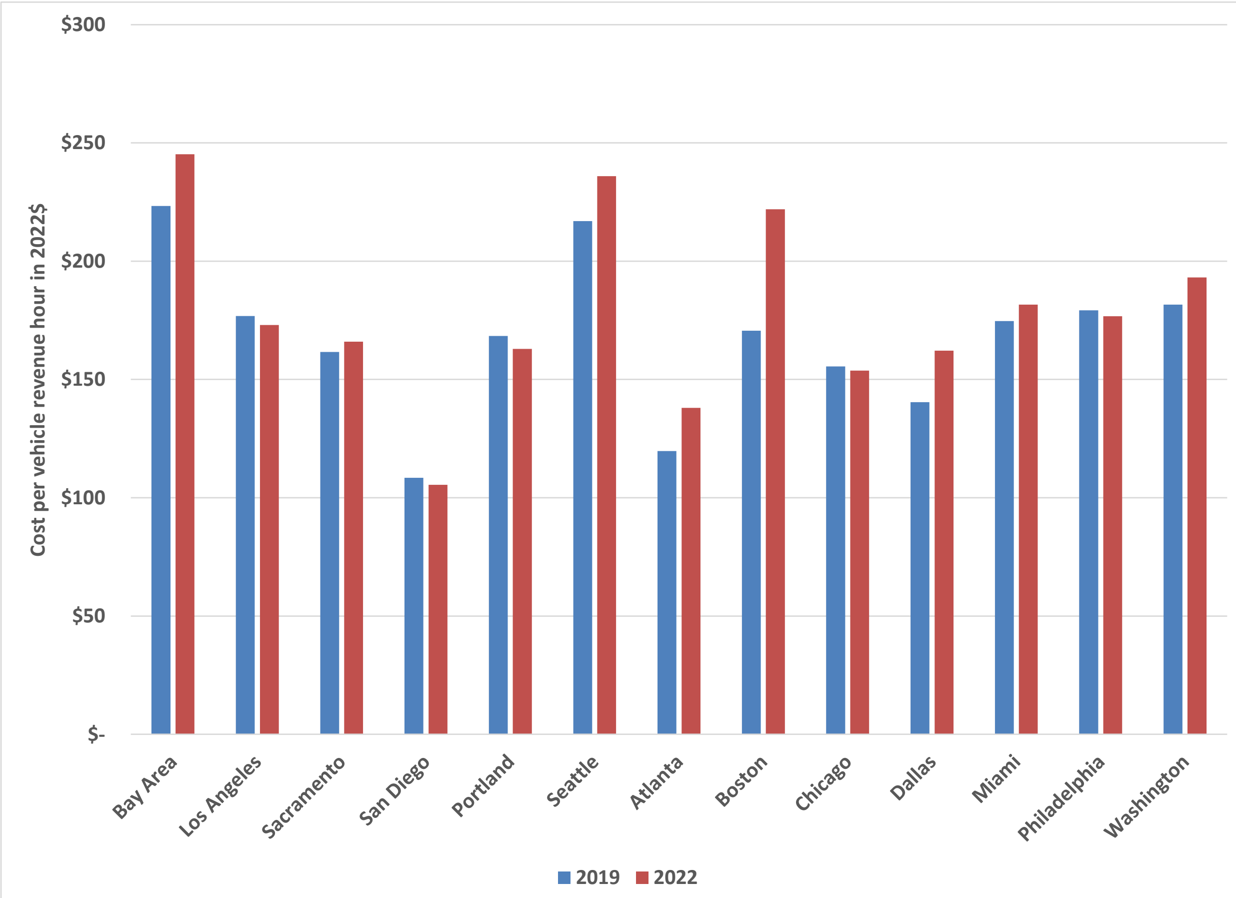


Figure 5.27 Rail Cost per Vehicle Revenue Hour Pre- and Post-Pandemic – Bay Area vs. Other Metropolitan Areas

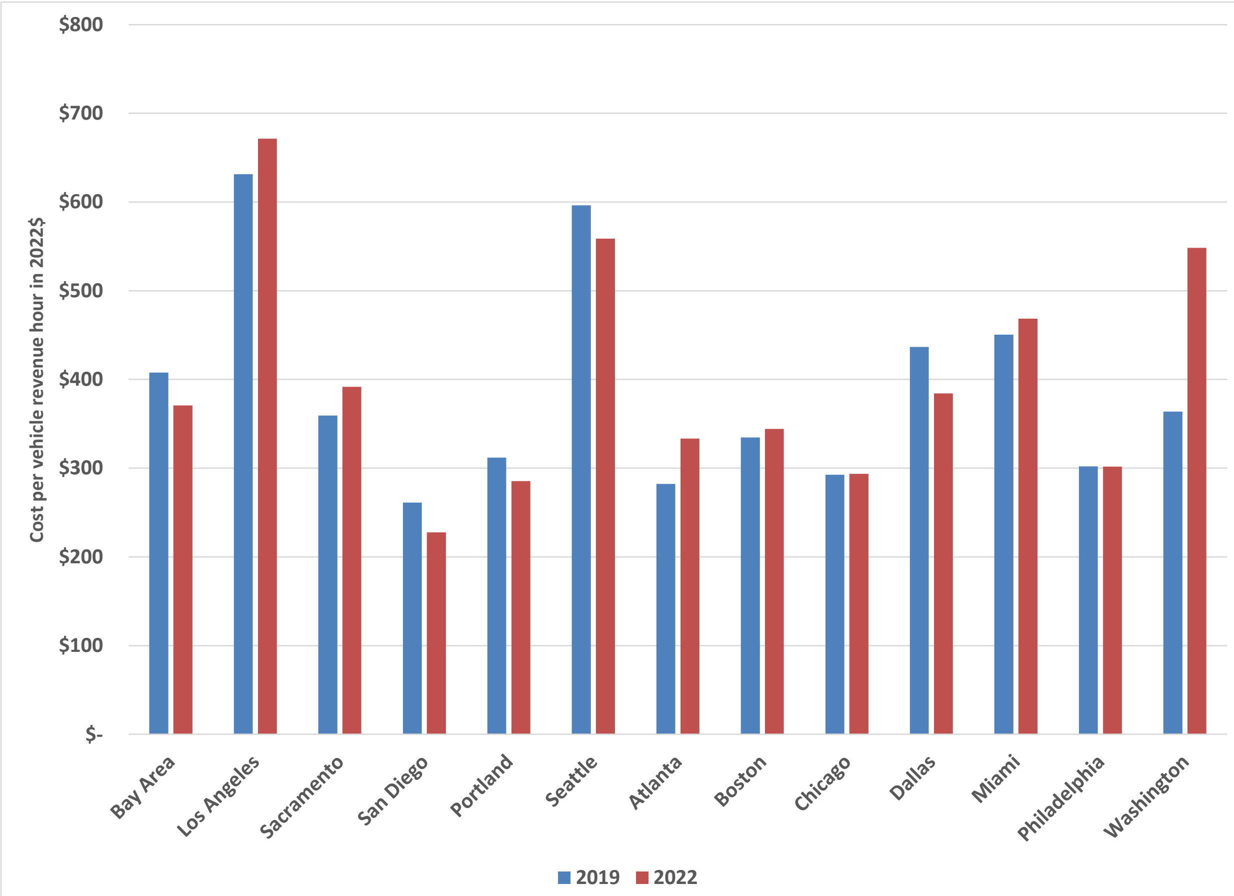
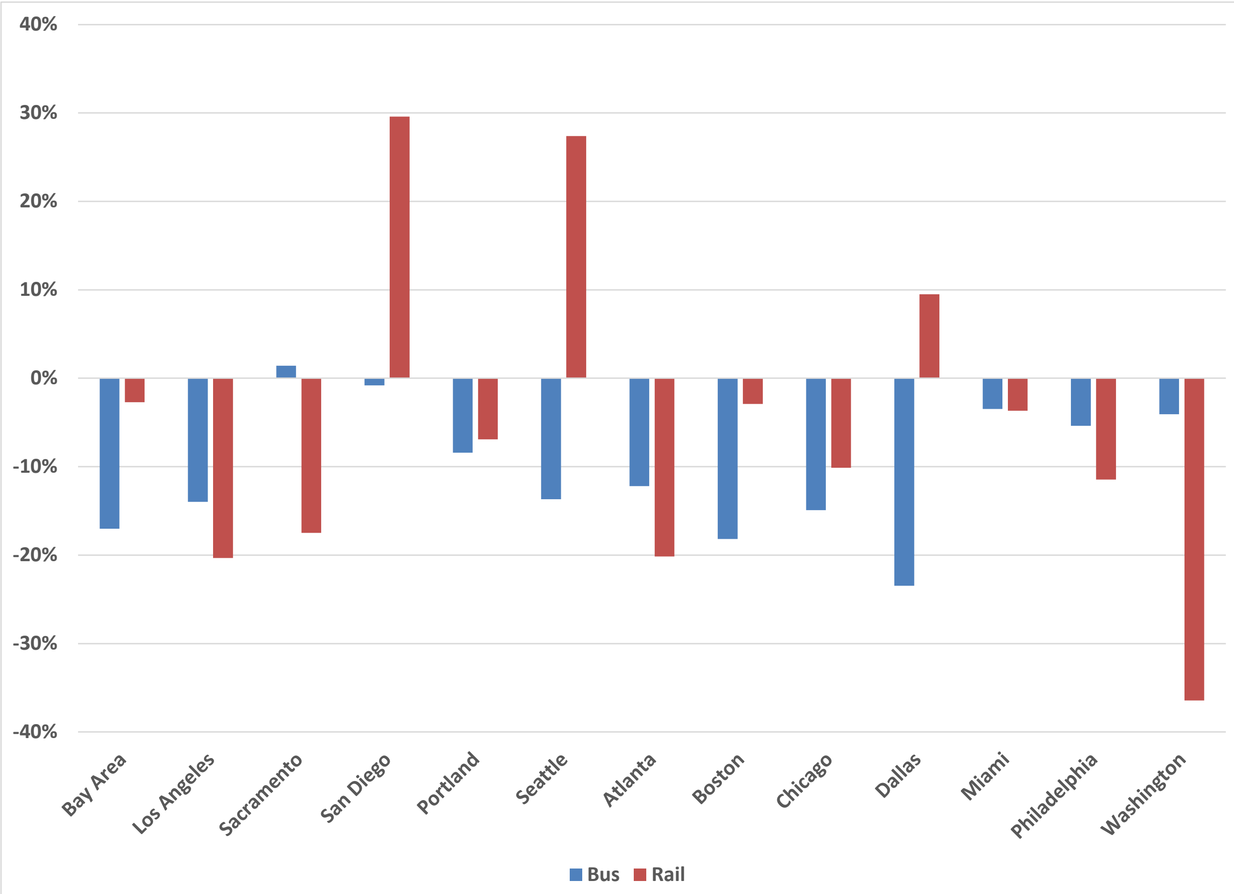


Figure 5.28 Change in Vehicle Revenue Hours of Service by Mode – Bay Area vs. Other Metropolitan Areas



Bus operating costs for the Bay Area appear to be higher than other metropolitan areas shown here. Part of this difference is likely due to the higher cost of living in the Bay Area, which ranges from 3% to 19% higher than those other metropolitan areas.[97]

Most metropolitan areas show an increase in demand-related operating costs (Figures 5.29–5.31). Pre-pandemic costs per passenger in the Bay Area were fairly close to the average for all 13 metropolitan areas shown in these figures. During and after the pandemic, the Bay Area experienced greater percentage patronage losses than most of the other metropolitan areas, and therefore its unit operating costs increased in greater proportion.

Figure 5.29 Bus Cost per Passenger Trip Pre- and Post-Pandemic – Bay Area vs. Other Metropolitan Areas

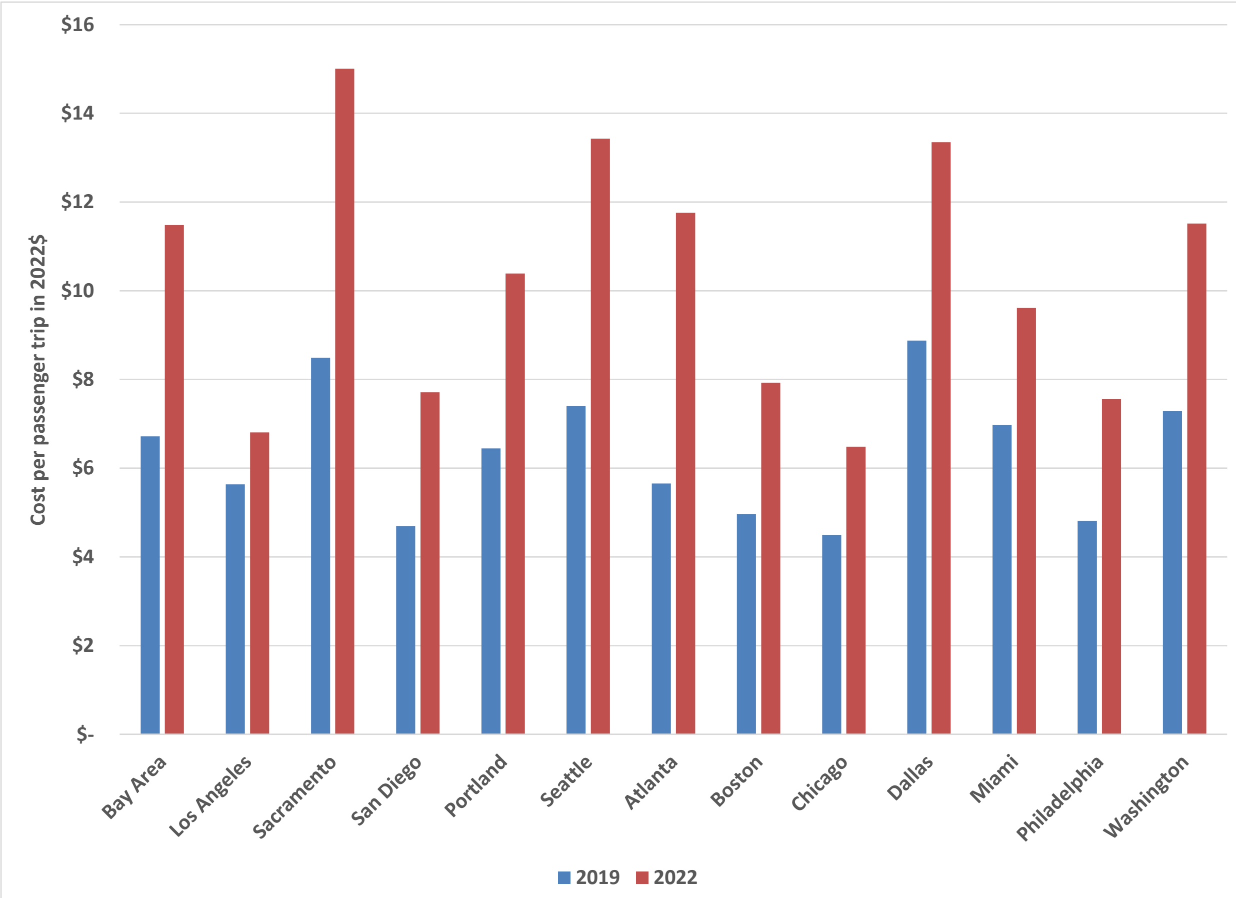


Figure 5.30 Rail Cost per Passenger Trip – Bay Area vs. Other Metropolitan Areas

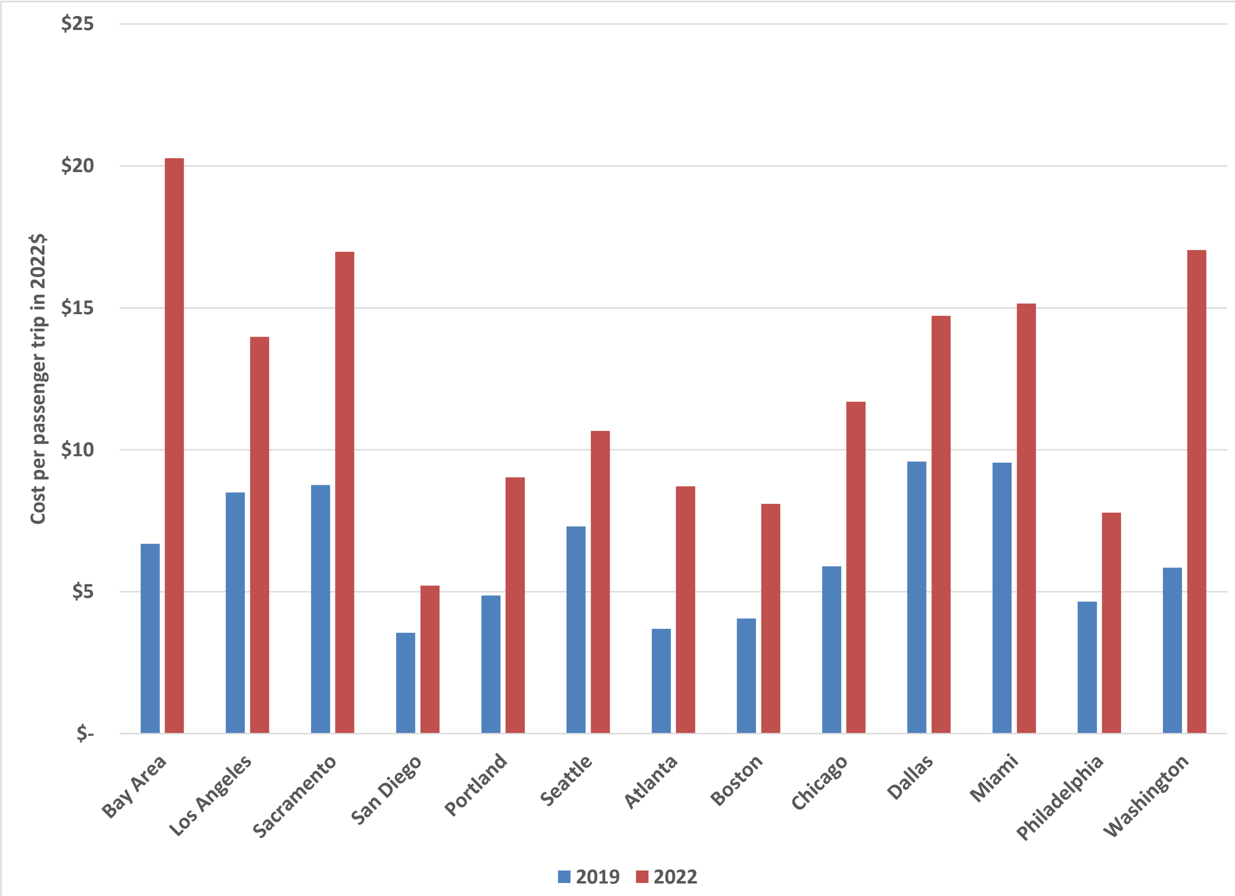
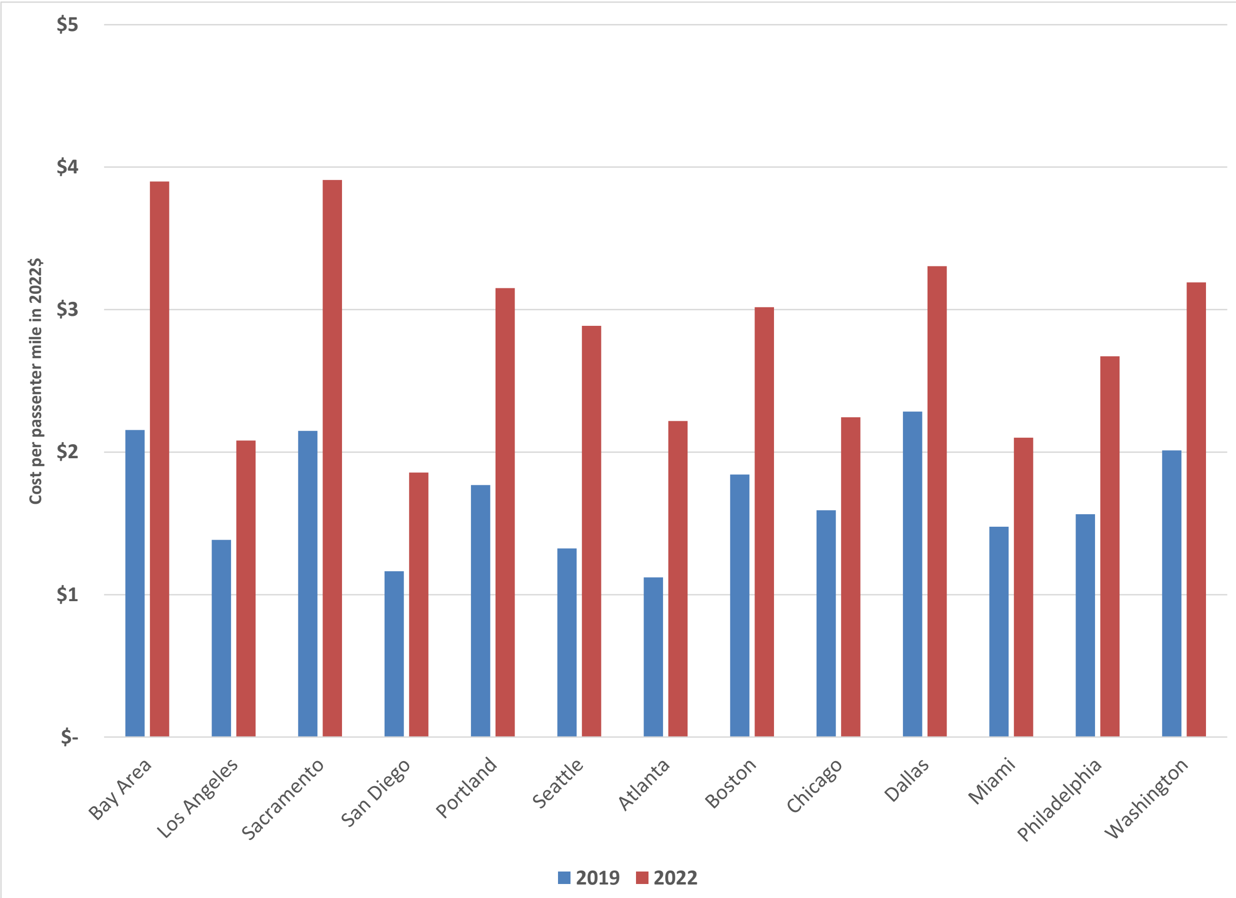


Figure 5.31 Rail Cost per Passenger Mile Pre- and Post-Pandemic – Bay Area vs. Other Metropolitan Areas



Farebox recovery ratios are shown in Figures 5.32 (bus) and 5.33 (rail) for the Bay Area and the 12 other metropolitan areas chosen for comparison. Before the pandemic, the Bay Area had one of the lower farebox recovery ratios for bus, but one of the highest farebox recovery ratios for rail. After the pandemic, farebox recovery for both bus and rail in the Bay Area were among the lowest of these metropolitan areas.

Figure 5.32 Bus Farebox Recovery Ratio Pre- and Post-Pandemic – Bay Area vs. Other Metropolitan Areas

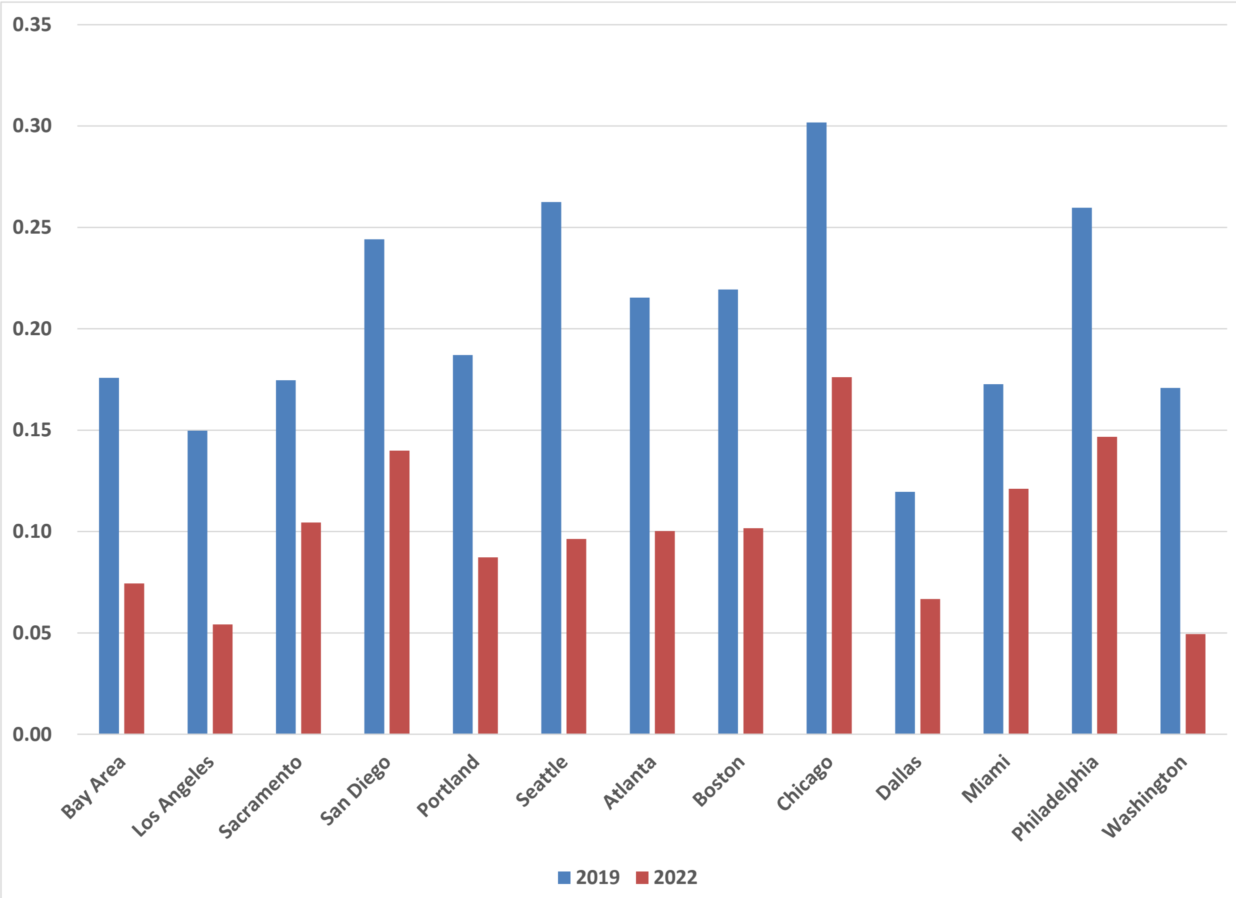
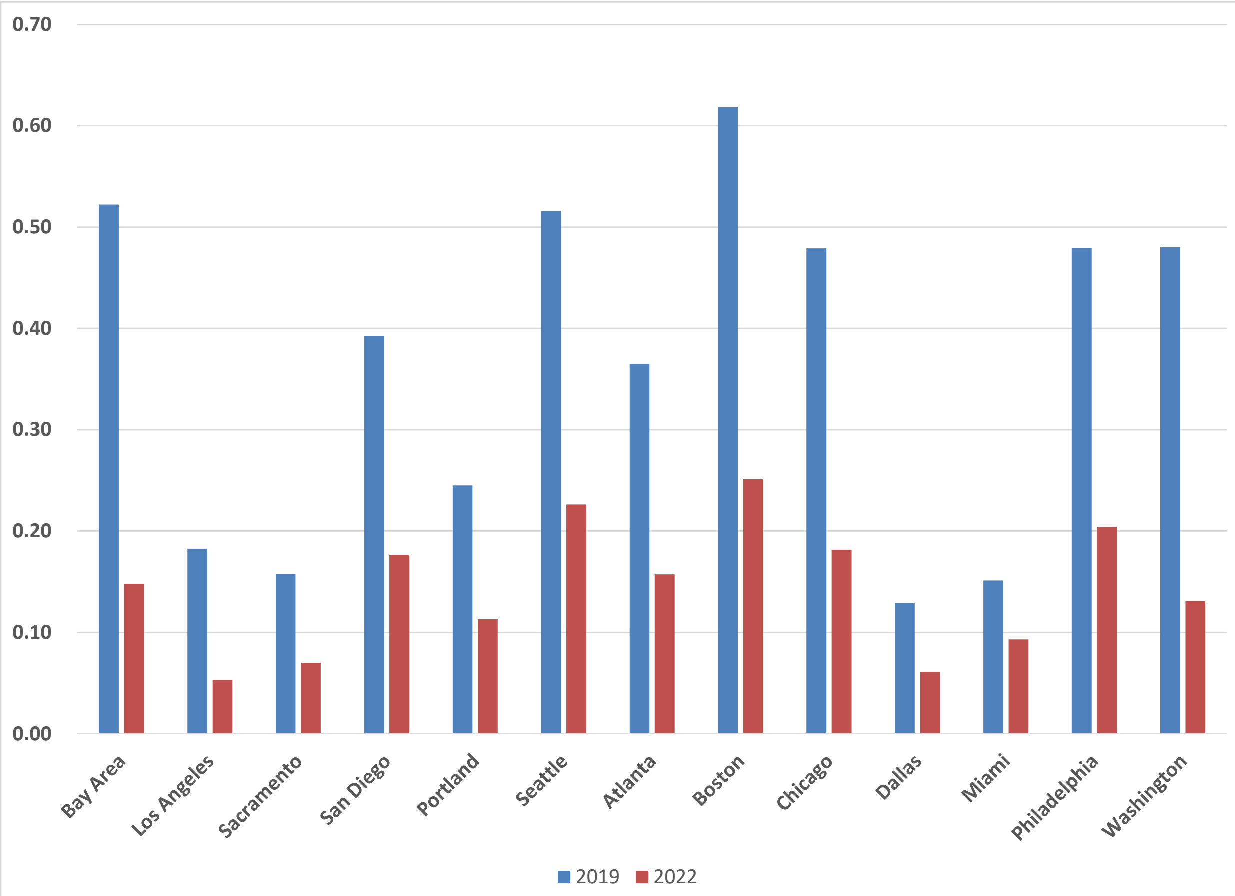


Figure 5.33 Rail Farebox Recovery Pre- and Post-Pandemic – Bay Area vs. Other Metropolitan Areas



Figures 5.34 and 5.35 provide a perspective on the reason for the relative decrease in farebox recovery for the Bay Area compared to other metropolitan areas. Bus and rail revenue loss for the Bay Area was among the largest of any other metropolitan area shown here. Rail revenue loss in dollars was the highest in the Bay Area of all these areas; only Chicago and Washington D.C. rail systems experienced greater dollar losses.

Figure 5.34 Fare Revenue Loss 2019–2022, Bay Area vs. Other Metropolitan Areas

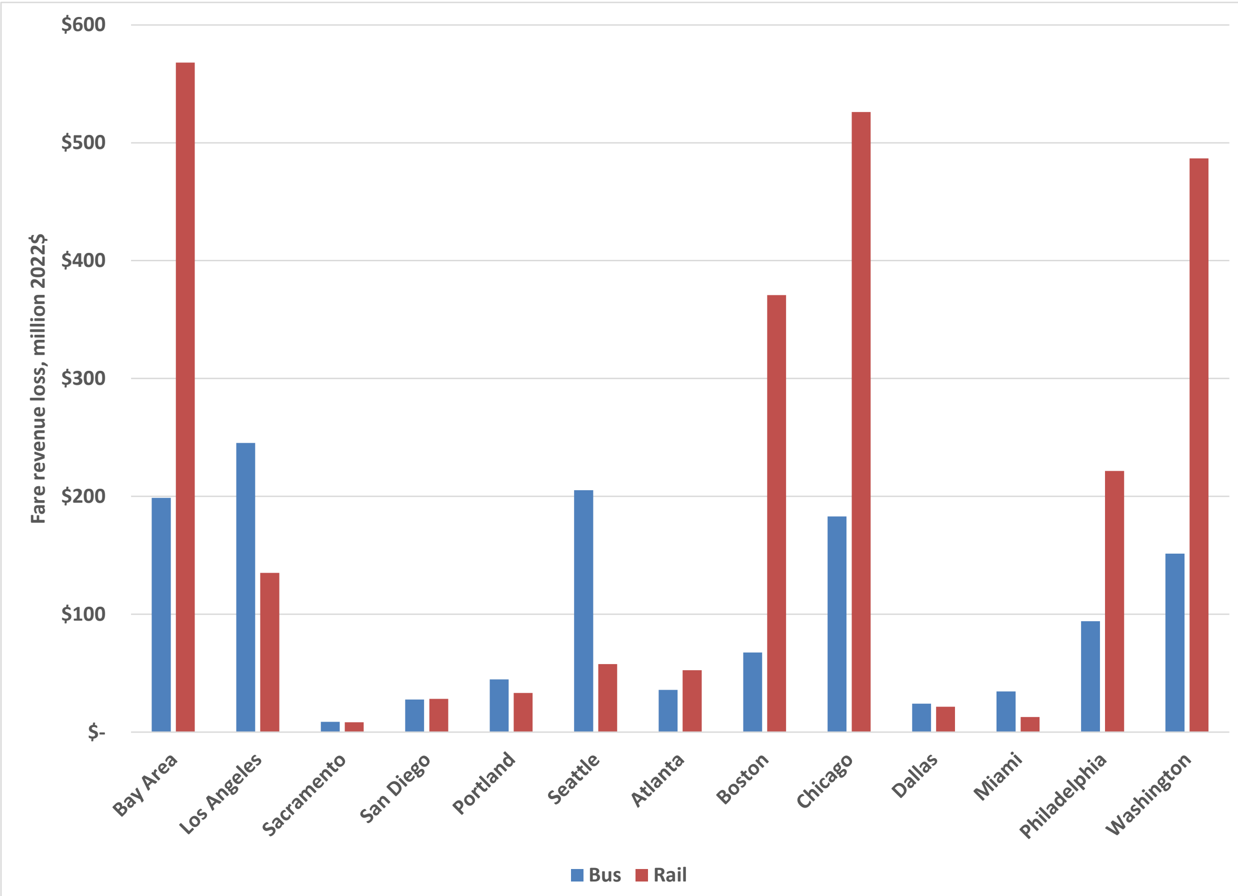
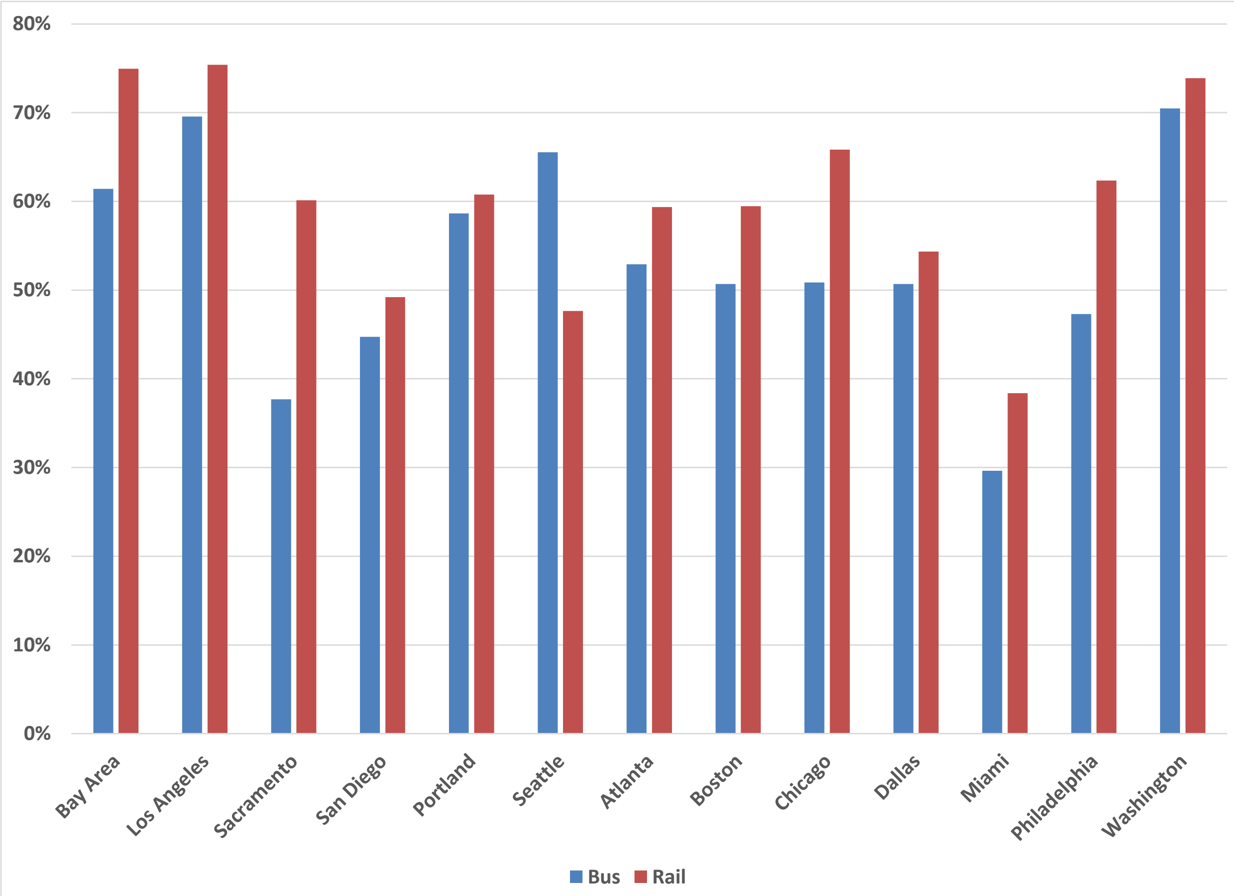


Figure 5.35 Percentage Fare Revenue Loss 2019–2022, Bay Area vs. Other Metropolitan Areas



5.6 The Bottom Line: Future Financial Health of Transit

As noted in Section 5.3.2, capital funding for transit has remained fairly constant immediately before, during, and after the pandemic. But many transit agencies face severe operating revenue shortfalls with the September 30, 2024, expiration of federal funding under the American Rescue Plan.[28] Federal funds accounted for over half of operating revenue for Caltrain, Golden Gate Transit, and BART in FY21 and FY22.

The problem is particularly acute for the three largest Bay Area transit operators: AC Transit, BART, and SFMTA. Projected operating budget shortfalls for these operators is shown in Table 5.9.

[28] Most agencies have drawn down all federal funds to put into reserves.

Table 5.9 Projected Operating Budget Shortfalls in Amounts ($ Million) and as Percentage of Operating Budget

	FY26		FY27		FY28	
AC Transit	$50	9%	$51	9%	$21	4%
BART	$35	3%	$385	31%	$377	30%
Caltrain	$36	14%	$45	17%	$61	22%
SFMTA	$13	1%	$244	16%	$269	19%

The problem is particularly acute for BART, Caltrain, and SFMTA. Reducing operating expenses to make up for the projected shortfalls would require service cuts far greater than the percentages shown in Table 5.9 due to the high fixed costs for these systems. Hence, the choice is clear: either additional operating revenue must be found to make up for some or all of the projected shortfalls, or severe service cuts will have to be made, possibly crippling the future viability of these systems.

5.7 Summary

This Section has discussed the changes in transit economics in the Bay Area due to the pandemic. The following are the main findings for fiscal years 2018–2022:

Operating costs and funding

- Operating costs have remained fairly constant for most operators except SFMTA, which has reduced its bus service significantly.
- For the past several years, federal funds, mainly under ARP, have made up for the shortfall in fare revenue. But ARP funding ended on September 30, 2024.
- State funding for transit operations has varied somewhat over this period. There was an increase in state funding in 2019–2020 to more than 20% of 2018 levels, but this decreased to about 15% above 2018 levels by 2022.
- Overall local sources for funding have decreased by more than 40% over this period. Some of this decrease is due to the large drop in taxable sales and a large drop in parking fee revenue and general fund support in San Francisco. But Santa Clara County appears to have passed new sales taxes to fund both VTA and BART to San Jose operations.
- The most significant financial effect on operating revenue has been the loss in fare revenue, mainly by BART and, to a lesser extent, Caltrain and SFMTA. BART fare revenue losses alone account for over half the fare revenue loss between 2019 and 2022.

Capital costs and funding

- Capital costs and funding sources appear not to have been affected much by the pandemic.
- Most funding sources are from programs that were in place before the pandemic.
- Changes in capital costs and funding have been mostly due to factors other than the pandemic, such as completion of the Stockton Street subway in San Francisco, BART car fleet replacement costs, and ongoing capital expenditures for BART to San José.

Productivity and efficiency

- Service delivery costs for most operators have increased somewhat over the five-year period for both bus and rail.
- BART service delivery costs appear to have remained fairly constant over the five-year period.
- Small operators in the Bay Area continue to have the lowest service delivery costs because
    - Most operators contract out service to private operators, which have lower costs for small operations.
    - Those small operators that directly operate their own service have lower wage scales than the large operators.
- Patronage-related unit costs have increased over the five-year period, mainly due to the decrease in demand.
- BART and Caltrain continue to have the lowest cost per passenger mile of service.
- Overall farebox recovery is less than half what it was before the pandemic. The decrease is especially acute for BART and Caltrain, whose farebox recovery rates are less than one-third of what they were before the pandemic.

Comparison: Bay Area v other metropolitan areas

As in the two previous Sections, we have provided an additional perspective on changes to transit in the Bay Area by comparing it to other metropolitan areas that:

- Are one of the four large metropolitan areas in California (Los Angeles, Sacramento, San Diego), or
- Are one of the major West Coast metropolitan areas (Portland, Seattle), or

- Are large metropolitan areas with established rail systems (Atlanta, Boston, Chicago, Dallas, Miami, Philadelphia, Washington, D.C.).[29]

Some of the key comparisons are the following:

- Unit service delivery costs for bus and rail are somewhat higher in the Bay Area than in other metropolitan areas. Part of this is because the cost of living in the Bay Area is highest among all metropolitan areas considered here.

- Pre-pandemic farebox recovery in the Bay Area was among the lowest for bus and among the highest for rail. After the pandemic, farebox recovery for both bus and rail in the Bay Area are lower than most other metropolitan areas compared here.

- The most significant finding is that the Bay Area experienced a much larger loss in total fare revenue than most other metropolitan areas. The Bay Area experienced the greatest loss in rail fare revenue and the third highest loss in bus fare revenue among the metropolitan areas shown.

Future financial health of transit in the Bay Area

Capital funding sources for transit in the Bay Area appear not to have changed much since the pandemic. The main issue is with operating funding, especially for the large agencies and most especially for BART and SFMTA. These agencies will face severe operating funding shortfalls after federal aid expires. Responses to this fall into three categories:

- **Increase ridership.** It is clear from existing trends that ridership recovery since the pandemic has slowed significantly for the large agencies. It appears highly unlikely that ridership for agencies such as SFMTA and BART will attain pre-pandemic levels, at least in the short to medium term (within 5 years). There are incremental changes that could be made, such as improved access service, that could increase ridership,[30] but these would result in only marginal increases in ridership.

- **Increase operating funding.** There are a number of possible ways to do this, including fare increases, additional tax revenues, and funding from other sources such as bridge toll surcharges.

- **Reduce operating costs.** The only possible way to reduce costs in the near term is to cut service. Transit agencies that operate their own service have high fixed operating costs,

[29] New York City was excluded because it is an outlier in terms of its size and percentage use of transit for commuting.

[30] BART noticed an increase in ridership on the Yellow (Concord – Millbrae/SFO) line after implementing 10-minute headways in September 2023.

especially for rail. If transit agencies have to reduce service to account for anticipated operating budget shortfalls, these service cuts would be far out of proportion to anticipated funding shortfalls.

6. Summary and Conclusions

6.1 Introduction

This Section presents a summary of our findings to date. We conclude with a set of possible remedies for the current financial crisis being faced by several of the major Bay Area transit agencies.

6.2 Summary of Findings

The following are the main findings of this study:

6.2.1 Demand

- Like other US metropolitan areas, the Bay Area saw a large drop in transit ridership during the pandemic.
- Bus and rail ridership in the Bay Area has shown some recovery since the pandemic but remains substantially below pre-pandemic levels.
  - Bus ridership has recovered faster than rail ridership and is now at about 80 percent of pre-pandemic levels.
  - Rail ridership has been much slower to recover. Muni and VTA rail ridership is about 60 percent of pre-pandemic levels, but ridership on BART and Caltrain is only about 40 percent of pre-pandemic levels.
- Mode shares have changed substantially for work trips since the pandemic.
  - Working at home has increased substantially from pre-pandemic levels.
  - Most of the decrease in transit patronage appears to be due to increased numbers of workers who work at home.
  - Transit operators with high pre-pandemic commuter ridership turned out to be particularly vulnerable to riders switching to working from home. The reasons why are described below.
- Persons who work at home show the following characteristics:
  - They have much higher earnings than the work population at large.

    - Workers in management, scientific, professional, and sales occupations are much more likely to work at home than those in other occupations.
    - Workers in information, insurance, professional, and scientific industries are much more likely to work at home than those in other industries.

- The pre- to post-pandemic change in median incomes for transit riders indicates that many high-income transit riders before the pandemic are likely to now be working at home instead.

- Downtown San Francisco vacancy rates remain among the highest of any major metropolitan area in the US, indicating that working at home has sharply reduced the number of trips to this major transit market. Although employers such as Salesforce have recently begun to require workers to spend more days in the office, there will likely remain a large percentage of workers who continue to work on hybrid office/at home work schedules.

6.2.2 Level of service

- Most agencies have made some service adjustments in response to lower ridership demand.

- Muni and AC Transit, in particular, have eliminated a number of express routes that formerly served long-distance commute trips.

- BART has made some service cuts by increasing its headways, particularly during the peak periods where less ridership demand has allowed for reducing service.

6.2.3 Economics and finance

- Farebox recovery rates for large bus and rail operators have declined substantially.
    - Bus farebox recovery rates are less than half of what they were before the pandemic.
    - Rail farebox recovery rates have fallen even more than bus recovery rates.
    - BART and Caltrain, in particular, used to have farebox recovery rates of over 70%. These percentages have declined to about 20%.

- Unit service delivery costs for the largest Bay Area transit agencies, such as cost per vehicle revenue hour and cost per vehicle revenue mile, are approximately the same or slightly higher than before the pandemic.

- All agencies have drawn down on their federal money allocations for operating funds.

- Current operating funding will carry these agencies through FY25.
- The largest agencies will face severe funding shortfalls beginning FY26, as shown in the following table.

Table 6.1 Projected Operating Budget Shortfalls in Amounts ($ Million) and as Percentage of Operating Budget

	FY26		FY27		FY28	
AC Transit	$50	9%	$51	9%	$21	4%
BART	$35	3%	$385	31%	$377	30%
Caltrain	$36	14%	$45	17%	$61	22%
SFMTA	$13	1%	$244	16%	$269	19%

In sum, the largest Bay Area transit operators are facing potentially severe shortfalls in operating funding, especially BART, Muni, and Caltrain. Absent significant changes, these agencies will face a fiscal cliff beginning FY26.

6.3 Possible Remedies

There is no easy solution to this problem. This Section presents several possible remedies and their anticipated effects on fiscal health, equity, and the environment.

These possible remedies fall into three categories (as seen in Table 6.2):

- Increase ridership
- Reduce operating costs
- Seek additional revenue sources

Table 6.2 Potential Remedies and Likely Effects

	Financial health	Equity	Environ-ment	Comments
Increase demand				
Reduce fares	Red ●	Green ○	—	Will likely decrease, rather than increase, total fare revenue.
Wait for demand to grow	Red ●	—	—	Will not grow fast enough to offset short term revenue shortfalls.
Improve service	Green ○	Green ○	Green ○	Added costs not likely to be offset by added demand.
Reduce costs				
Moderate service cuts	Green ○	Red ○	Red ○	Most agencies have already made service cuts, but not enough to offset revenue shortfalls.
Severe service cuts	Green ○	Red ●	Red ●	Would likely cause severe drop in demand. Severe negative effects on transit dependents. Unlikely agencies can make sufficient service cuts to offset revenue shortfalls. Expected severe increase in highway congestion and GHG emissions.
Eliminate/replace low-productivity service	Green ○	Red ○	—	Infeasible for most rail service. Potential demand reductions likely to more than offset cost savings.
Additional revenue sources				
Increase fares	Green ○	Red ○	—	Some increase in revenue likely, but not enough to offset operating budget shortfalls.
Additional taxes	Green ●	Red ○	Green ●	Half cent sales tax would largely offset budget shortfalls for Muni and BART.
Bridge toll surcharge	Green ●	Red ○	Green ●	Potentially increased revenue for transit operators, reduction in auto demand would benefit environment. Slight negative effect on lower income groups.

Note: Green indicates positive effect, red indicates negative effect. Filled circles indicate maximum effect. Empty circles indicate minimum effect. Black lines indicate almost no effect.

6.3.1 Increase ridership

There are several possible ways to increase ridership:

- **Simply wait for ridership to increase sufficiently so that fare revenues increase.** This does not appear to be a workable solution. Given current ridership trends, it is unlikely that ridership, especially rail ridership, will increase to anywhere near pre-pandemic levels within the next five years.

- **Reduce fares to encourage greater ridership.** This has been proposed in other contexts as a "solution" to low ridership. But transit ridership has been shown to be relatively unresponsive to fare reductions. Fare reductions almost inevitably reduce overall fare revenues.[32]

- **Service changes to improve ridership,** such as better coordination of access service for rail**.** Better coordination of access service for rail. There is still the issue of "last mile" service: i.e., getting passengers to and from rail stations. Providing additional access service—e.g., subsidized taxi service to and from stations—is possible, but the ridership gains are not likely to offset the increased costs of service.

6.3.2 Reduce operating costs

Operating costs could be reduced by cutting service or by other measures such as replacing low-productivity service with cheaper alternatives. Several agencies, including AC Transit, BART, and Muni, have made service cuts by eliminating some routes or reducing service frequencies. But any operating cost savings produced by these cuts are not likely to make up for the anticipated budget shortfalls, particularly for rail operators.

BART, in particular, presents a serious problem:

[32] Economists measure change in demand as a function of change in price using a dimensionless quantity called *price elasticity*, which is defined as the percentage change in demand divided by the percentage change in price. Price elasticities for the vast majority of goods and services are negative, which means that an increase in price leads to a decrease in demand, and vice-versa. From the standpoint of fare reductions, a fare elasticity of less than -1 indicates that a fare decrease would result in a demand increase that would more than make up for the fare reduction, and therefore overall fare revenues would increase. Contrariwise, elasticity greater than -1 and less than zero indicates that a fare reduction would result in an overall decrease in fare revenue. Experience in the US has shown that fare elasticities for bus have historically averaged to about -0.4, while fare elasticities for heavy rail have averaged about -0.18. This indicates that fare reductions for both bus and rail would typically result in overall fare revenue decreases, even more so for rail than for bus. See National Academies of Sciences, Engineering, and Medicine, *Traveler Response to Transportation System Changes Handbook, Third Edition: Chapter 12, Transit Pricing and Fares* (Washington, D.C.: The National Academies Press, 2004), https://doi.org/10.17226/13800.

- BART's anticipated revenue shortfall is more than the forecasted shortfall for Muni, Caltrain, and AC Transit combined.

- There are few options for BART to increase its fare revenue. As noted above, and as found in Reinke (1989), decreasing fares would very likely decrease overall revenue. And a large increase in fares could further depress ridership.[33, 98]

- It would be very difficult for BART to reduce its service costs enough to make up for the 30% budget shortfall beginning FY 2026.

    - Fixed costs make up a large percentage of BART's overall operating costs.

    - Therefore, service cuts would likely have to be extremely large—as much as 60% or more. In other words, rail operating costs don't scale.

    - If BART were to make the necessary cuts to live within current forecast revenues, the system would likely become unrecognizable from what it has been over the past fifty years.

        - Increasing service headways beyond their current 20 minutes could well lead to a "ridership cliff," where demand falls significantly because of the service reduction.

        - Other service reductions, such as reduced hours or days of operation, would further exacerbate ridership decline.

        - Despite its high fares, BART still serves a large number of transit dependent riders. The disproportionate effect on transit-dependent riders presents a significant equity issue.

6.3.3 Additional funding sources

The Bay Area has in the past shown a willingness to support transit through taxes. Eight of the nine Bay Area counties have special sales taxes devoted to transit, although most of the money is allocated to capital expenditures. The three original BART counties—Alameda, Contra Costa, and San Francisco—have a special half-cent sales tax that is allocated to BART and Muni for operating funding. Bridge toll revenues are also used in part to support transit, although the bulk of the transit money is used for capital improvements.

[33] Partly in response to the findings in Reinke (1989), BART has adopted a policy of small increases in fares every few years to keep up with inflation, rather than larger fare increases at longer intervals. *Automatically Collected Patronage Data: Proceedings of the International Conference on Microcomputers in Transportation*. Conference sponsored by Urban Transportation Division of The American Society of Civil Engineers, San Francisco, California, June 21–23, 1989.

Sales taxes

BART and Muni currently share revenues from a special half-cent sales tax in the three original BART counties: Alameda, Contra Costa, and San Francisco. BART is allocated three-quarters of the sales tax revenue, with the remainder going to Muni. BART's share for FY24 was expected to be on the order of $320 million. An additional half-cent sales tax allocated in the same manner would nearly make up for BART's anticipated operating budget shortfall; it would also make up for approximately 40 percent of Muni's anticipated operating budget shortfall.

Bridge toll surcharge

A bridge toll surcharge is another potential source of revenue. The Golden Gate Bridge Highway & Transportation District recently increased tolls on the Golden Gate Bridge as part of a multi-year toll increase program intended to make up for anticipated operating budget shortfalls.

A toll surcharge of $1.50 on all state bridges in the Bay Area was proposed in the state legislature, but was not approved. Based on FY23 data on toll-paying vehicles, this toll would have raised over $65 million annually. Opposition to the measure came from officials who were concerned about equity effects. But Census data for 2023 show that the average earnings for workers from Alameda and Contra Costa counties who commute to San Francisco was over $100,000 per year. Furthermore, there are measures that can be taken to mitigate the equity impacts of increased tolls, such as an income-based toll reduction program.

6.4 Summary

In summary:

- The large Bay Area transit operators, particularly BART and Muni, are facing severe operating budget shortfalls beginning FY26.
- It is likely there is no feasible way for BART to cut service costs enough to offset the expected operating budget shortfall and remain a viable system.
- It is likely that BART and Muni will need to seek alternative funding sources for operations in order to remain viable.

There are a number of factors to consider, including the following:

- The Bay Area has invested billions of dollars in its transit systems, BART in particular. The original BART system was funded almost entirely with local money; in today's dollars, the cost of the original system was over $10 billion (and would likely cost much more if it were to be built today), with an additional $40 billion attributable to the opportunity cost of the original capital investment. BART district voters passed an additional $3.5 billion funding measure in 2016 to rehabilitate the system. The question is whether or not the Bay Area is willing to forego this investment.

- California has been in the forefront of combating climate change. Transportation accounts for 40% of California's greenhouse gas emissions. BART runs almost entirely on renewable energy. The cost of greenhouse gas emissions, were current BART riders to drive instead, would be in excess of $50 million per year; other air pollution costs would be in excess of $100 million per year.

Estimating congestion costs due to BART and Muni not operating would require further analysis involving regional travel demand models. But, based on experience from the past BART strike, it is likely that congestion costs of not having BART in operation would be quite severe.

7. Appendix A

7.1 Select Methods Used by Previous Studies to Research the Pandemic's Effects on Travel Behavior

A number of studies have explored the impacts that the COVID-19 pandemic has had on travel behavior in general and on individual travel patterns in particular. These studies have effectively provided researchers with some of the specific effects that COVID-19 has had on certain cities and towns throughout the world.

Wilbur et al. (2023) studied the impact of COVID-19 on public transit ridership in Nashville and Chattanooga, TN during the beginning of the pandemic, focusing specifically on fixed-line bus routes and paratransit. The study aimed to investigate: (1) the degree to which the pandemic affected ridership on fixed-line public transit and the relationship between reduced demand and reduced vehicle trips; (2) how COVID-19 changed ridership patterns and whether the changes are expected to persist after the lifting of restrictions; and (3) whether there were disparities in ridership changes across socioeconomic groups and among mobility-impaired users.

Methods used to investigate the first two questions included a spatiotemporal analysis of bus ridership decline from January through June 2020 and a comparison of ridership declines to anonymized mobile location data, which used data obtained from SafeGraph, to identify whether public transit users had switched to personal vehicles. Bus boarding count data was obtained from the Nashville Metropolitan Transit Authority for January 2019 to June 2020 and from the Chattanooga Area Regional Transportation Agency for January to June 2020. Findings showed that both cities experienced significant declines in ridership (65–66 percent) during the first month of the pandemic, then moderate recovery before stabilizing below pre-pandemic levels three months later. The largest declines were seen for weekday morning and evening commute times. The initial decline preceded a decline in vehicle trips, which the researchers felt was a result of other factors influencing rider behavior outside of reductions in vehicle trips. Data also showed that foot traffic recovered to a higher degree than transit ridership during the study period, which may be indicative of riders shifting to personal vehicles.

Methods used to investigate the third question included a correlation analysis and explanatory linear model to investigate the relationship between socioeconomic indicators and the drop in transit ridership, as well as analysis of changes in paratransit demand before and during COVID. Data for socioeconomic indicators of income, employment, education level, race, and housing information, were obtained from the U.S. Census, the LODES dataset, and ProximityOne. Data on paratransit ridership was obtained from Nashville MTA for 2-week periods from April 28 to May 11, 2020 and from April 26 to May 9, 2019. Findings indicated that higher-income and higher-educated census tracts experienced higher decreases in ridership levels. For paratransit ridership, there was a 66 percent decline in demand in 2020 compared to 2019.

Jiao et al. (2023) studied the varying impacts of the pandemic on transit ridership at the census tract level in Austin, TX, to determine which areas experienced disparate impacts. They obtained ridership data for the period between March 1, 2019, and January 9, 2021 from the Capital Metropolitan Transportation Authority, demographic data for the Austin-Round Rock metropolitan statistical area from the American Community Survey, and spatial characteristics data for the study. Variables in the analysis included population, median age, race, median income, transit user ratio, median transportation time, unemployment rate, distance from downtown (in km), stop density, and percent without vehicle. A multivariate clustering analysis was employed to understand the relationship between variables. It demonstrated that the impact of the level of ridership change was reflected in the demographic divide between the east and west areas of Austin, with poorer and residents of color being clustered in the east and white, affluent residents residing being clustered in the west. Ridership declined more severely in the western part of the city. Geographically weighted regression models were employed to understand the geographic distribution of the impacts of the variables on transit ridership.[99]

Hu and Chen (2021) studied the impact of COVID-19 on transit ridership to determine the extent to which the decline in transit ridership could be explained by the outbreak of the pandemic and the extent to which factors of land use, socio-demographics, COVID-19-related factors, and transit services contributed to the decline. A Bayesian structural time series model was used to infer the impact of COVID-19 on station-level transit ridership for the Chicago "L" train system, controlling for confounding variables of trend, seasonality, weather, and holidays. Ridership for the system was obtained for the period from January 2001 through April 2020. Data before 2019 was set as the training set for the model and 2019 ridership data was used as the testing dataset. Findings indicated that 72.4 percent of the drop in ridership could be attributed to the COVID-19 pandemic. A partial least squares regression was used to further examine the impact by incorporating various factors of land use, socio-demographics, pandemic-related factors of case and death counts, and transit service factors of trips and frequency. Findings indicated that ridership declined more in areas with more commercial land uses and in areas with more white, educated, and high-income individuals. Areas with more jobs in trade, transportation, and utility sectors and with higher numbers of COVID-19 cases and deaths presented smaller declines in ridership.[100]

Osorio et al. (2022) sought to determine the primary factors contributing to ridership loss on bus and transit during the COVID-19 pandemic, including determining how the effects vary of time, space, and between transit modes. With their findings, they hoped to answer the questions of how transit could recover to pre-pandemic levels and what lessons transit agencies could learn from the variation in ridership to enhance future decision making. The study focused on bus and rail ridership for services run by the Chicago Transit Authority. Ridership data was obtained from the Chicago Data Portal for the period between March 1, 2020 and March 1, 2021. The authors first used a Bayesian structural time series model, based on the model used by Hu and Chen, to estimate counterfactual ridership based on historical data. They then plugged the estimation into new dynamics models for daily ridership loss. The new dynamics model was used to explain observed ridership variations with instant and prolonged effects because it captures the impact of both individual risk perception and external regulatory factors. Factors analyzed objective risk measurements of daily confirmed cases and deaths to measure public fear/risk perception and external regulatory factors, such as executive orders (travel restrictions), school closures, and remote working policies. The authors also used linear regression analysis to draw connections between socioeconomic and land use characteristics of neighborhoods and instant effects on ridership loss. The models indicated that a majority of ridership losses could be attributed to regulatory factors rather than voluntary self-protection behavior, so they estimated that ridership would recover to pre-pandemic levels with the lifting of travel restrictions and executive orders. However, they did note that the impact of sustained remote and hybrid work policies was not considered in this finding. They found that public fear affected ridership for bus and rail differently with the residual effect of fear, measured by daily deaths and news coverage, affecting rail for longer periods of time compared to bus. They additionally noted that fear-based ridership was estimated to recover as people experienced caution fatigue as the pandemic continued.[101]

Soria et al. (2023) investigated factors shaping public transit pandemic behavior with a focus on explaining individual-level choices to discontinue ridership and intentions to return to transit when COVID-19 no longer posed a significant health risk. They also investigated the likelihood of using public transit if fare systems were to be integrated with other mobility services such as ride-hailing and micromobility. The authors used binary and ordered logit models to conduct exploratory data analysis of the survey data to inform their findings. Separate models were used for lapsed ridership, return to transit, and fare integration. Survey data was obtained from the Chicago Regional Transportation Authority, and transit ridership statistics were obtained from the National Transit Database. The survey was distributed in the Chicago area in two waves from November 9, 2020 to December 4, 2020 and from January 19, 2021 to February 5, 2021. It collected sociodemographic information, data on employment characteristics (sector, employment status, teleworking frequency), and past and current travel behavior including which transit agency services they used; it also asked respondents a hypothetical budgeting question to reveal their transit investment allocation preferences. Findings indicated that an ability to telework and vehicle ownership had the highest impact on the choice to discontinue ridership. Other impactful factors on ridership included race, user priority of sanitation of transit facilities and vehicles, and type of transit service utilized. Racial and ethnic minorities were less likely to lapse in ridership, but findings indicated that those who did would be less likely to return. Women were more likely to lapse in ridership and were also found to be less likely to return. Top concerns reported in the survey data included sanitation/ventilation and mask/distancing enforcement on transit vehicles and seamless travel across the different travel services, though model results indicated that those who prioritize off-peak services would be more likely to use transit more with fare integration. For the type of transit service utilized, findings indicated that bus users are more likely to return than train riders.[102]

Mashrur et al. (2023) identified and reviewed strategies for recovering ridership in the post-pandemic era, focusing on three classes of public transit users: non-public transit users, occasional users, and moderate users. Strategies discussed in the study were derived from survey data from the Stated Preference Experiment on Travel mode and especially the Transit choice behavior (SPETT'21) survey. The survey was administered as a web-based survey. Researchers noted that the SPETT project monitors the impacts of the pandemic on transit demand in the Greater Toronto Area but did not specify whether respondents were also from the same area or if the survey reached a wider geographic area. The study included 513 of the survey responses in which the respondent reported not using transit since the pandemic started. The survey presented randomized hypothetical scenarios from a pool of 24 scenarios to the respondents to capture responses regarding transit ridership habits in the "current" situation and the post-COVID situation.[103]

Mashrur et al. first used a multiple indicator and multiple choices model to analyze responses categorized into three attitude groups (i.e., latent constructs): concerns regarding pandemic characteristics, post-pandemic transit usage, and continuation of transit safety policies during the post-pandemic context. They then used a two-stage model, consisting of binary discrete choice models and an ordered generalized extreme value model, to estimate the likelihood of the respondents' return to transit in the post-COVID era. Findings from the model indicated that all classes of public transit users valued availability of parking facilities near transit. Moderate pre-pandemic transit users valued free parking facilities, fare incentives (discounts, free transfers between municipalities), and operational improvements (reliability, improved waiting time for transfers, and reduced transfers) in their decision to return to transit. Occasional pre-pandemic transit users valued parking facilities in general (even if paid), improved transit performance, safety policies on-board, and fare discount incentives. Responses for the non-public transit users indicated that they are psychologically less willing to take transit, so the researchers suggested solutions of continuing health and safety policies for a period of time in the post-COVID era and enhanced cleaning on transit vehicles. Non-public transit user responses indicated that they would be incentivized to switch to transit if there were network changes to increase direct trips and if automobile parking costs increased.[104]

Watkins et al. (2022) completed a series of studies at the system, route, and stop levels to first understand factors contributing to the pre-pandemic decline in transit ridership and then to identify and evaluate the effectiveness of strategies for public transit agencies to mitigate or reverse ridership challenges from the pre- and post-COVID eras. Findings for the factors contributing to a pre-pandemic decline in ridership at the system level were the same as those reported in Erhardt et al. (2022). At the route level, the authors did case studies to assess the impact of e-scooters and fare discounts on transit ridership. At both the route and stop levels, the authors did a case study on giving transit priority in the form of light rail and BRT in the Minneapolis/St. Paul area. At the stop level, case studies included analyzing ridership changes based on time (time of day and day of the week) and sensitivity to service frequency changes for four US agencies: TriMet

(Portland), Miami-Dade Transit, Metro Transit (Minneapolis-St. Paul), and MARTA (Atlanta). The researchers also analyzed the peaking problem by looking at BART as a case study. Fixed-effect regression models were used in multiple studies to analyze ridership data from the National Transit Database against various factors of amount of service, travel costs (fares and gas prices), transit priority, and socio-demographics. To evaluate the strategies prior to making final recommendations, the authors completed three simulations using the CityCast MATSim framework, which simulates the movements of persons ("agents") and vehicles on a public transport network. The simulation models used the cities of Atlanta and Oshkosh as case studies, and scenarios included a low-income focus, high-ridership focus, and high-ridership focus with exclusive bus lanes. Based on the findings from the various studies and the simulation models, the authors made five main recommendations for public transit agencies to mitigate or reverse ridership decline.

The first recommendation—to rethink overall mission, service standards, metrics, and service delivery—was based on three findings: (1) the system-level finding that service additions resulted in ridership increases of 3–5 percent for bus and 10–18 percent for rail in the pre-pandemic period from 2012 to 2018; (2) the stop-level case study findings that ridership remained higher during AM and PM peaks and declined the most during nighttime service; and (3) the simulation model findings that showed reallocation of existing service has the potential to increase ridership without major budget increases. The second recommendation to redesign fare policy was based on (1) the system-level finding that fare increases resulted in a ridership decline of 0–4 percent for bus and 2–5 percent for rail in the pre-pandemic period, and (2) the route-level findings from a Topeka, KS case study of fare-free promotions that showed significant positive impacts on ridership can result from strategic fare discounts. The third recommendation to give transit priority was based on (1) findings from case studies in Minneapolis-St. Paul for light rail, which showed the introduction of light rail increased ridership despite a decrease in overall service frequency of bus, and (2) findings from Cleveland for BRT implementation, which showed a possible ridership increase of between 22–46 percent in implementing full BRT or BRT features. The fourth recommendation to consider partnership with shared-use mobility providers carefully is based on (1) emerging modes potentially competing with bus ridership; (2) findings from the system-level analysis that indicated ride-hailing and e-scooters (new competing modes) resulted in a 10–12 percent reduction in bus ridership prior to the pandemic; and (3) and findings from an e-scooter case study in Louisville that indicated that this mode had limited impacts on bus ridership and could serve as a first/last-mile solution. The final recommendation to encourage transit-oriented density was based on a finding from the system-level analysis that ridership decline in the pre-pandemic period could be partially attributed to decentralization in metro areas and a growth in suburbs.[105]

In this policy brief, Epstein et al. (2022) examined where, how, and why transit ridership and operations changed during the pandemic. They analyzed ridership data from the National Transit Database and conducted interviews with transit managers. The findings focused mainly on ridership in California. Findings from the analysis showed that California ridership was at its lowest in April 2020 when bus boardings dropped by 73 percent and rail boardings dropped by 84 percent compared to the previous year. Ridership has recovered slowly in the years since the start of the pandemic with boardings around 61 percent as of July 2022. Findings consistent with other research articles include (1) ridership remaining below pre-pandemic levels despite service levels being mostly restored; (2) transit being most in-demand for residents of lower-income, minority neighborhoods primarily served by bus lines; and (3) essential workers and lower-income residents continuing to use public transit for their trips during the pandemic, whereas wealthier areas with a higher share of white residents were more likely to shift their travel behavior to telework and errand and work trips done by private vehicle. A comparison between ridership in the Los Angeles (LA) region and the San Francisco (SF) Bay Area showed that despite the regions following similar ridership trajectories, the LA region rebounded slightly more than the SF Bay Area. In light of these findings, Epstein et al. recommended that transit agencies focus on improving rider safety, providing frequent and reliable service, restructuring service to reduce the number of transfers, and improving transit stop amenities as these strategies may attract travelers back to transit and result in a positive feedback loop.[106]

In a brief article, Jared Brey (2023) summarized ridership prediction challenges facing various public transit agencies following the pandemic. At the time of writing (March 2023), agencies including BART, the Washington Metropolitan Transit Authority, and the Metropolitan Transportation Authority of New York were projecting ridership levels short of pre-pandemic levels even years after the pandemic. Brey noted that although long-range ridership projections have become more accurate with time, the pandemic has complicated transportation modeling for transit ridership, and new data on travel behavior and preferences in the post-pandemic period are needed to more accurately model future predictions. He additionally discusses the challenge that it is unclear which social behaviors from the pandemic are permanent and which are temporary. In sum, more up-to-date data are needed to inform travel demand models, and travel modelers will need to pay close attention to how the weight of certain factors, such as gas prices and office occupancy rates, has changed due to the pandemic and how it will continue to change going forward.

8. Appendix B: Operator Ridership

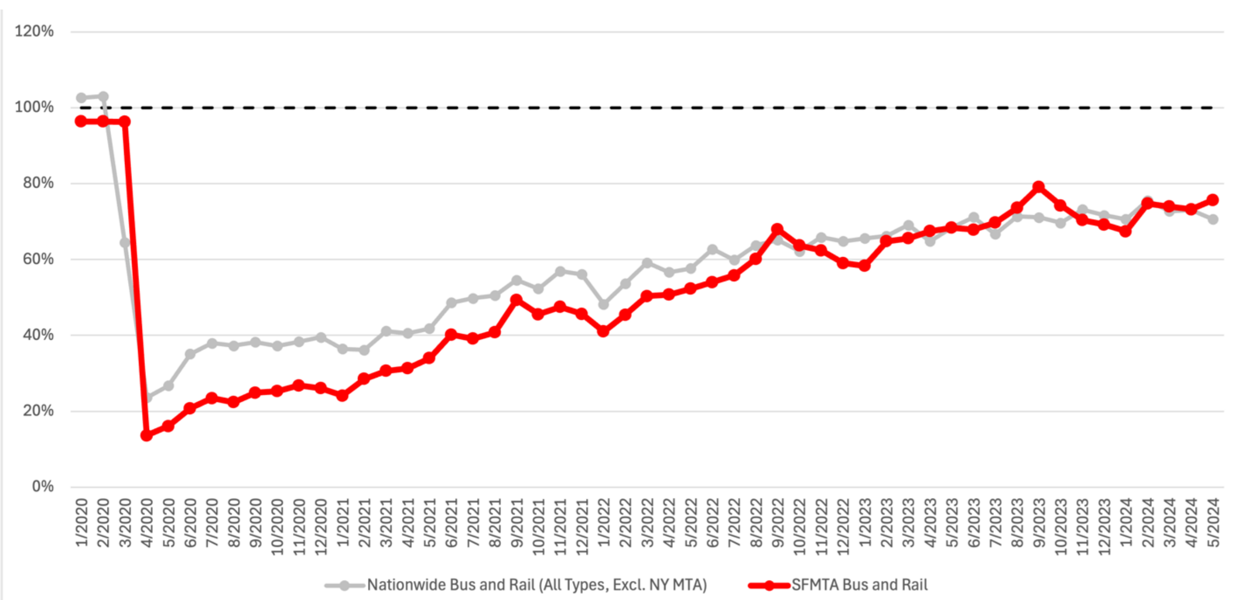
8.1 Ridership at the Bay Area's "Big 7" Transit Operators: Trips

Ridership percentages for seven major SF Bay Area transit agencies were graphed and analyzed to identify trends in ridership recovery from the start of the pandemic through May 2024. Results were also summarized for Marin Transit, an exemplary small operator. The graphs present ridership as a percentage of pre-COVID baselines for the agencies as a whole and are also broken down by mode where applicable. Each graph also presents corresponding nationwide ridership recovery trends with data from the Metropolitan Transportation Agency of New York (NY MTA) removed. Data was obtained in the form of unlinked passenger trips (UPTs) from the National Transit Database (NTD) and was only available through May 2024. Percentages of pre-COVID baselines were calculated by taking the sum of UPTs for each month and dividing by the sum of UPTs for the corresponding month in 2019.

8.1.1 SFMTA (MUNI)

Figure 8.1 shows the monthly overall ridership recovery for the San Francisco Municipal Transportation Authority (SFMTA) compared to nationwide recovery.

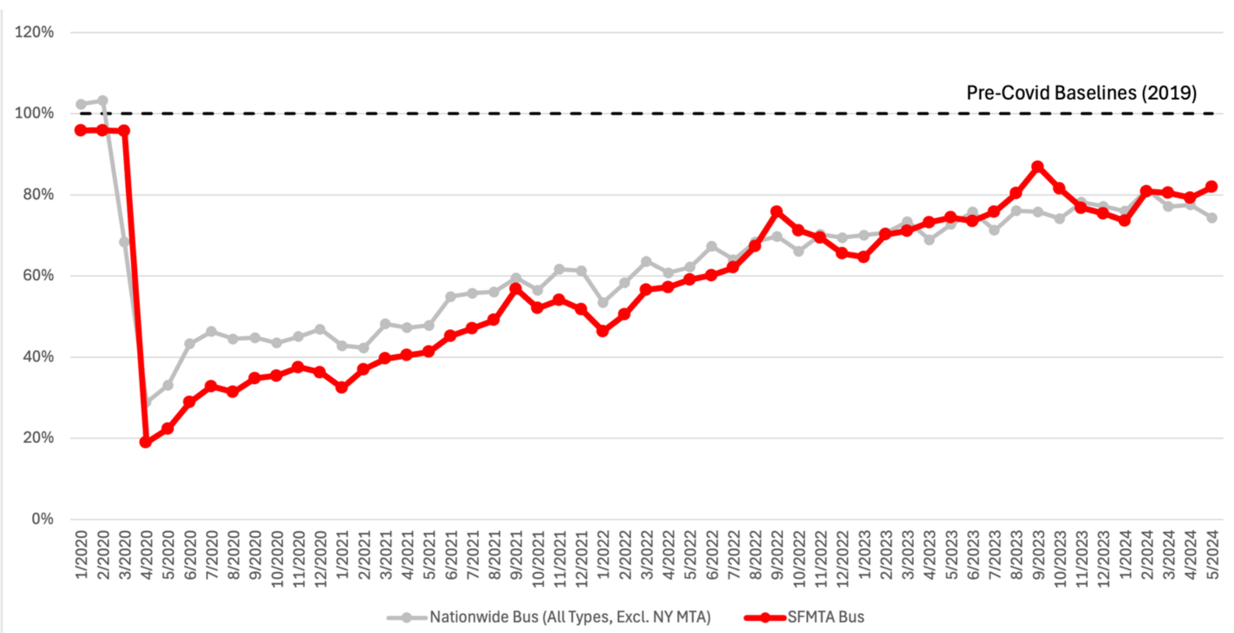
Figure 8.1 Monthly SFMTA Ridership Recovery for All Available Modes Compared to the Nationwide Trend



SFMTA appears to follow a similar trend to nationwide ridership recovery with both showing modest recovery since April 2020, with some slight dips in ridership recovery around the winter season. Slight dips during the winter could be attributed to increased risk of exposure to illness, particularly around January and February 2022 which coincided with the spread of the highly contagious omicron variant. Interestingly, SFMTA ridership recovery also shows peaks around September, with the exception of September 2020, which could indicate a trend of people increasingly returning to transit each year as summer ends and/or school restarts. SFMTA ridership declined more steeply at the beginning of the pandemic and, until September 2022, SFMTA's ridership recovery was below the nationwide recovery trend, indicating that SFMTA was initially slower to recover compared to other transit agencies across the nation. However, through May 2024, both SFMTA and Nationwide ridership recovery hovered around 70 percent, indicating that SFMTA's recovery has caught up.

Figure 8.2 shows the monthly ridership recovery for SFMTA bus service compared to the nationwide trend.

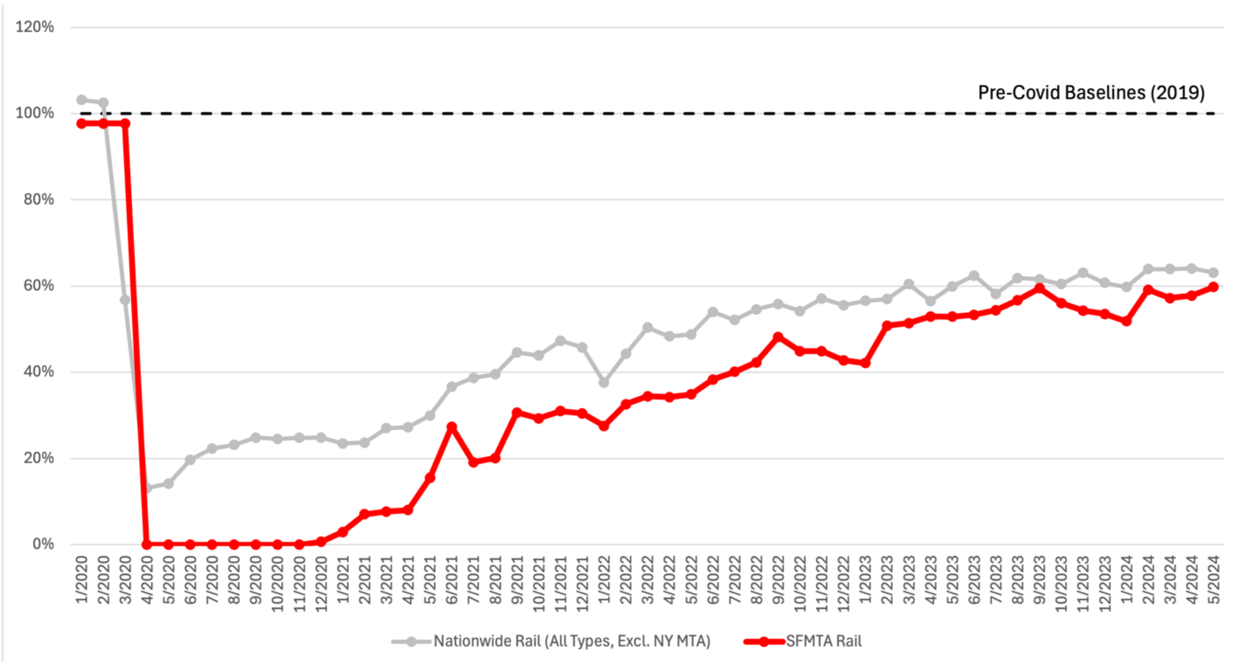
Figure 8.2 Monthly SFMTA Ridership Recovery for Bus Service Compared to the Nationwide Trend



SFMTA's bus ridership recovery declined less steeply compared to overall SFMTA ridership and caught up with the nationwide trend more quickly. Similar to the overall (all transit modes) ridership recovery, bus ridership recovery also experienced peaks around September and dips in the winter months. In September 2023, bus ridership for SFMTA reached nearly 90 percent before slightly declining through the end of the year. Ridership recovery for SFMTA bus rose slightly in 2024 and hovered just above 80 percent through May 2024. Beginning mid-2022, MUNI bus ridership recovery has generally remained on par with the nationwide trend of bus recovery.

Figure 8.3 shows the monthly ridership recovery for SFMTA rail service compared to the nationwide trend.

Figure 8.3 Monthly SFMTA Ridership Recovery for Rail Service Compared to the Nationwide Trend

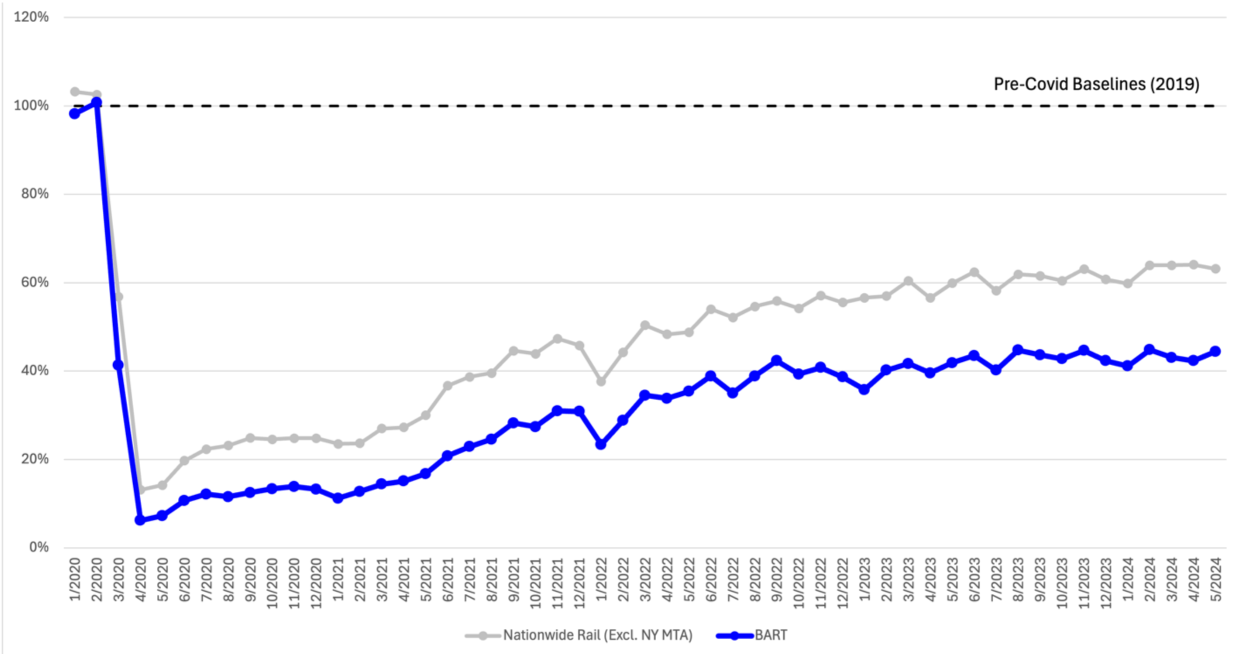


SFMTA paused their rail operations from April 2020 through November 2020, which they did not do for their bus operations. In December 2020 when rail service restarted, SFMTA initially saw slow and volatile recovery, but rail ridership appears to have risen significantly and maintained a steady recovery as of September 2021. That being said, rail recovery for SFMTA remains slightly lower than the nationwide trend. This is consistent with literature suggesting that choice commuters have not returned to rail. As of May 2024, nationwide rail recovery was around 65 percent whereas SFMTA rail recovery was closer to 60 percent.

8.1.2 BART

Figure 8.4 shows the ridership recovery for the Bay Area Rapid Transit (BART) District compared to the nationwide trend.

Figure 8.4 Monthly BART Ridership Recovery Compared to the Nationwide Trend

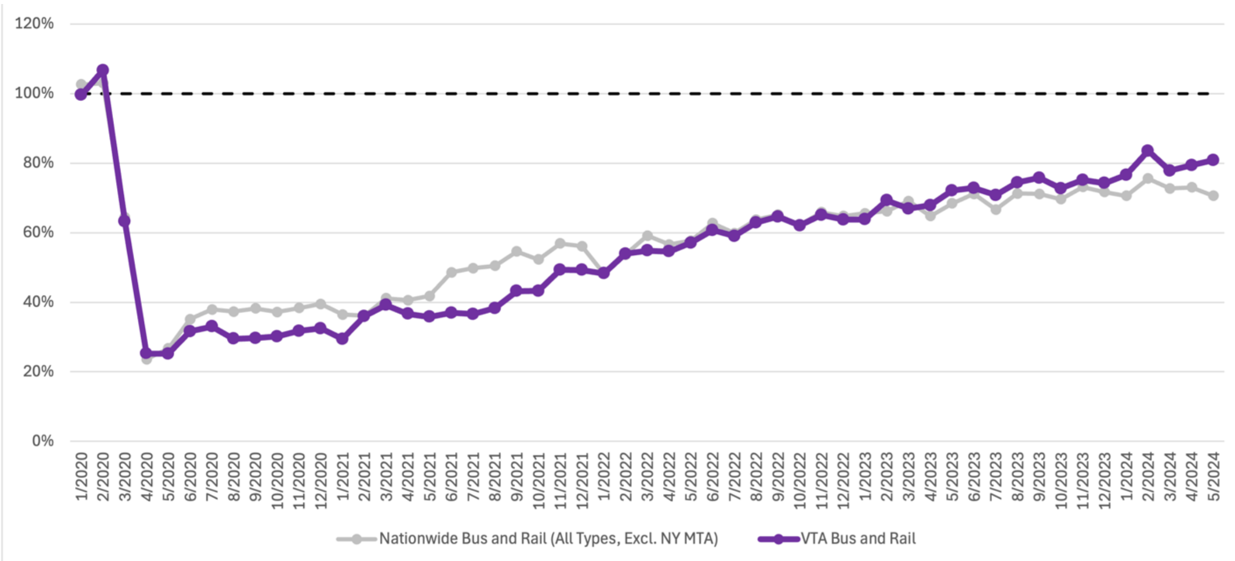


Although the recovery trend for BART and nationwide rail follow a nearly identical pattern, BART ridership dropped more steeply at the beginning of the pandemic and has yet to recover at the same level as other rail agencies throughout the nation. In April 2020, BART ridership was below 10 percent compared to pre-COVID ridership, and ridership has recovered slowly and steadily without any large gains in ridership at any point. Both nationwide and BART recovery experienced a setback around January 2022, which may be attributed to the spread of the omicron variant of COVID-19. BART ridership recovery did not surpass 40 percent until around June 2022 and remained around that figure with only marginal growth toward the end of the year. For much of 2023 and 2024, BART ridership recovery remained between 40 and 45 percent, whereas nationwide rail recovery was between 60 to 65 percent.

8.1.3 VTA

Figure 8.5 shows overall ridership recovery for the Santa Clara Valley Transportation Authority (VTA) compared to the nationwide trend.

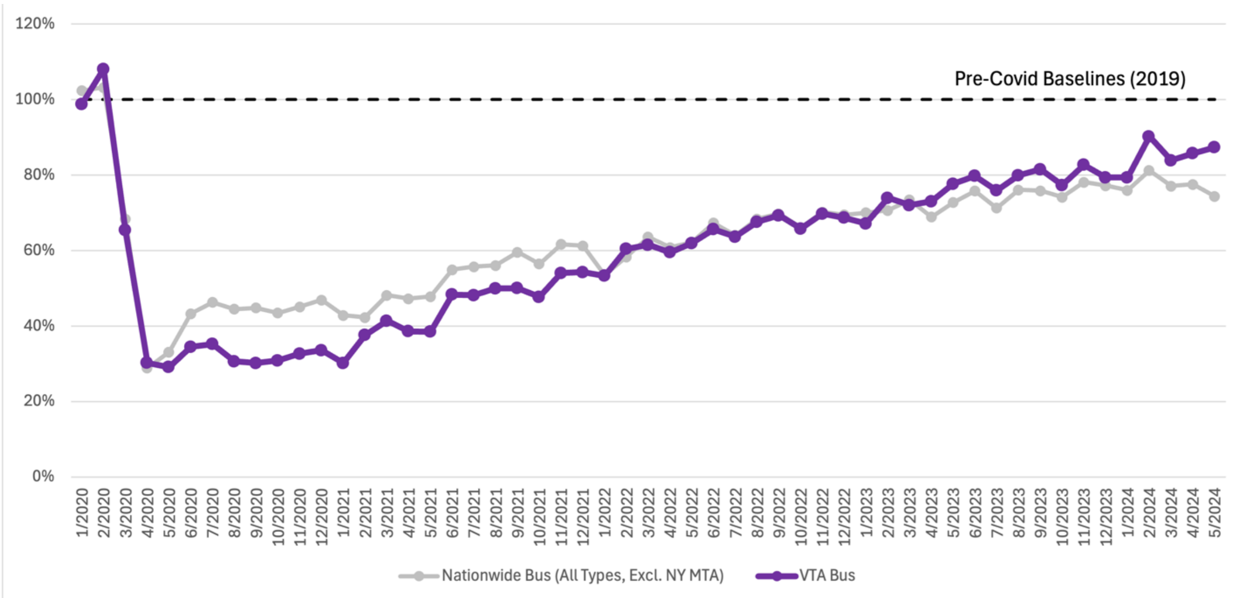
Figure 8.5 Monthly VTA Ridership Recovery for All Available Modes Compared to the Nationwide Trend



VTA's initial decline in ridership appears to be on par with other transit agencies throughout the nation, but remained lower than the nationwide trend for much of the period between April 2020 and December 2021. Starting in January 2022, VTA ridership recovery was nearly identical to the nationwide trend and then began surpassing it slightly toward the end of 2023. Unlike some other agencies, VTA ridership recovery appears to be less impacted by dips during the winter season. With only some slight volatility, VTA has seen a steady recovery since the start of the pandemic. Starting in early 2023, VTA's ridership recovery has been slightly higher than the nationwide trend. As of May 2024, VTA's ridership recovery was just above 80 percent while the nationwide trend was closer to 70 percent.

Figure 8.6 shows ridership recovery for VTA's bus service compared to the nationwide trend.

Figure 8.6 Monthly VTA Ridership Recovery for Bus Service Compared to the Nationwide Trend



The recovery trajectory for VTA bus ridership follows a similar trend to VTA's overall ridership recovery, which may indicate that bus ridership has a greater impact on the agency's overall ridership. Bus ridership initially remained lower than the nationwide trend through December 2021 before following an almost identical recovery path between January 2022 and March 2023 and then slightly surpassing the nationwide trend through the end of the year. VTA's bus ridership has recovered fairly well and was around 90 percent of pre-COVID levels in May 2024 compared to around 75 percent nationwide.

Figure 8.7 Monthly VTA Ridership Recovery for Rail Service Compared to the Nationwide Trend

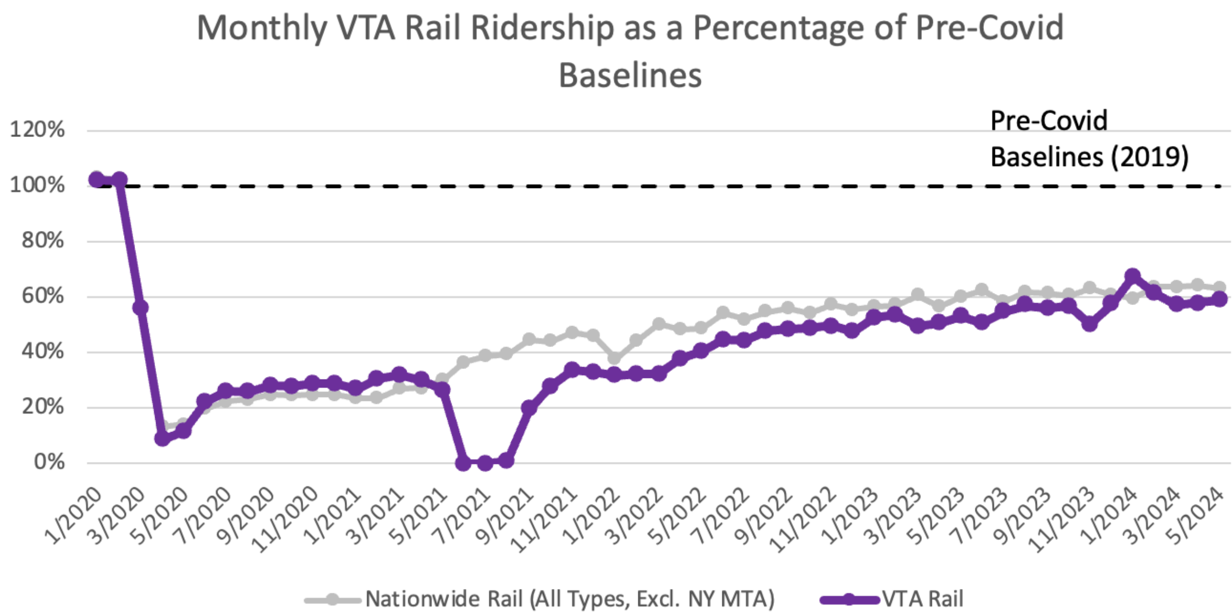
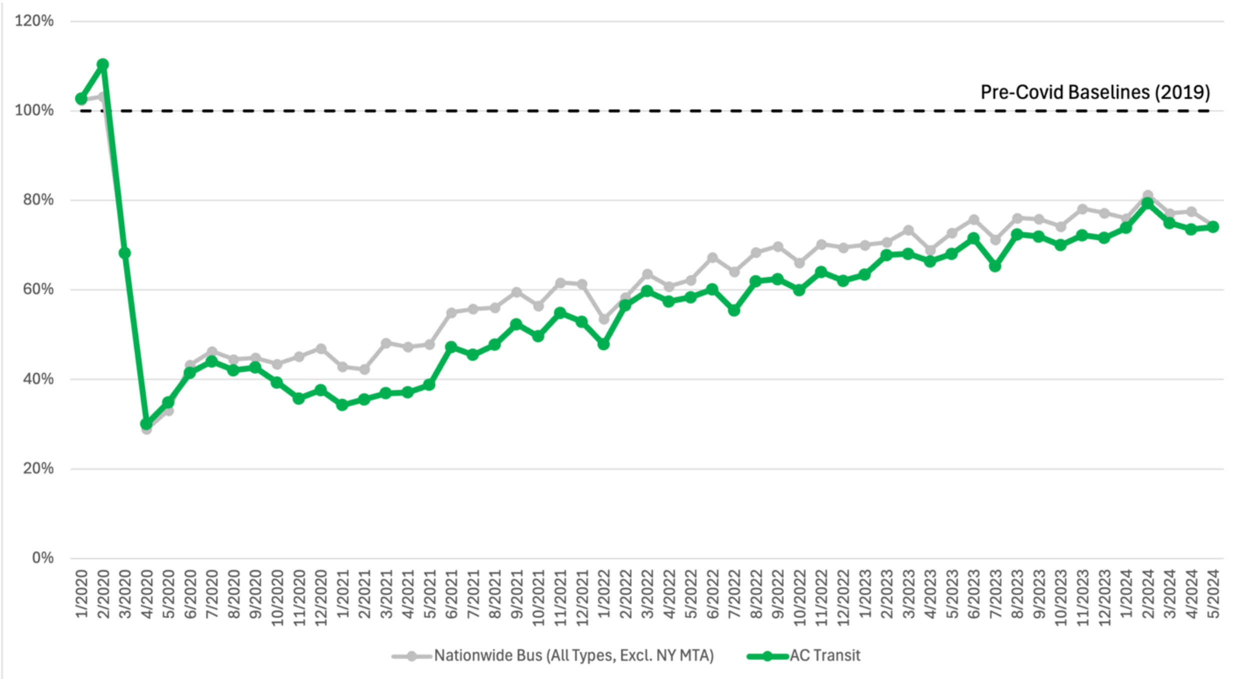


Figure 8.7 shows ridership recovery for VTA's rail service compared to the nationwide trend. Between June 2020 and May 2021, VTA's rail ridership was on trend with nationwide recovery, even slightly exceeding it. This recovery pattern deviates from other rail operators such as BART, Caltrain, and MUNI rail. However, service was paused in June through July 2021 following a mass shooting at the agency's rail maintenance yard at the end of May 2021. When light rail service resumed in August 2021, significant gains in recovery were made through November 2021, but VTA recovery was no longer in line with the nationwide trend. Instead, it trailed behind until reaching a similar point in December 2023 where recovery for both VTA and the nationwide trend were sitting at just under 60 percent of pre-pandemic levels. Despite seeing a slight jump in ridership to 70 percent in January 2024, VTA's rail ridership continued to trail slightly behind the nationwide trend in 2024.

8.1.4 AC Transit

Figure 8.8 shows ridership recovery for the Alameda-Contra Costa Transit (AC Transit) District compared to the nationwide bus recovery trend.

Figure 8.8 Monthly AC Transit Ridership Recovery Compared to the Nationwide Trend

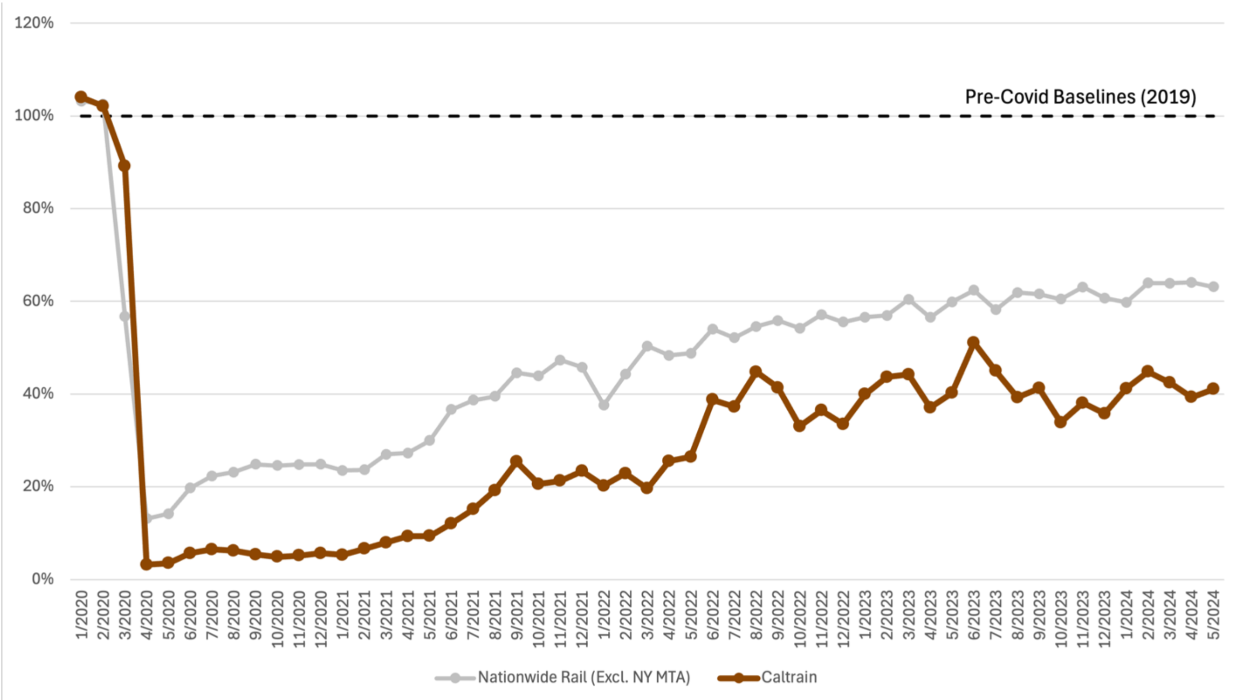


Initial decline in ridership was on par with other agencies with some modest gains in the summer of 2020. However, unlike the nationwide trend, AC Transit ridership recovery declined again through the remainder of 2020 and remained below the nationwide trend, only surpassing nationwide ridership recovery in December 2023. That being said, AC transit ridership recovery generally followed a similar pattern to the nationwide trend and did not trail too far behind. AC transit ridership continued to closely trail the nationwide trend in 2024 with both sitting just above 70 percent in May 2024.

8.1.5 Caltrain

Figure 8.9 shows Caltrain ridership recovery compared to the nationwide trend for rail.

Figure 8.9 Monthly Caltrain Ridership Recovery Compared to the Nationwide Trend

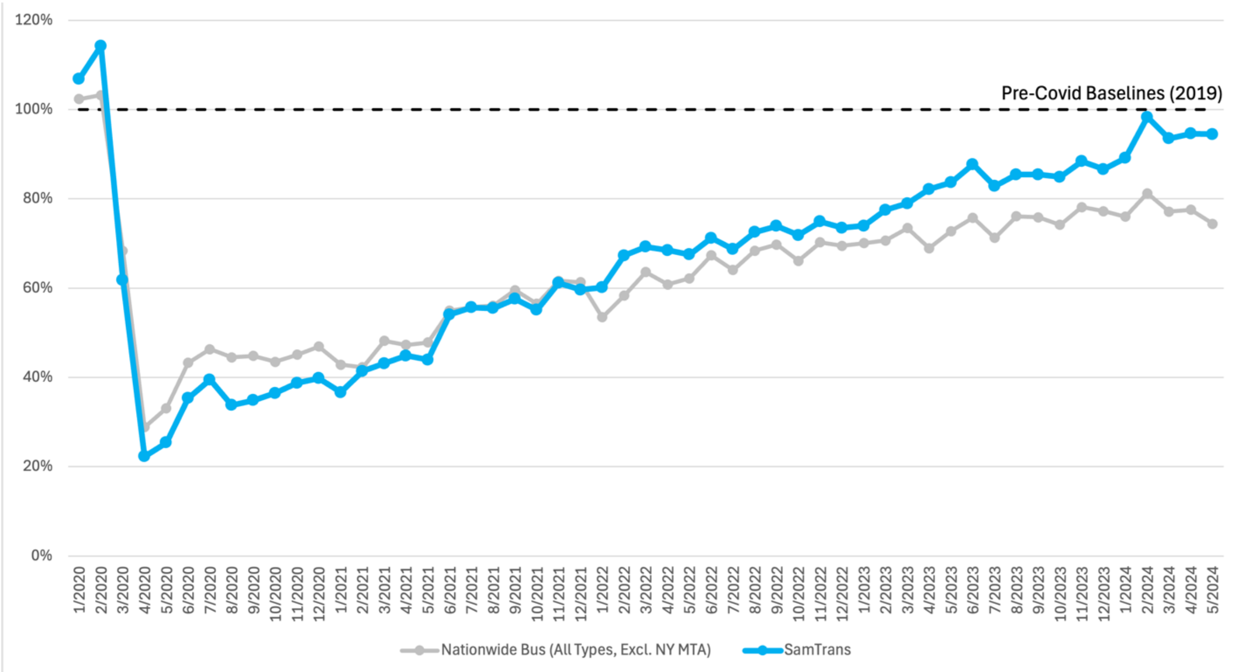


Although Caltrain ridership did not decline nearly as much compared to the nationwide trend in March 2020, ridership in April 2020 fell to just around 5 percent compared to pre-COVID levels and remained under 10 percent through May 2021. During that period, ridership recovery remained steady and then rose sharply through September 2021 compared to previous months. From that point, ridership recovery was slightly volatile with some substantial peaks in August 2022 and June 2023. Unlike other Bay Area agencies, Caltrain's ridership recovery does not follow a similar, steady pattern of recovery as that of the nationwide trend. This may be attributed to service interruptions from construction related to the Caltrain electrification project, which is expected to conclude by the Fall of 2024. Caltrain has struggled more than most agencies to recover ridership and, as of May 2024, sits at just above 40 percent of pre-COVID levels compared to around 65 percent nationwide.

8.1.6 SamTrans

Figure 8.10 shows ridership recovery for the San Mateo County Transit District (SamTrans) compared to the nationwide bus recovery trend.

Figure 8.10 Monthly SamTrans Ridership Recovery Compared to the Nationwide Trend

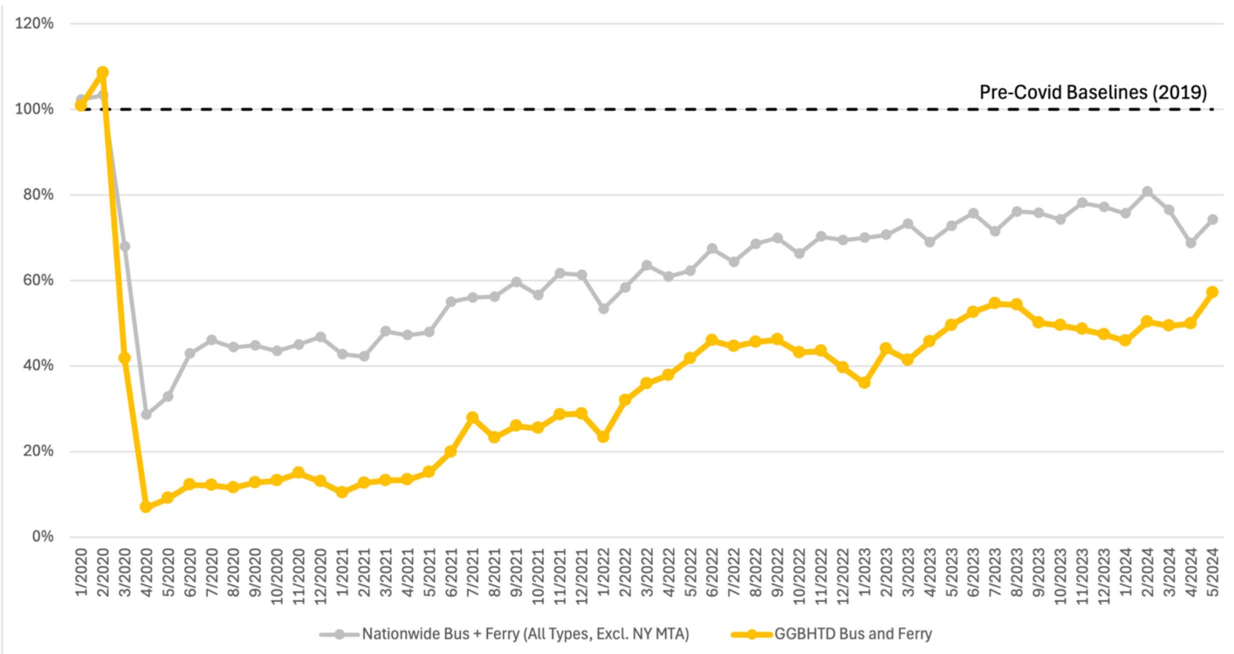


While SamTrans ridership initially declined more steeply and remained below the nationwide trend, the agency quickly caught up and recovery was pretty much on par with the nationwide trend from June 2021 through December 2021. While other bus agencies in the U.S. saw a slight decline in ridership recovery in January 2022, SamTrans ridership actually continued to recover instead of dipping and has remained above the nationwide trend since. Interestingly, SamTrans' recovery pattern seems to deviate from the nationwide trend starting in February 2023. While nationwide bus recovery was slightly volatile from February 2023 through June 2023, SamTrans ridership continued to rise steadily. In June 2023, SamTrans ridership reached nearly 90 percent of pre-COVID levels and hovered between 80 and 90 percent through the end of the year. SamTrans ridership continued to recover through May 2024 and even reached nearly 100 percent of pre-COVID ridership in February 2024. The nationwide trend for bus ridership has remained around 75 percent in 2024 while SamTrans ridership has been above 90 percent.

8.1.7 Golden Gate

Figure 8.11 shows the overall ridership recovery for the Golden Gate Bridge Highway and Transportation District (GGBHTD) compared to the nationwide trend.

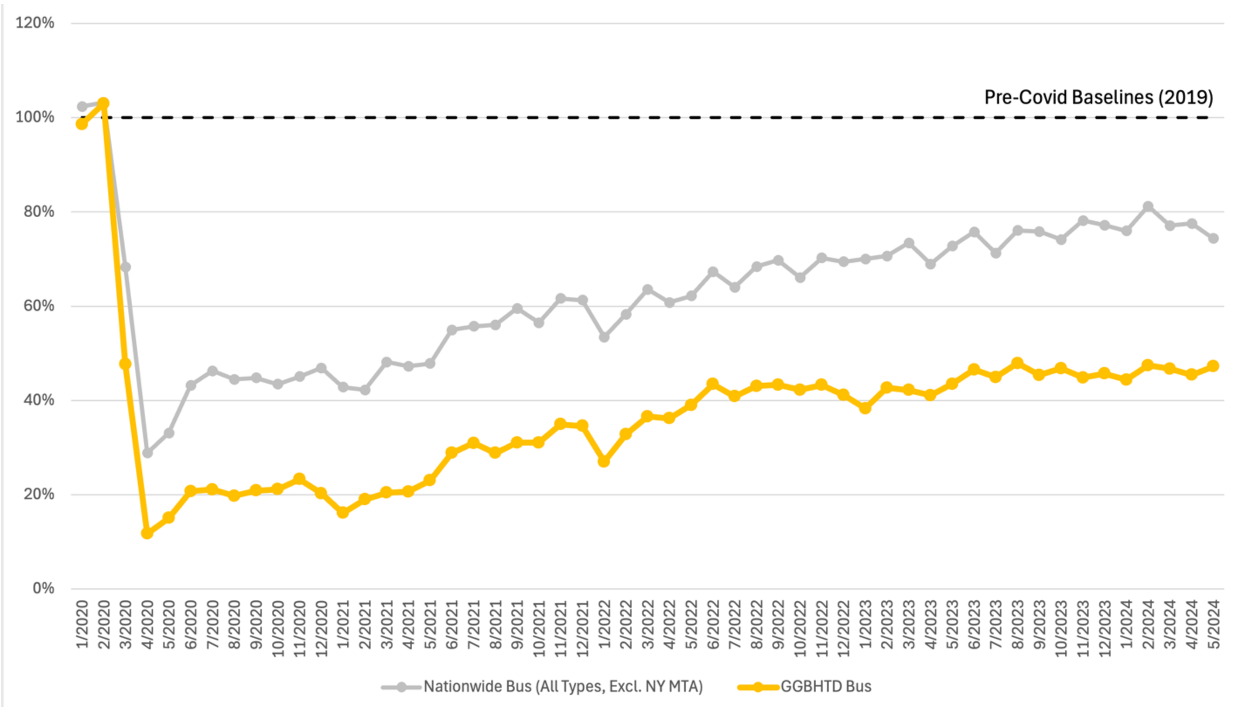
Figure 8.11 Monthly GGBHTD Ridership Recovery for All Available Modes Compared to the Nationwide Trend



Although GGBHTD provides bus and ferry services, its ridership recovery is on par with other Bay Area commuter rail agencies, such as BART and Caltrain. At the start of the pandemic, ridership declined more severely compared to the nationwide trend and dropped to less than 10 percent in April 2020. Recovery has remained substantially lower than the nationwide trend and appears to have been more heavily impacted by declines in ridership during the winter months. As of May 2024, GGBHTD ridership was a little under 60 percent of pre-COVID levels compared to around 75 percent nationwide.

Figure 8.12 shows the ridership recovery for GGBHTD's bus service compared to the nationwide trend.

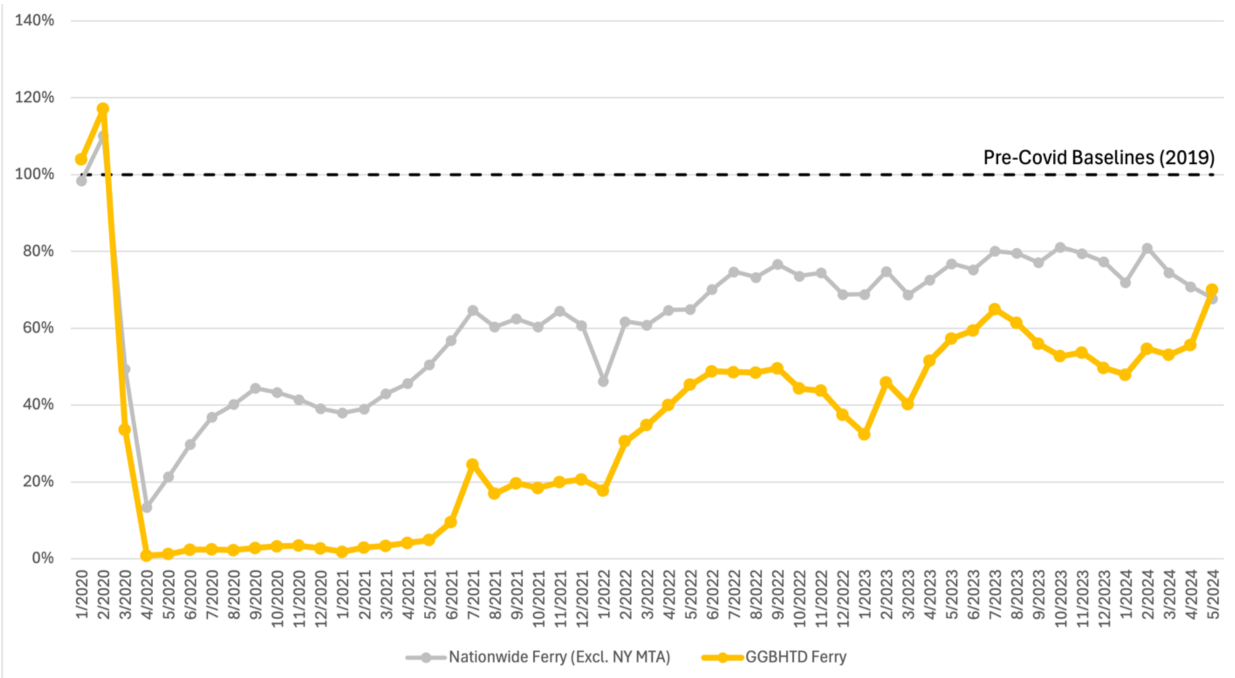
Figure 8.12 Monthly GGBHTD Ridership Recovery for Bus Service Compared to the Nationwide Trend



As mentioned above, GGBHTD's recovery is on par with that of Bay Area commuter rail agencies and is struggling to match the recovery levels of other bus service providers. GGBHTD's focus is transit to and from San Francisco from other parts of the region, so the comparatively low ridership recovery could be indicative of a decline in the need for trips into San Francisco. In May 2024, GGBHTD's bus ridership recovery was around 45 percent compared to around 75 percent nationwide. This is the same as the overall recovery trend for all GGBHTD modes, indicating that bus ridership more heavily impacts the agency's overall ridership.

Figure 8.13 shows the ridership recovery of GGBHTD's ferry service compared to the nationwide trend.

Figure 8.13 Monthly GGBHTD Ridership Recovery for Ferry Service Compared to the Nationwide Trend



From the beginning of the pandemic through June 2021, GGBHTD's ferry ridership remained extremely low at less than 10 percent of pre-COVID levels. In July 2021, however, the agency saw a substantial jump in ridership to around 25 percent before stabilizing at around 20 percent for the following few months. Starting in February 2022, ridership increased fairly significantly and stabilized at around 50 percent through September 2022. Ridership then dips again and peaks once more at around 65 percent in July 2023 before declining again through the end of the year. Ridership recovery for GGBHTD's ferry ridership does not appear to follow the nationwide trend and seems to peak during summer months before declining again. These gains in ridership recovery during the summer season may be attributed to tourists visiting the Bay Area. The declines in ridership following summer months could be attributed to a decline in the need for trips to San Francisco. As expected, GGBHTD's ferry ridership began to rise again toward the 2024 summer season. However, for the first time, ridership surpassed the nationwide trend sitting slightly above at 70 percent.

8.1.8 Marin Transit

Figure 8.14 Monthly Marin Transit Ridership Recovery Compared to the Nationwide Trend

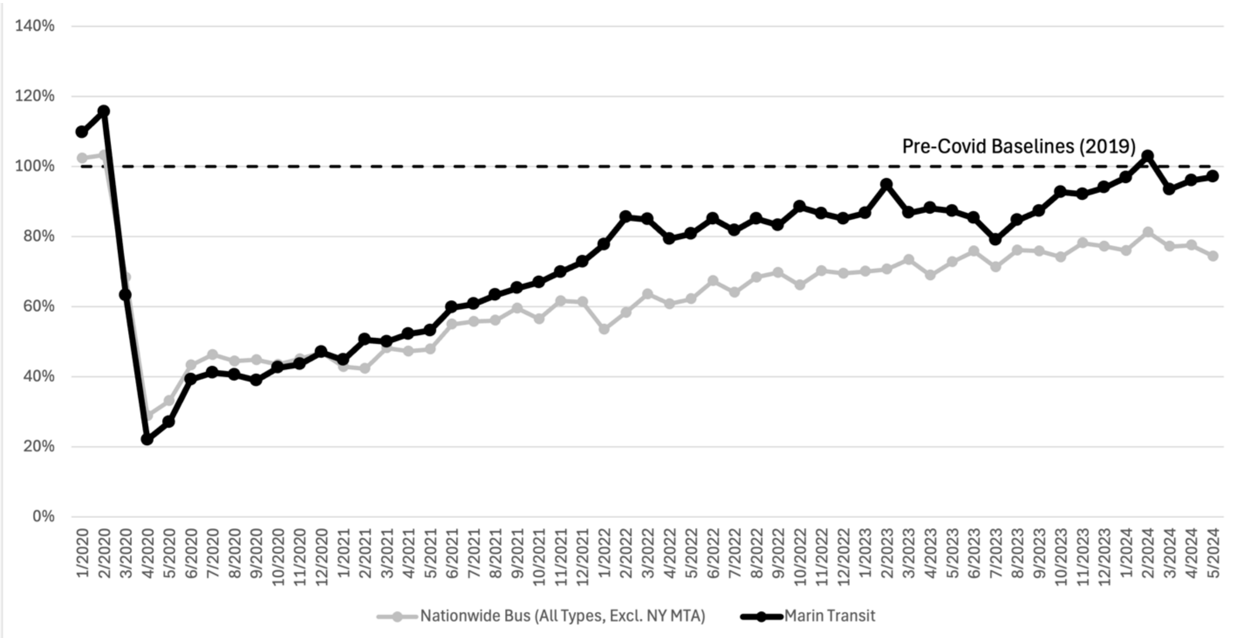


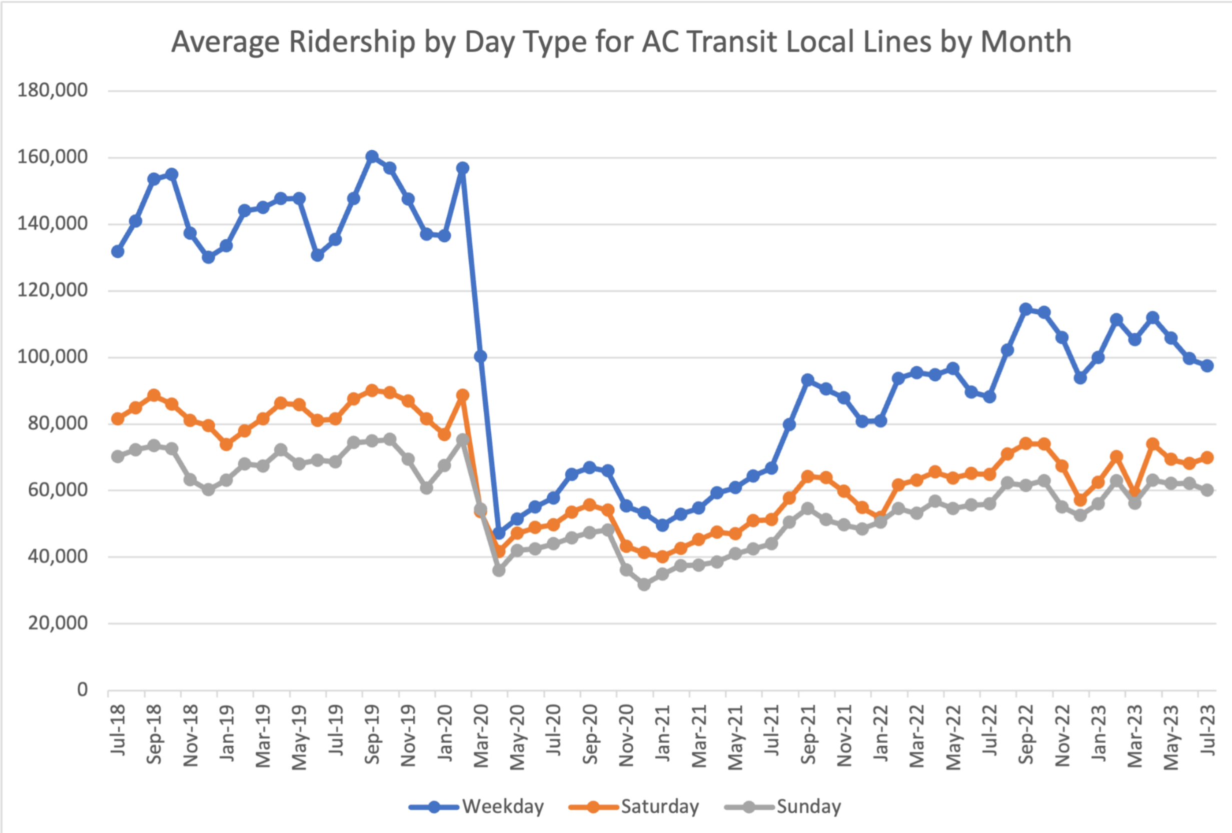
Figure 8.14 shows the ridership recovery for Marin Transit compared to the nationwide recovery trend for bus service. Marin transit initially closely followed behind the nationwide trend, but then quickly surpassed other bus transit providers in the nation by January 2021. Although the agency initially dropped to around 20 percent of pre-COVID ridership at the beginning of the pandemic, it reached 80 percent of pre-COVID ridership by February 2022 and has, for the most part, maintained ridership recovery above the 80 percent threshold. For most of 2023, ridership recovery for the agency was near or above 90 percent compared to between 70 and 80 percent nationwide. In February 2024, Marin Transit ridership briefly surpassed pre-COVID ridership levels, while in the following months it continued to sit closer to 100% of pre-COVID levels.

8.2 Focused Analysis of Ridership at select Bay Area Transit Operator Case Studies

8.2.1 AC Transit

Figure 8.15 shows the sum of average monthly ridership across all AC Transit local lines by day type (weekday, Saturday, and Sunday) for a five-year period between July 2018 and July 2023.

Figure 8.15 Average Monthly Ridership for AC Transit Local Lines by Day Type



Trends for weekday, Saturday, and Sunday service have generally followed a similar pattern. Consistent with nationwide trends, ridership began dropping in March 2020 and fell to some of the lowest levels in April 2020 before increasing steadily through September 2020. However, ridership began falling again between October and November 2020 and continued a downward trend until ridership began picking back up in January 2021 (it is not unusual to see ridership levels drop around the winter holiday season). From the beginning of 2021, ridership steadily increased through July 2021 and jumped up between August and September 2021. From that point, ridership levels fluctuated and appear to have reached all-time ridership highs since the pandemic around September and October 2021. In September 2022, ridership levels seem to have plateaued at around 60 percent of pre-pandemic ridership for weekday service and around 75 percent of pre-pandemic ridership for Saturday and Sunday service.

Figure 8.16 Average Monthly Ridership for AC Transit Local Lines by Day Type as a Percentage of Pre-COVID Ridership

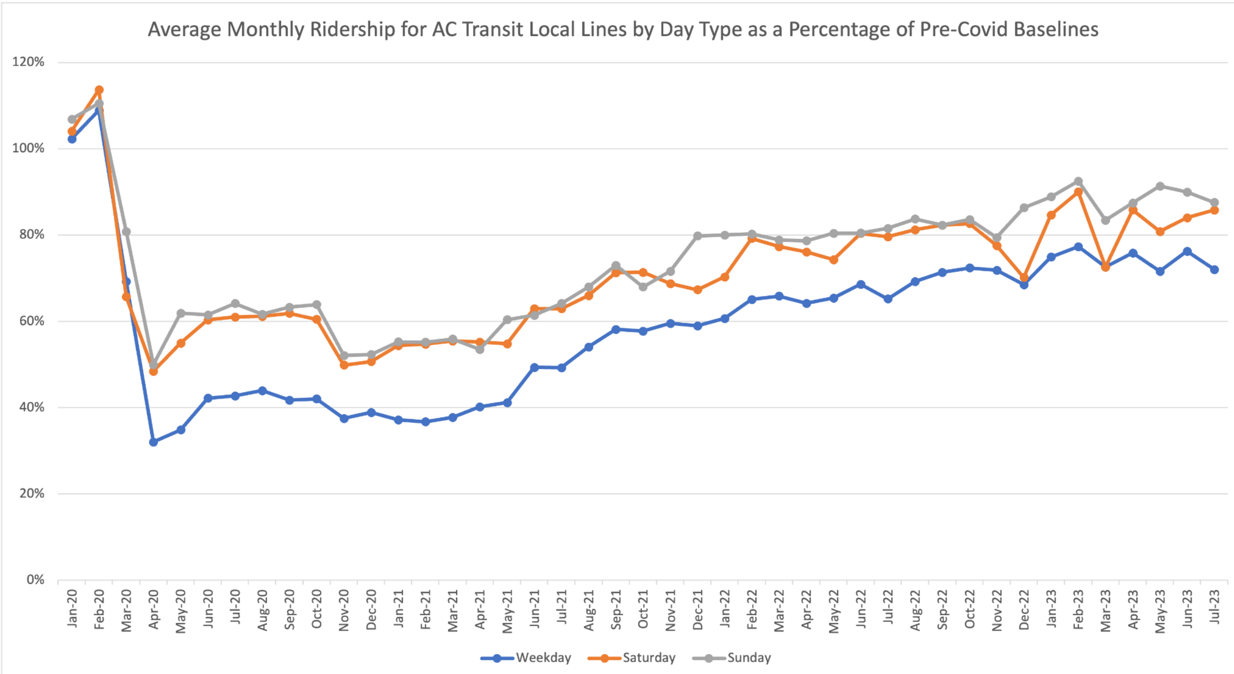


Figure 8.16 shows the average monthly ridership for all AC Transit local lines by day type as a percentage of pre-COVID ridership from January 2020 through July 2023, calculated using 2019 ridership averages for the corresponding month. Consistent with nationwide trends, there was a drastic drop in ridership at the start of the pandemic in March 2020, which continued to all-time lows in April 2020. Weekday ridership dropped more significantly compared to weekend ridership and comparatively has not recovered to the same levels. That being said, the ridership recovery levels across all day types are generally shown to follow a consistent pattern of recovery.

Figure 8.16 shows a trend of ridership recovering through the summer months and then dipping slightly or plateauing around the winter months. This may indicate that recovery gains increased through the summer months, but lost momentum toward the winter months. A possible factor impacting ridership recovery for the winter months could be increased concerns about the risk of exposure to illnesses during the season. Overall, ridership recovered modestly through July 2023, with some fluctuation. Consistent with findings from the literature, ridership for these local bus lines recovered faster compared to rail, and weekend ridership recovered faster compared to weekday ridership. This could be attributed to riders who rely on the bus to get around continuing to take the bus throughout the pandemic as it was their only option. As of July 2023, weekday ridership for local lines was at 72 percent of pre-pandemic levels and weekend ridership for local lines was above 85 percent.

Total average monthly weekday ridership is shown in Figure 8.16 to have higher ridership numbers compared to the total averages for Saturday and Sunday. However, Figure 8.16 shows that weekend (Saturday and Sunday) ridership percentages of pre-COVID ridership levels for local lines decreased less than weekday ridership at the beginning of the pandemic and remained higher throughout the pandemic and after. The plots for ridership recovery percentages compared to total ridership averages appear to be steadier as well, especially after the winter 2020 drop in ridership. Unlike in Figure 8.15 where ridership trends consistently show a drop in ridership during the winter of each year, ridership as a percentage of recovery compared to the same 2019 month shows that ridership continued to recover in 2021 and 2022 during the winter months. Overall, the ridership charts for the AC Transit local lines show that ridership has been slowly, but surely recovering throughout the pandemic and after.

Figure 8.17 Average Monthly Ridership for AC Transit Transbay Lines by Day Type

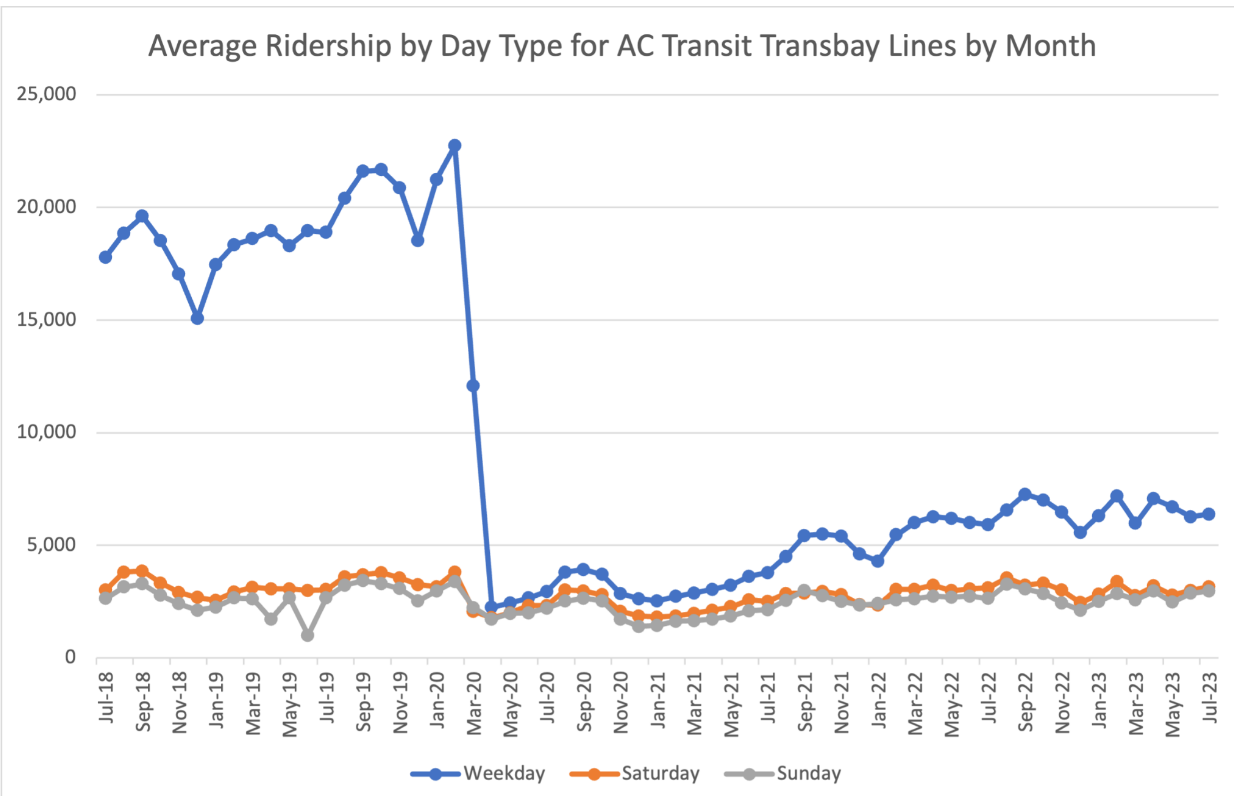


Figure 8.17 shows the total average monthly ridership for all AC Transit transbay lines by day type for a 5-year period between July 2018 and July 2023. Weekday ridership dropped significantly in March 2020 through April 2020 and then began a modest recovery through September 2020 before declining again through the end of the year. While the ridership decrease follows a similar trend to a lesser degree, Saturday and Sunday transbay ridership levels did not drop nearly as drastically and have stabilized compared to weekday ridership, which remains extremely low as numbers are closer to weekend ridership numbers than weekday ridership numbers from before the pandemic.

Figure 8.18 Average Monthly Ridership for AC Transit Transbay Lines by Day Type as a Percentage of Pre-COVID Ridership[34]

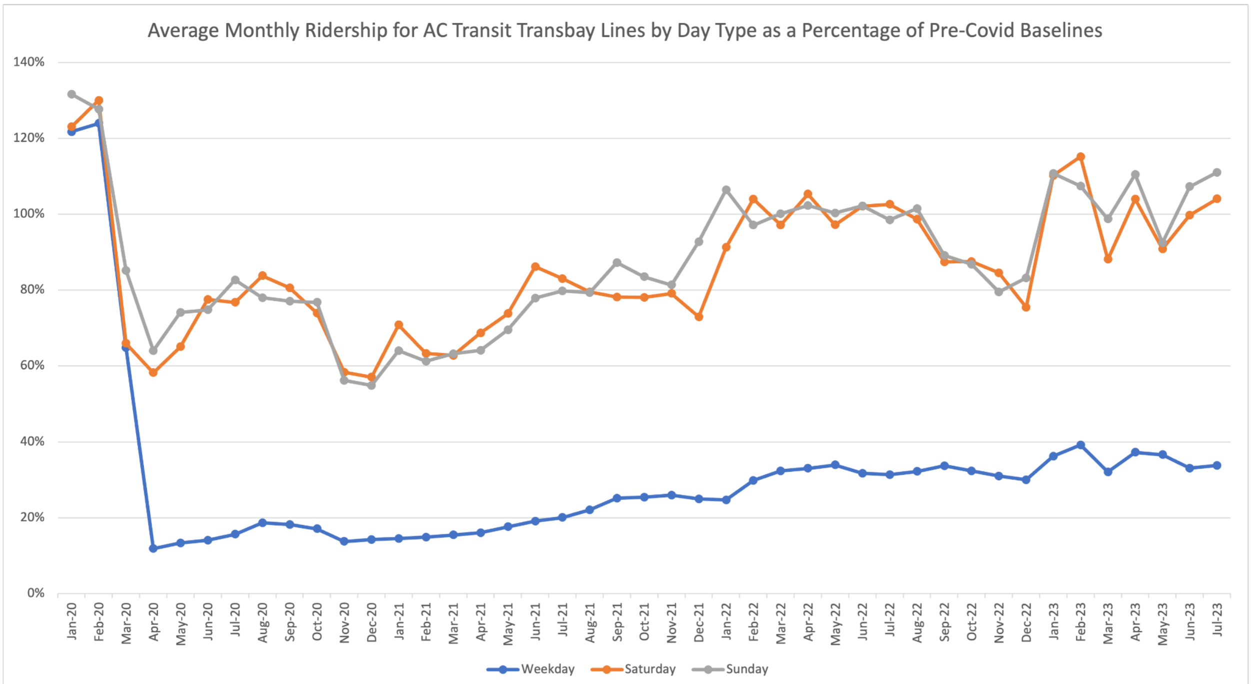


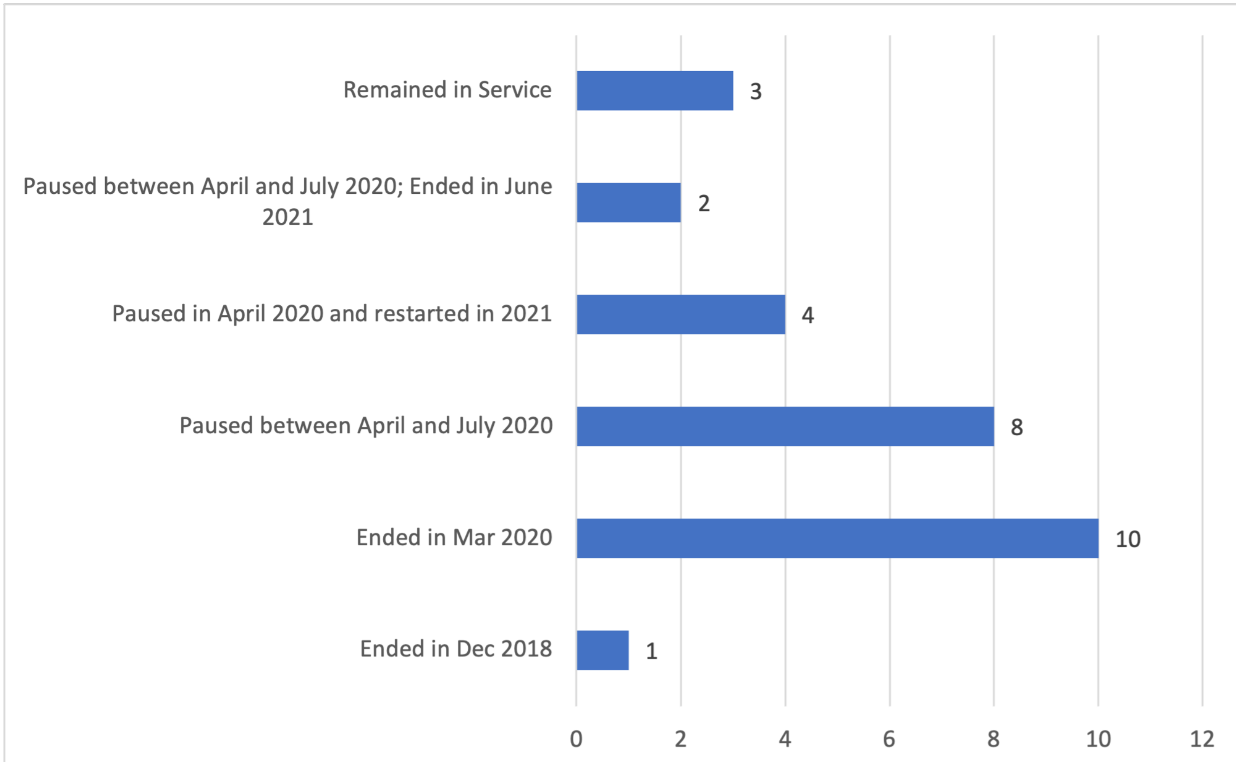
Figure 8.18 shows the average monthly ridership for all AC Transit local lines by day type as a percentage of pre-COVID ridership from January 2020 through July 2023, calculated using 2019 ridership averages for the corresponding (or similar) month. Transbay ridership recovery trends differ from the trends for local lines. Weekend ridership levels dropped far less significantly compared to weekday ridership levels. At the lowest points, weekend transbay ridership remained above 55 percent of pre-pandemic levels whereas weekday transbay ridership fell to only 12 percent at the lowest point in April 2020. Weekend ridership recovery has been much more volatile than weekday ridership, which has been relatively steady. Volatility could be attributed to smaller denominations for weekend ridership. As of July 2023, weekday transbay ridership levels were less than 40 percent of pre-pandemic levels while weekend ridership appears to have recovered. This indicates that weekday riders of the transbay likely had a higher proportion of choice riders compared to weekend riders. Low transbay weekday ridership may also be a factor of remote work eliminating the need to commute to San Francisco.

The trends shown in Figure 8.18 are consistent with the trends for ridership averages shown in Figure 8.17. Weekday transbay line ridership decreased drastically more compared to weekend ridership, and recovery has been slow through July 2023. AC Transit has responded accordingly, cutting some transbay lines to align operation with lower demand. Figure 8.19 shows service timelines among the different transbay to San Francisco AC transit lines. After the pandemic, a

[34] Baseline ridership values for the months of April and June were substituted with 2019 ridership values from May and July, respectively, due to inconsistencies in the values for April and June 2019.

total of 15 transbay weekday lines to San Francisco (excluding early bird express) remain in service. It appears that the lines kept running throughout the pandemic had the highest ridership levels pre-pandemic and the lines that had service paused or were canceled had lower ridership levels comparatively.

Figure 8.19 Service Timelines Among the Different Transbay to SF Lines (Excludes the U Line Between Fremont and Stanford)



8.3 Conclusions

While in most cases Bay Area transit operators have witnessed lower rates of transit ridership than the national average, our research has shown that this difference has varied widely among bus and rail operators and among services serving major regional downtown destinations and those primarily serving communities outside of the downtown. In many cases, these ridership levels have approached—and in some cases exceeded—average U.S. ridership recovery levels.

Similar to what has been witnessed in many other U.S. metropolitan areas, our analyses of post-2019 transit ridership figures reveal that Bay Area bus systems have generally recovered ridership at a higher rate than their rail counterparts. While not all bus operators have recovered ridership levels at the same rate, they have generally been higher than the ridership recovery levels experienced by the Bay Area rail operators. For example, bus systems such as AC Transit, Muni, VTA, and SamTrans have consistently shown higher rates of ridership recovery than rail systems (e.g., BART, Caltrain). This is even true among multimodal operators, such as Muni or VTA, where bus ridership in late 2023 was between 75 and 80 percent of what it was in 2019, while rail ridership was just below 60 percent at both operators.

It should additionally be noted that two of the rail operators, Muni and VTA, actually shut down rail services for an extended period of time, the former as a response to the COVID pandemic and perceived cost savings through limited bus deployment, and the latter as a result of a mass shooting at the VTA rail yard in San José. In each case, it can be argued that these temporary halts in service further delayed recovery, and resulted in ridership lagging behind nationwide averages.

Another major finding from these analyses was that transit ridership recovery rates among transit operators have additionally tended to be lower on services that feature downtown San Francisco service, particularly during peak times. The Muni, BART, and Caltrain rail systems, which have prominently served downtown San Francisco and its financial and high-tech employment centers, have experienced very slow ridership recovery rates.

Similarly, bus systems that largely serve work trips to and from downtown have also seen slower recovery rates, such as Golden Gate Transit and AC Transit. Bus systems less focused on serving work trips to downtown employment centers have fared better. Ridership figures for these operators have shown that individual lines that did not serve downtown saw higher ridership recovery rates than the downtown-bound lines. In contrast, transbay AC Transit ridership after March 2020 showed the huge impact that the pandemic had on weekday service in contrast to weekend services on the same transbay lines.

9. Appendix C: Operator Level of Service Changes

9.1 Service Supply Components

9.1.1 Service supply: Vehicle revenue-hours at the Bay Area's "Big 7" transit operators

Vehicle Revenue Hour (VRH) percentages for eight Bay Area transit agencies were graphed and analyzed to identify trends in service levels from the start of the pandemic through May 2024. Results were also summarized for Marin Transit, an exemplary small operator. The graphs present VRH as a percentage of pre-COVID baselines for the agencies as a whole and are also broken down by mode where applicable. Each graph also presents corresponding nationwide VRH recovery trends with data from the Metropolitan Transportation Agency of New York (NY MTA) removed. Using data obtained from the National Transit Database (NTD), percentages of pre-COVID baselines were calculated by taking the sum of VRHs for each month and dividing by the sum of VRHs for the corresponding month in 2019.

SF MUNI

Figure 9.1 shows the monthly overall VRH recovery for the San Francisco Municipal Transportation Authority (SFMTA) compared to nationwide recovery.

Figure 9.1 Monthly SFMTA VRH Recovery for All Available Modes Compared to the Nationwide Trend

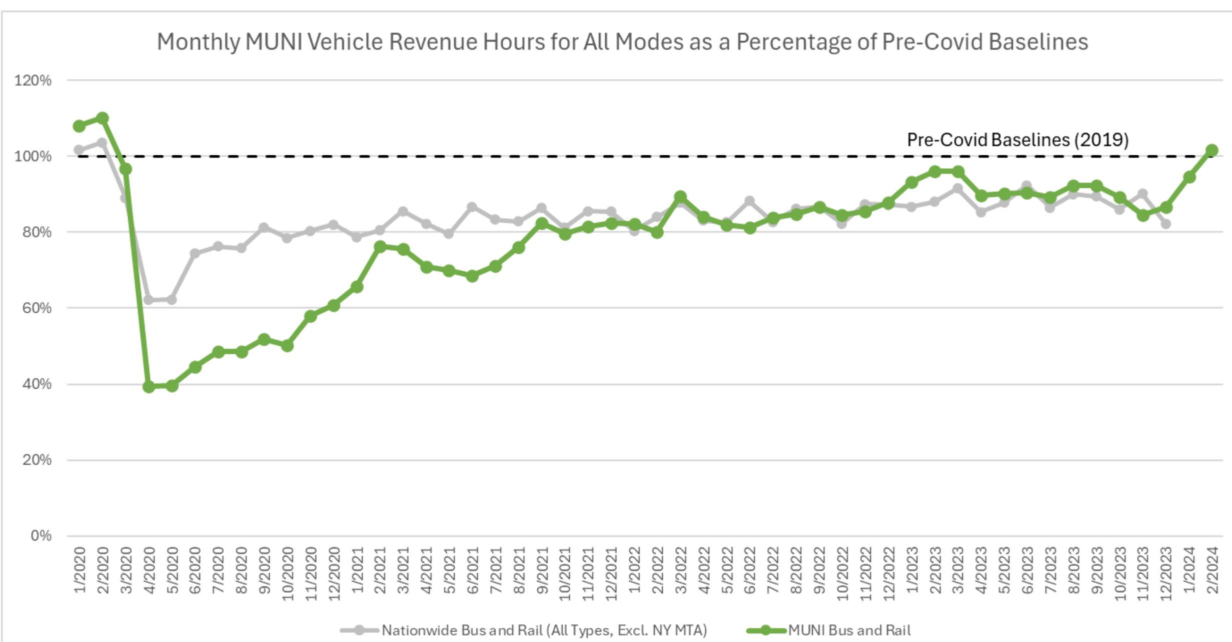
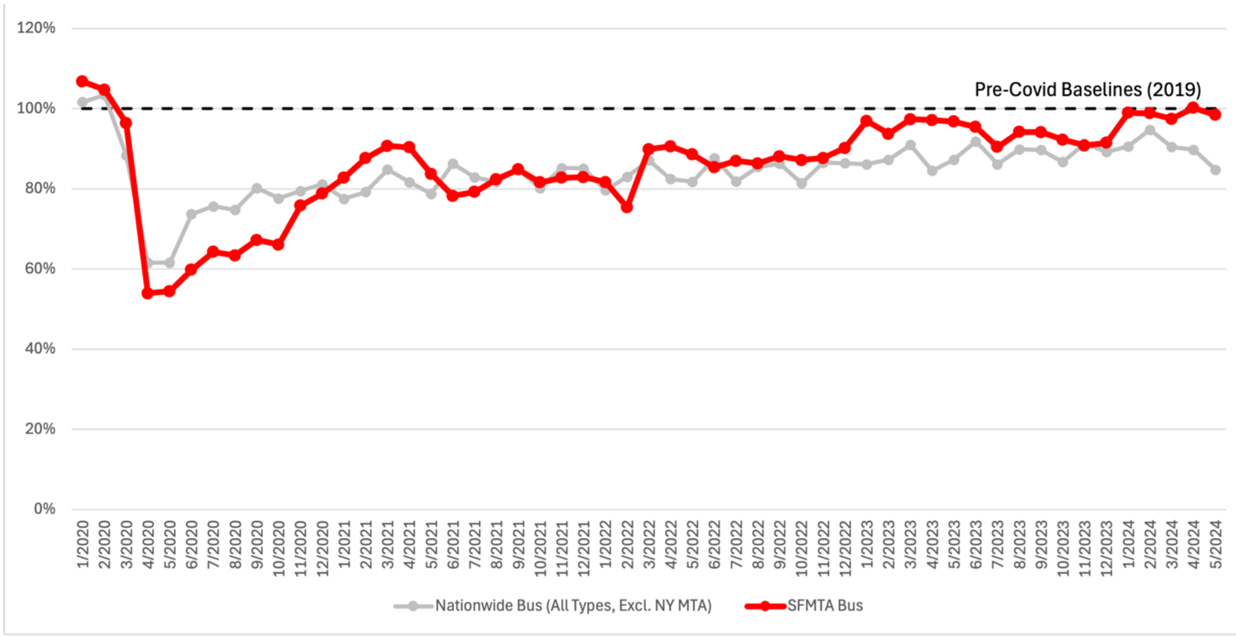


Figure 9.2 Monthly SFMTA VRH Recovery for Bus Service Compared to the Nationwide Trend



SFMTA initially operated at a much lower service level of 40 percent compared to the nationwide low of slightly above 60 percent, roughly from April 2020 until February 2021. Beginning in September 2021, SFMTA's VRH recovery has remained fairly consistent with the nationwide trend. The initial dip at the beginning of the pandemic can likely be attributed to SFMTA pausing light rail service from April 2020 through November 2020. For 2023, SFMTA VRH recovery appears to have stabilized at around 90 percent of pre-COVID service levels. In 2024, SFMTA service levels peaked at above 100% of pre-COVID service levels in February before dropping back to around 90 percent in the following months.

Figure 9.2 shows the monthly VRH recovery for SFMTA bus service compared to the nationwide trend. Generally, the VRH recovery for bus service only dipped slightly below the nationwide trend at the beginning of the pandemic from April 2020 through December 2020 and at some other points later in the pandemic, including May and June 2021 and February 2022. For the most part, MUNI bus service has kept up with or slightly exceeded the nationwide trend for bus VRH recovery. For 2023, VRH recovery generally remained between 90 and 100 percent for MUNI and between 80 and 90 percent nationwide. In 2024, VRH recovery for SFMTA bus remained constant at around 100 percent.

Figure 9.3 Monthly SFMTA VRH Recovery for Rail Service Compared to the Nationwide Trend

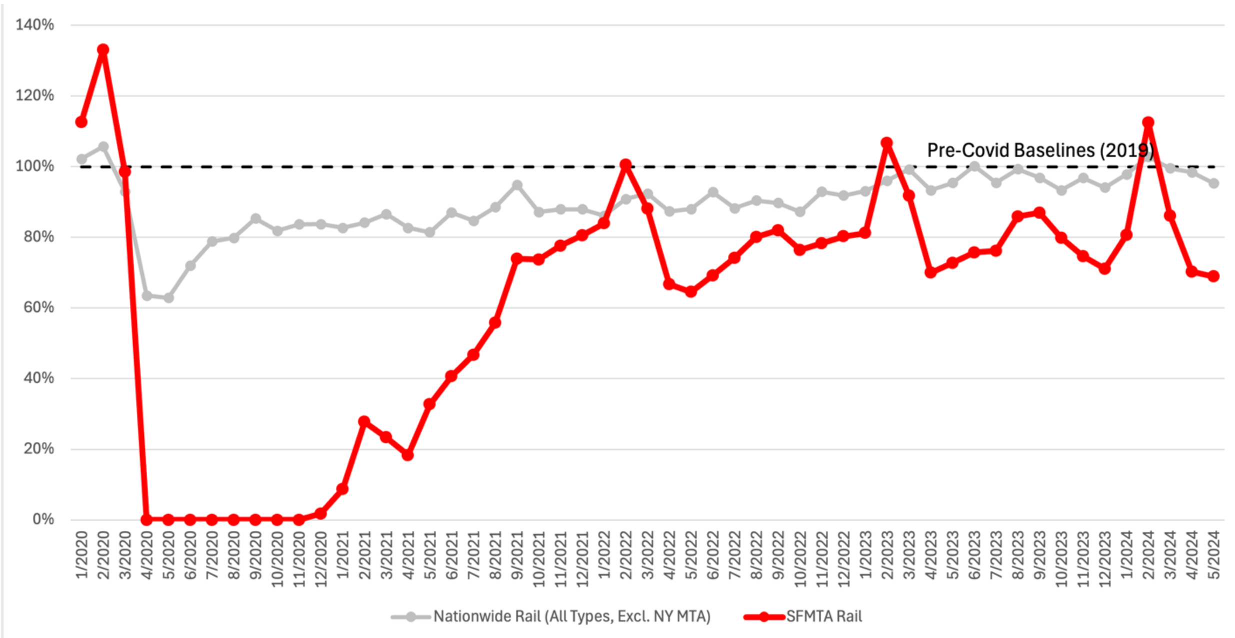
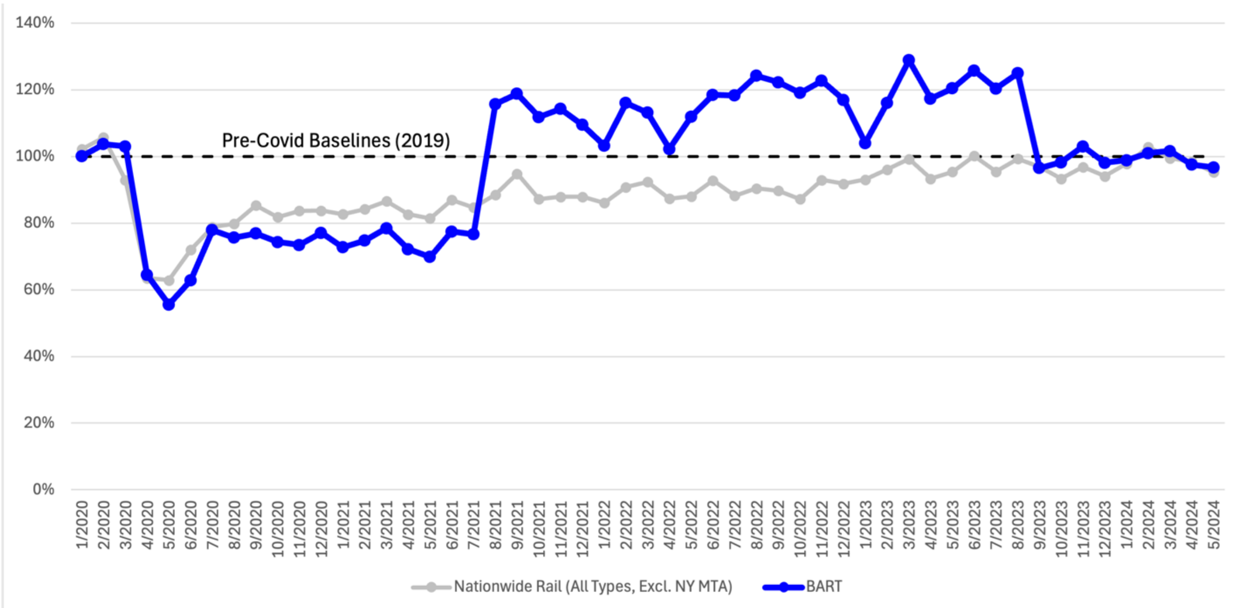


Figure 9.3 shows the monthly VRH recovery for SFMTA rail service compared to the nationwide trend. VRH remained consistent with the pre-COVID baseline for March 2020, then dropped to zero from April 2020 through November 2020 due to SFMTA pausing light rail service. In December 2020, VRH recovered slowly at first, dipped slightly between February and April 2021, then recovered substantially and caught up with the nationwide trend in January 2021. VRH recovery peaked around February 2022, February 2023, and February 2024. After each of these peaks, there is a sizable drop in VRH recovery levels which suggests that SFMTA may ramp up service levels in February for some reason. Generally, rail recovery for SFMTA has remained below the nationwide trend, which did not drop as much and remained relatively stable since the beginning of the pandemic, fluctuating between 80 and 100 percent since August 2020. Comparatively, SFMTA rail VRH recovery has fluctuated between 70 and 90 percent of pre-COVID service levels for much of 2023. As of May 2024, SFMTA rail service levels were closer to 70% compared to around 100% nationwide.

BART

Figure 9.4 shows the monthly VRH recovery for BART compared to the nationwide trend.

Figure 9.4 Monthly BART VRH Recovery Compared to the Nationwide Trend



BART initially reduced service slightly more than the nationwide trend through July 2021. However, starting in August 2021, the agency returned to normal service and ran longer trains to allow riders more space to practice social distancing.[35,36] These extended trains may explain a jump in service to levels exceeding those of the 2019 baselines for the period from August 2021 through August 2022. On September 11, 2023, BART implemented its reimagined service plan where it adjusted service to accommodate more off-peak trips and made the full transition to running only the new "Fleet of the Future" trains. In order to achieve this, BART had to run shorter trains and also indicated in their reimagined service plan that shorter trains would enhance feelings of safety while riding BART.[37] The impact of the reimagined service plan was that BART VRH recovery returned to around 100 percent of pre-COVID baselines.

[35] BART, "Bart returns to near-regular service starting 8/2/21," BART.gov, August 2, 2021, https://www.bart.gov/news/articles/2021/news20210802-0.

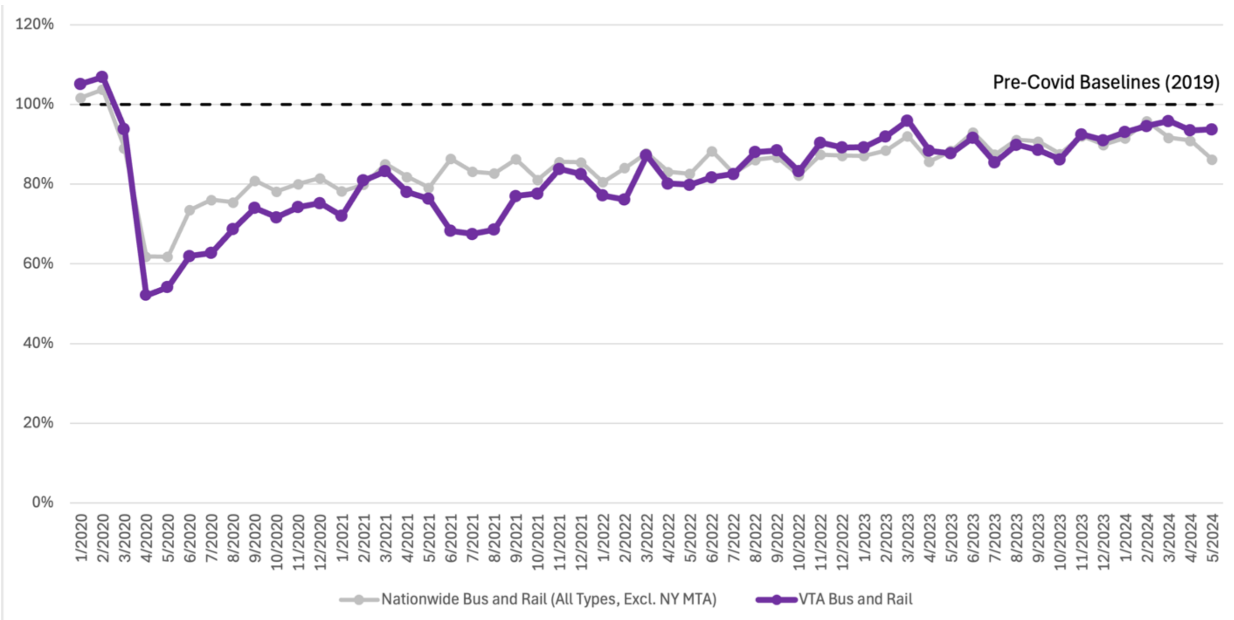
[36] BART, "BART increases service four weeks early starting 8/2/21," BART.gov, July 1, 2021, https://www.bart.gov/news/articles/2021/news20210701#:~:text=Starting%20August%202%2C%202021%2C%20BART,minute%20frequencies%20from%208pm%2Dmidnight.

[37] BART, "BART's reimagined schedule starts September 11th aimed at increasing ridership," BART.gov, September 5, 2023, https://www.bart.gov/news/articles/2023/news20230427.

VTA

Figure 9.5 shows the monthly overall recovery levels for the Santa Clara Valley Transportation Authority (VTA) compared to the nationwide trend.

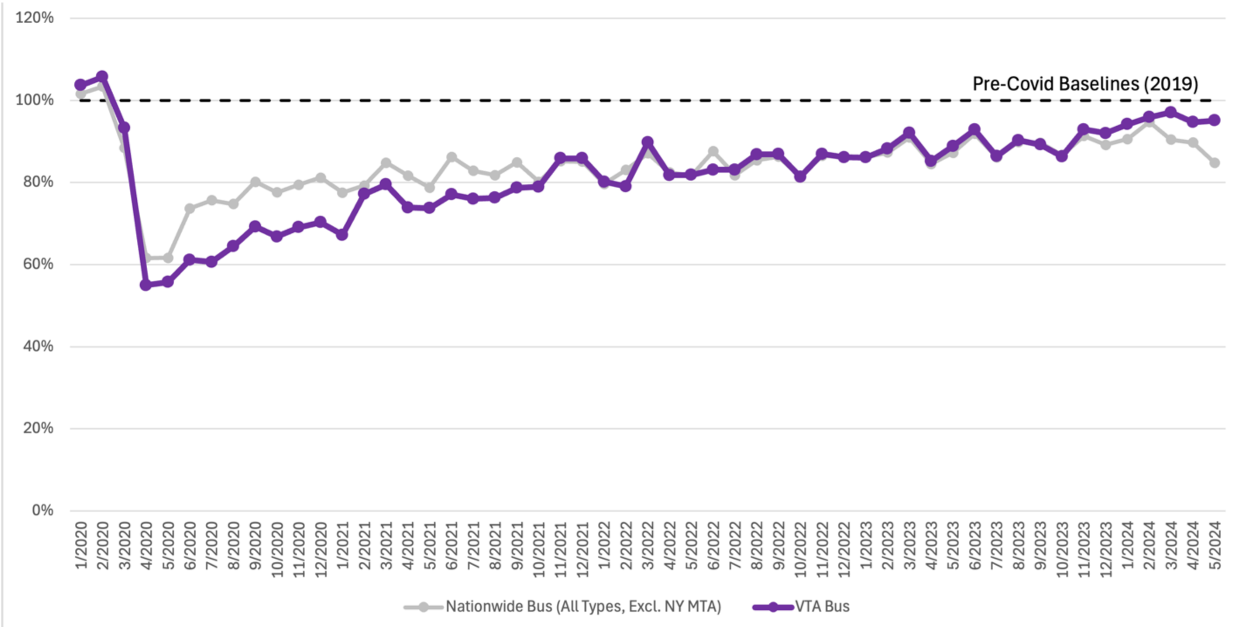
Figure 9.5 Monthly VTA VRH Recovery for All Available Modes Compared to the Nationwide Trend



For the most part, VTA VRH recovery has remained fairly consistent with the nationwide trend for bus and rail VRH recovery. The agency appears to have initially cut service slightly more than other transit agencies in the nation, but then caught up by February 2021 at 80 percent of pre-COVID service levels. A slight dip down to 70 percent in June and July 2021 likely reflects rail service shutting down for those two months following the mass shooting at VTA's rail maintenance yard. After VTA resumed service, the agency caught up with the nationwide trend quickly and remained at around 90 percent of pre-COVID service levels from November 2022 through May 2024.

Figure 9.6 shows the monthly VRH recovery for VTA's bus service compared to the nationwide trend.

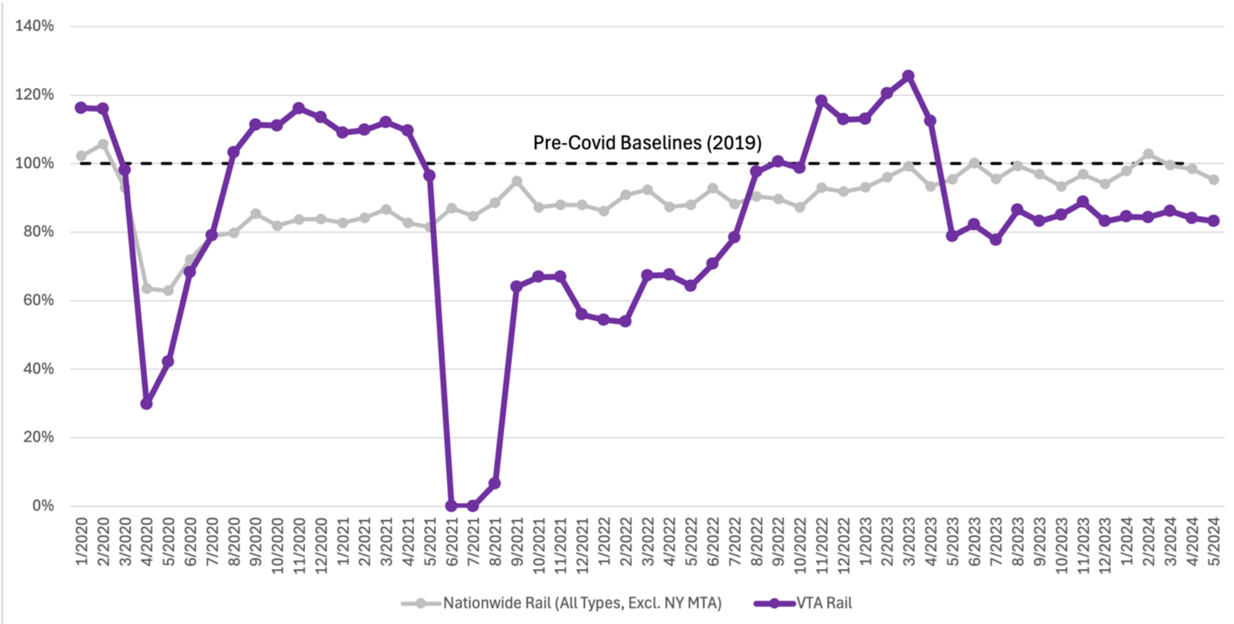
Figure 9.6 Monthly VTA VRH Recovery for Bus Service Compared to the Nationwide Trend



Similar to VTA's VRH recovery for all modes, bus service dipped slightly under other agencies in the nation initially. By October 2021, VTA's bus service caught up with the nationwide trend and remained nearly consistent from that point through October 2023. At the end of 2023, VTA appears to have increased its bus service slightly as VRH recovery was sitting at around 90 percent while the nationwide trend dropped back down to 80 percent. For all of 2023, VTA's bus VRH recovery was between 80 to 90 percent. In 2024, VTA's bus VRH recovery rose slightly and sat at around 95 percent.

Figure 9.7 shows the monthly VRH recovery for VTA's rail service compared to the nationwide trend.

Figure 9.7 Monthly VTA VRH Recovery for Rail Service Compared to the Nationwide Trend

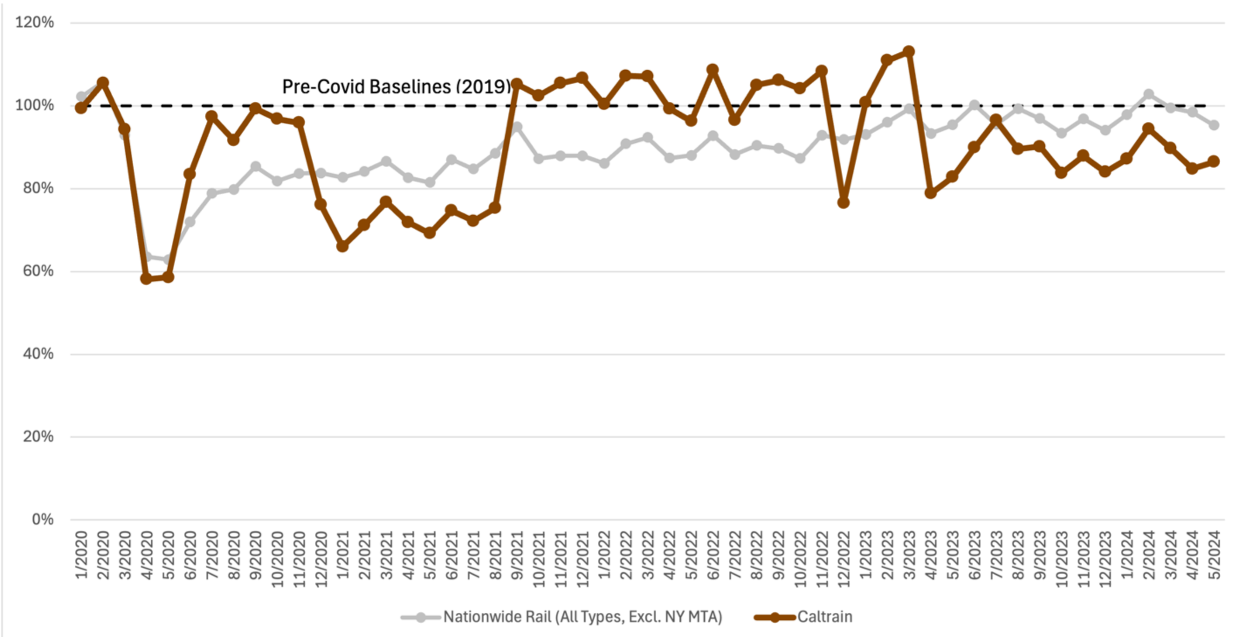


VTA's rail VRH initially dropped down to just 30 percent in April 2020, less than half of the nationwide trend for the same month. However, the agency recovered service levels quickly and jumped to over 100 percent of pre-COVID VRH for the period between August 2020 and April 2021. As previously mentioned, service was impacted in June and July 2021 due to the mass shooting at VTA's rail maintenance yard, but recovered quickly in September 2021, jumping to over 60 percent. For the period between August 2022 and April 2023, VRH either reached or exceeded pre-COVID service levels. However, service levels dropped back down to 80 percent by May 2023 and remained between 80 and 90 percent of pre-COVID VRH through early 2024.

Caltrain

Figure 9.8 shows the monthly VRH recovery for Caltrain compared to the nationwide trend.

Figure 9.8 Monthly Caltrain VRH Recovery Compared to the Nationwide Trend

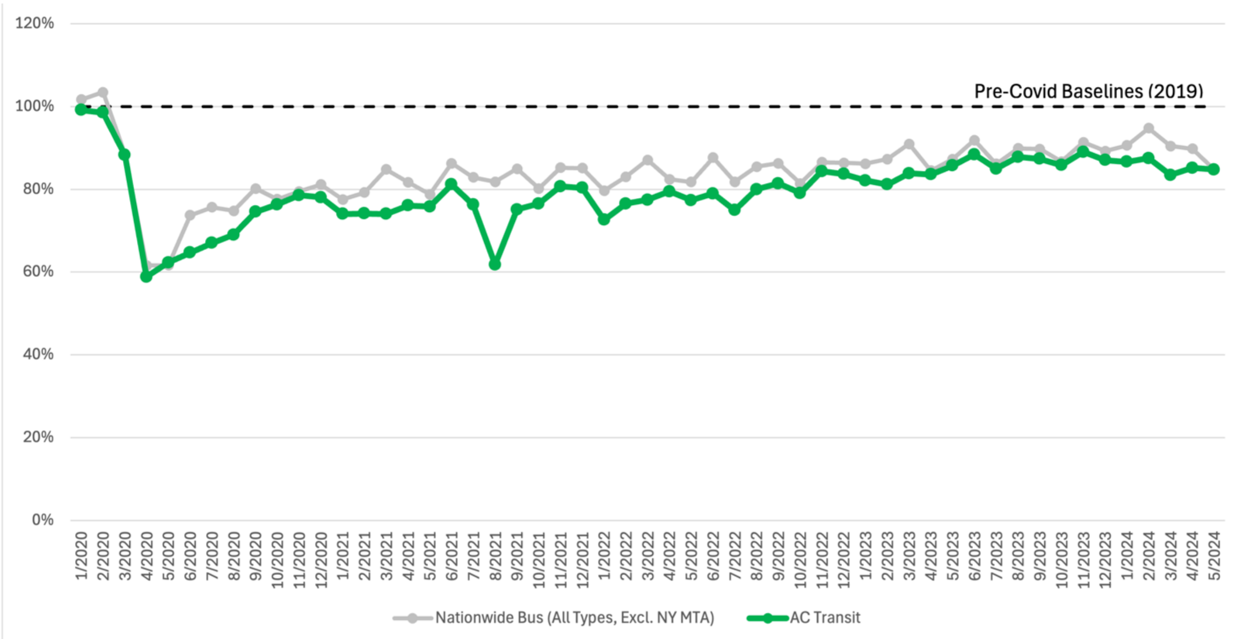


Caltrain VRH recovery initially dropped slightly lower than other rail agencies in the U.S., then abruptly increased to between 90 and 100 percent of pre-COVID service levels for the period between July 2020 and November 2020 before dropping back down to 70 to 80 percent of pre-COVID VRH through August 2021. In September 2021, Caltrain VRH saw another abrupt increase to over 100 percent of pre-COVID VRH and remained around that level through March 2023, with one exception of decreased VRH recovery in December 2022. For the remainder of 2023 and through early 2024, however, Caltrain VRH recovery was slightly under the nationwide trend and generally stayed between 80 and 90 percent of pre-COVID service levels.

AC Transit

Figure 9.9 shows the monthly VRH recovery for AC Transit compared to the nationwide trend.

Figure 9.9 Monthly AC Transit VRH Recovery Compared to the Nationwide Trend

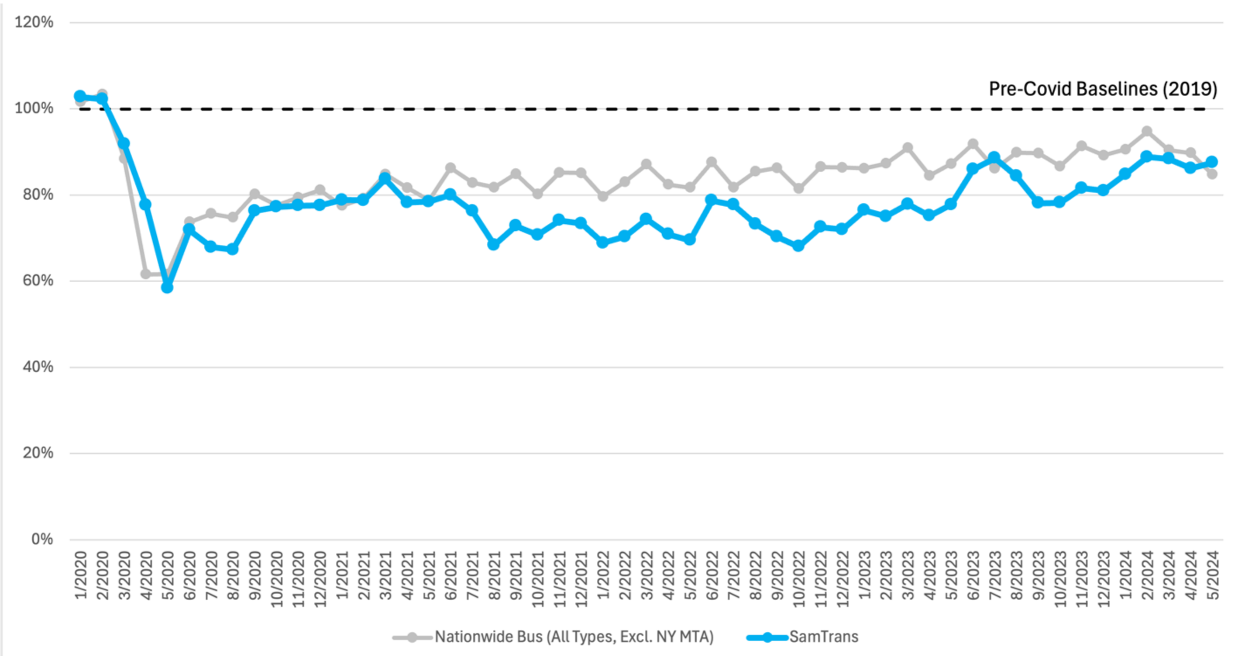


AC transit's VRH recovery generally trailed closely behind the nationwide trend through March 2023, with one exception in August 2021 where VRH recovery dipped to around 60 percent. By April 2023, the AC Transit's VRH recovery caught up with the trend for other agencies throughout the nation at around 85 percent of pre-COVID VRH. The agency remained between 80 to 90 percent of pre-COVID VRH for all of 2023 and through early 2024.

SamTrans

Figure 9.10 shows the monthly VRH recovery for SamTrans compared to the nationwide trend.

Figure 9.10 Monthly SamTrans VRH Recovery Compared to the Nationwide Trend

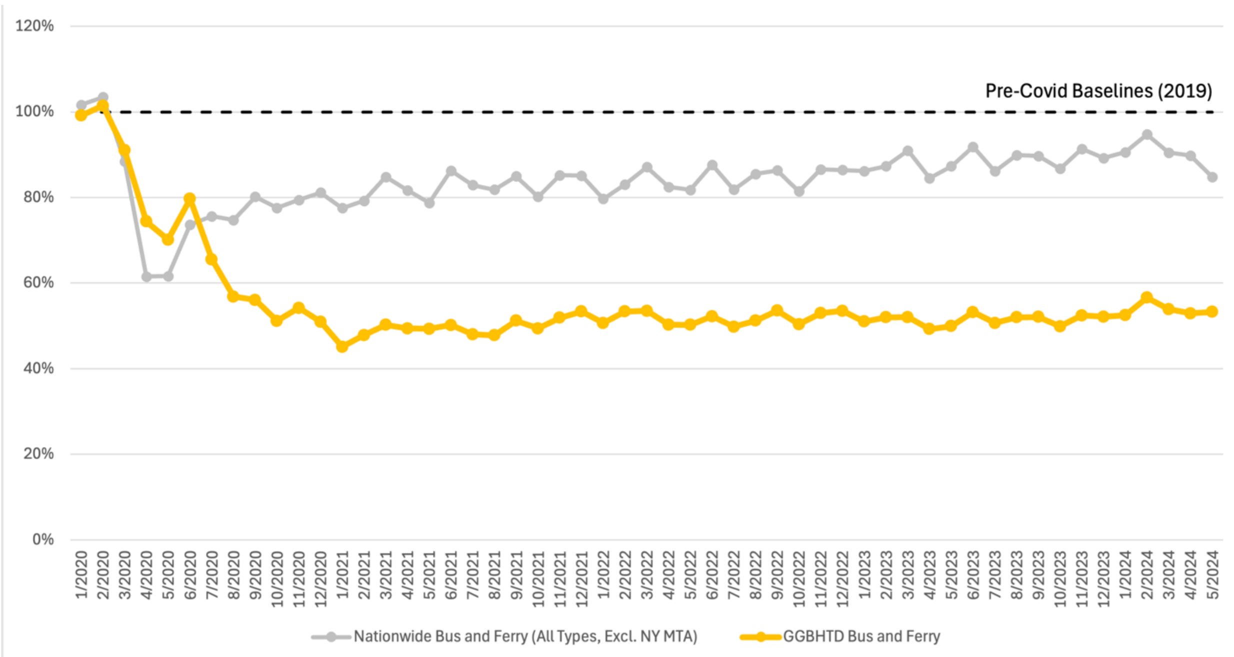


Ridership recovery for SamTrans appears to have initially kept up with the nationwide trend for bus VRH recovery during the early pandemic stages through June 2021. Starting in July 2021, however, ridership dipped slightly below the nationwide trend and fluctuated between 70 and 80 percent of pre-COVID service levels until the summer of 2023 where service appears to have peaked around 90 percent before dropping slightly down to around 80 percent toward the end of the year. In 2024, SamTrans VRH levels began to rise again and was just under 90 percent as of May.

GGBHTD

Figure 9.11 shows the monthly overall VRH recovery for GGBHTD compared to the nationwide trend.

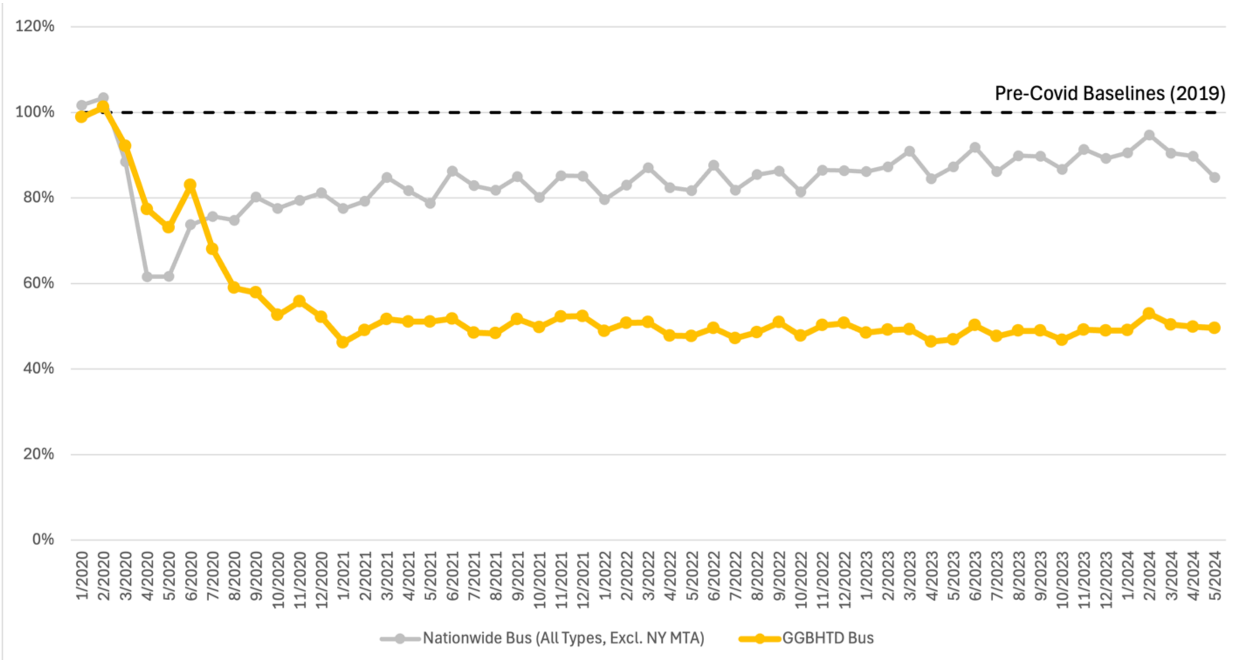
Figure 9.11 Monthly GGBHTD VRH Recovery for All Available Modes Compared to the Nationwide Trend



Unlike other agencies, which have mostly recovered between 80 to 100 percent of pre-COVID service levels, GGBHTD has remained fairly constant at 50 percent of VRH recovery since December 2020. Initially, the agency did not dip as much as other Bay Area transit service providers and maintained relatively higher service levels at the beginning of the pandemic, instead of dipping to a low point as is reflected in the VRH trends for other agencies. The VRH recovery trend for GGBHTD appears to be heavily skewed by the agency's bus service as its ferry service is shown in Figure 13 to have caught up with the nationwide trend as of January 2022, but overall service recovery has stagnated around 50 percent despite the recovery of ferry service.

Figure 9.12 shows VRH recovery for GGBHTD's bus service compared to the nationwide trend.

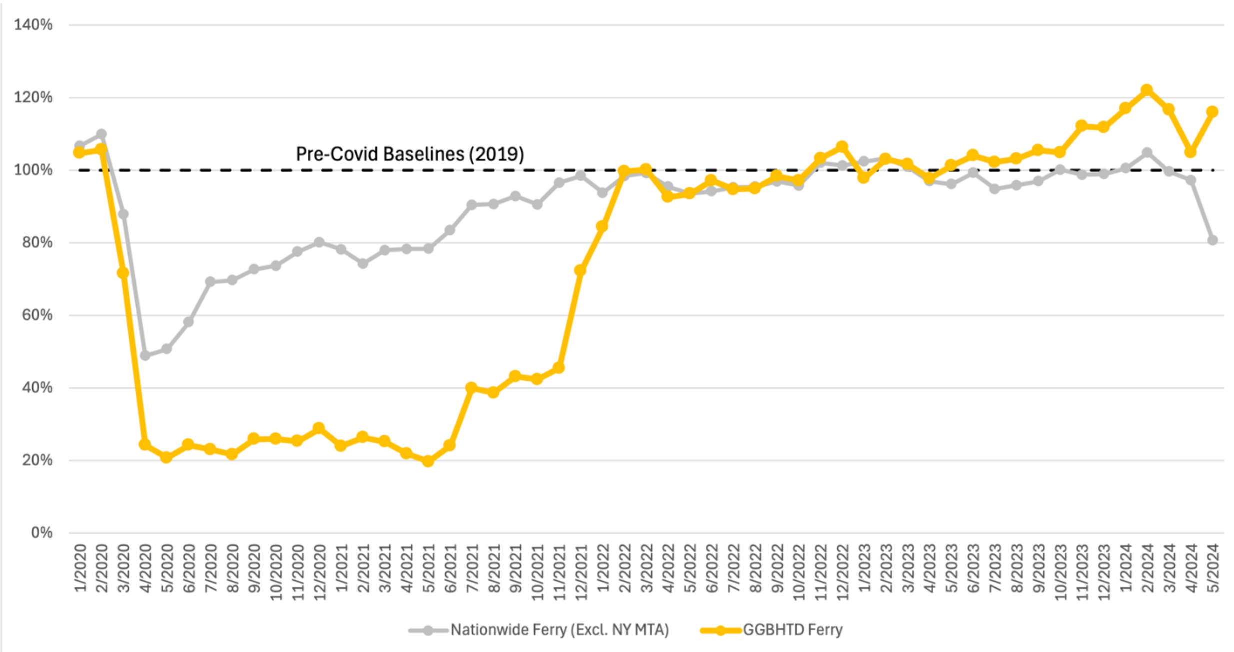
Figure 9.12 Monthly GGBHTD VRH Recovery for Bus Service Compared to the Nationwide Trend



The VRH recovery trend for bus service is extremely similar to that of GGBHTD's overall VRH recovery trend. Unlike other agencies, which had stark drops in VRH within the first few months of the pandemic, GGBHTD's service declined more and more each month until stabilizing at around 50 percent of pre-COVID service levels. One exception is an increase in VRH recovery in June 2020, which could be a result of the agency having believed that things would start opening back up during the summer after a few months of quarantining. After this slight increase, GGBHTD VRH for bus service dropped again and remained at around 50 percent through May 2024.

Figure 9.13 shows VRH recovery for GGBHTD's ferry service compared to the nationwide trend.

Figure 9.13 Monthly GGBHTD VRH Recovery for Ferry Service Compared to the Nationwide Trend

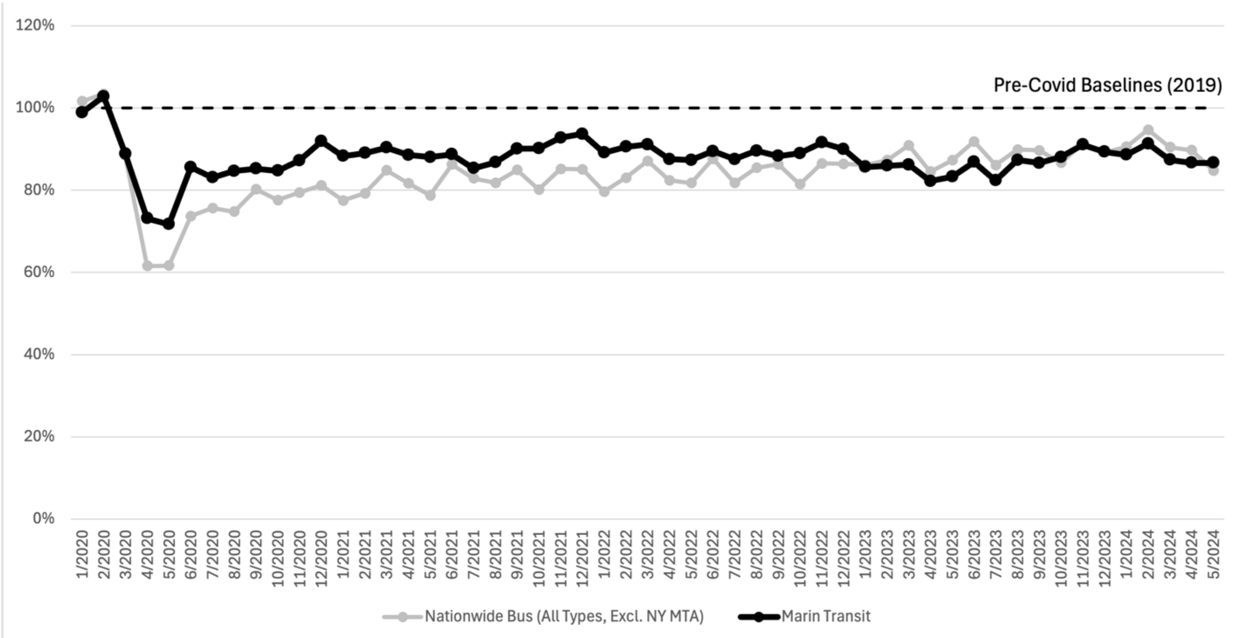


GGBHTD's VRH recovery trend is much more consistent with trends for other transit agencies where there is an initial drop to a low point at the beginning of the pandemic around April 2020. For GGBHTD, service levels remained low through June 2021 and then picked substantially and caught up with the nationwide trend around February 2022. It was during this same period that both the nationwide and GGBHTD ferry VRH recovery trends reached pre-COVID levels. From that point, GGBHTD VRH for ferry service remained near 100 percent of pre-COVID levels through the end of 2023. In early 2024, GGBHTD appears to have ramped up ferry service levels, which peaked in February 2024.

Marin Transit

Figure 9.14 shows the VRH recovery trend for Marin Transit compared to the nationwide VRH recovery trend for bus service.

Figure 9.14 Monthly Marin Transit VRH Recovery Compared to the Nationwide Trend



Unlike other Bay Area transit agencies, Marin Transit maintained a higher relative level of service than the nationwide trend at the beginning of the pandemic. The agency initially decreased its service levels to just above 75 percent of pre-COVID service levels, then quickly bounced back up to around 85 percent by June 2020. From that point, Marin Transit maintained VRH recovery levels of around 90 percent of pre-COVID service levels through December 2023. The nationwide trend initially dropped to 60 percent of pre-COVID VRH and only caught up with Marin Transit VRH recovery levels around the beginning of 2023. Both nationwide and Marin Transit VRH recovery appears to have stabilized around 90 percent of pre-COVID service levels for 2023 and 2024.

10. Appendix D: Operator Productivity Changes

10.1 Transit Service Productivity: Ridership per Vehicle Revenue-hour at the Bay Area's "Big 7" Transit Operators

Ridership per Vehicle Revenue Hour (VRH) was calculated and graphed for eight Bay Area transit agencies (the "Big 7" plus Marin Transit) to identify trends in post-COVID ridership recovery while accounting for the amount of service provided. The graphs present riders per VRH, or productivity, by month as a percentage of pre-COVID baselines for the agencies as a whole and are also broken down by mode where applicable. Riders per VRH were initially calculated by dividing the value of unlinked passenger trips by the value of vehicle revenue hours for the same month. Percentages for riders per VRH recovery were then calculated by dividing the riders per VRH values for January 2020 through May 2024 by the value of the corresponding month in 2019. Each graph also presents nationwide trends for corresponding transit modes with data from the Metropolitan Transportation Agency of New York (NY MTA) removed.

10.1.1 SFMTA (MUNI)

Figure 10.1 Monthly SFMTA Riders per VRH Recovery for All Available Modes Compared to the Nationwide Trend

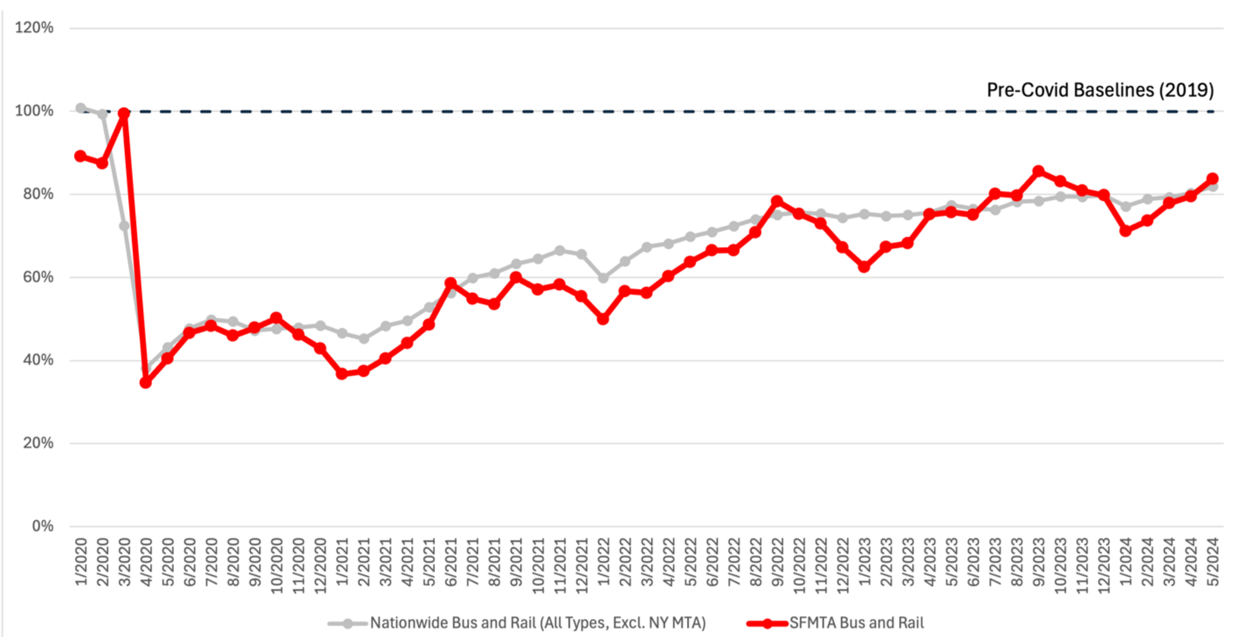


Figure 10.1 shows the productivity recovery trend for all SFMTA modes compared to the nationwide combined trend for bus and rail service. SFMTA's productivity recovery trend is slightly more volatile compared to the nationwide trend as it tends to dip in the winter and peaks each year around September. This indicates that SFMTA may have been maintaining similar service levels year-round despite reduced ridership in the winter months. For much of 2021, 2022, and early 2023, SFMTA seemed to have trailed behind the nationwide trend for productivity recovery. However, the agency's productivity seemed to have stabilized around 80 percent between the end of 2023 and early 2024, which is consistent with the nationwide trend.

Figure 10.2 Monthly SFMTA Riders per VRH Recovery for Bus Service Compared to the Nationwide Trend

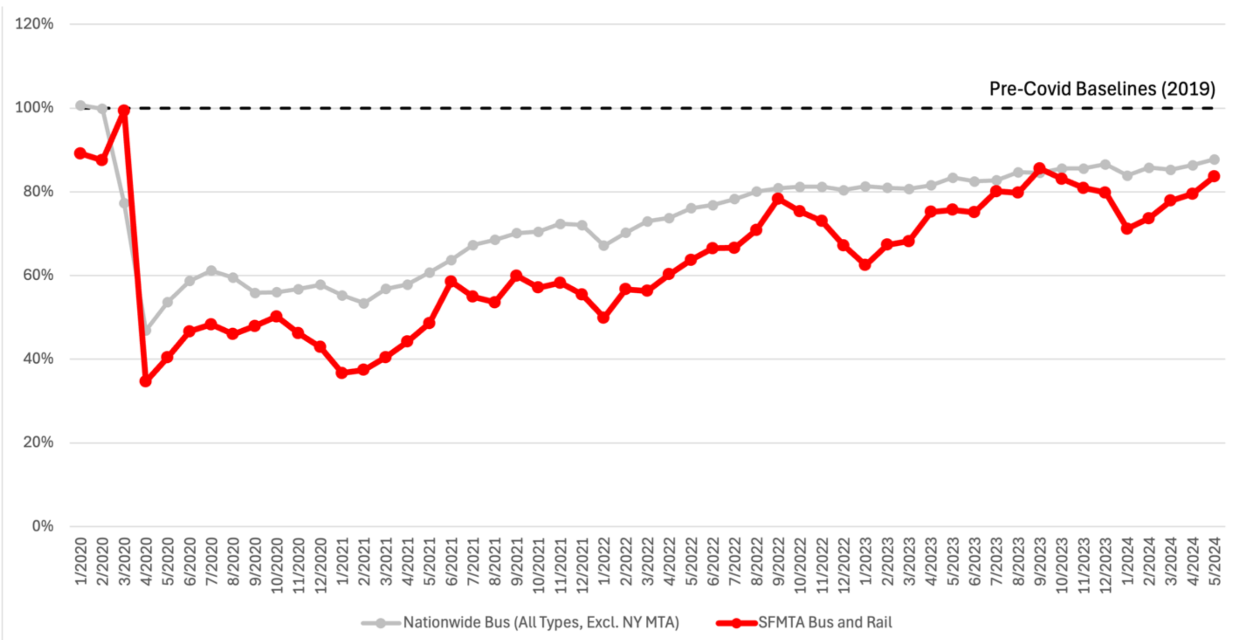


Figure 10.2 shows the productivity recovery trend for SFMTA bus service compared to the nationwide trend for bus operators. Similar to SFMTA's overall trend, there are dips in the winter and peaks around September 2023. For most of the pandemic and post-pandemic period, SFMTA's bus productivity recovery has trailed behind the nationwide trend with the exception of peaks around September 2022 and September 2023. In September 2023, the productivity level surpassed 90 percent before declining to slightly over 80 percent toward the end of the year. The nationwide trend does not appear to experience these same dips to the same degree and for the same period. Between September 2023 and December 2023, the nationwide trend increased slightly instead of declining.

Figure 10.3 Monthly SFMTA Riders per VRH Recovery for Rail Service Compared to the Nationwide Trend

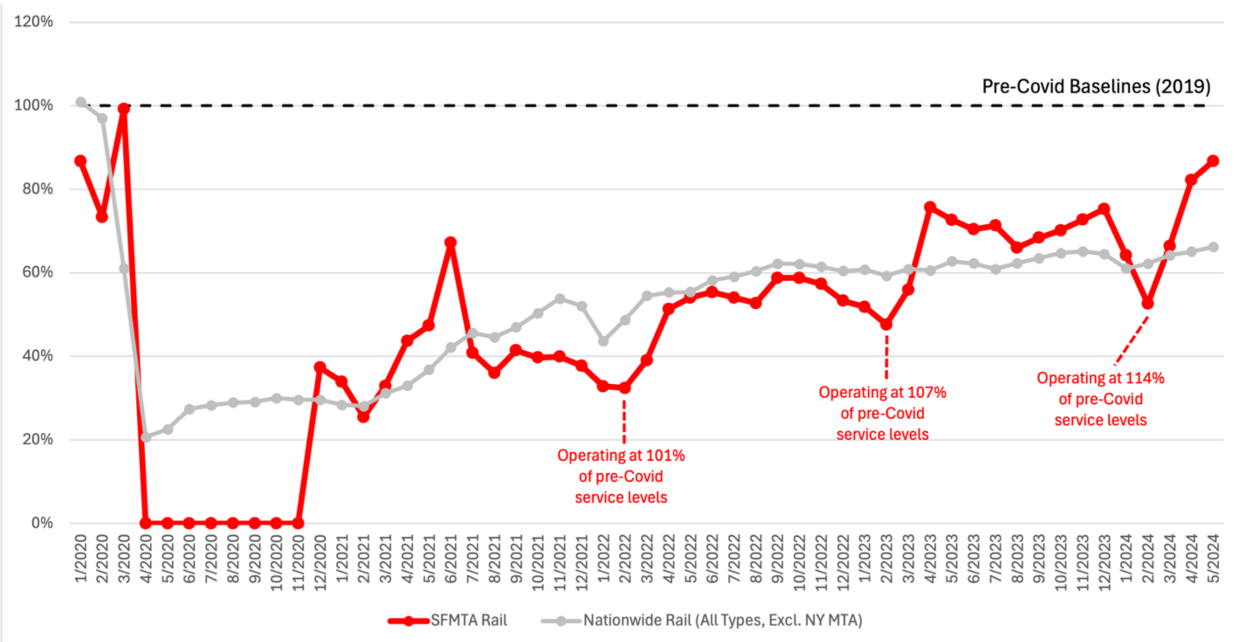


Figure 10.3 shows the productivity recovery trend for SFMTA rail service compared to the nationwide trend for rail operators. The trend for SFMTA rail productivity recovery is much more volatile compared to the nationwide trend. In March 2020, the nationwide trend for productivity compared to 2019 levels dropped to 60 percent but SFMTA retained most of its ridership. However, SFMTA shut down its rail service completely in the months that followed, as noted previously. When rail service restarted in December 2020, the productivity level jumped to just under 40 percent of pre-COVID levels, which was slightly higher than the nationwide value of 30 percent for the same month. After that, SFMTA's rail productivity recovery has fluctuated and rose to a high point of nearly 70 percent around June 2021 before declining to around 40 percent for the rest of 2021. For most of 2022, SFMTA's productivity remained around 50 to 55 percent of pre-COVID levels, which was slightly under the nationwide trend of around 60 percent. Between February 2023 and April 2023, the productivity level for SFMTA jumped from just under 50 percent to 70 percent and appears to have stabilized at around 60 to 70 percent for the rest of 2023, while the nationwide trend remained slightly above 60 percent. In February 2024, SFMTA productivity dipped below 60 percent of pre-COVID levels before jumping to above 80 percent in April and May 2024.

10.1.2 BART

Figure 10.4 Monthly BART Riders per VRH Recovery Compared to the Nationwide Trend

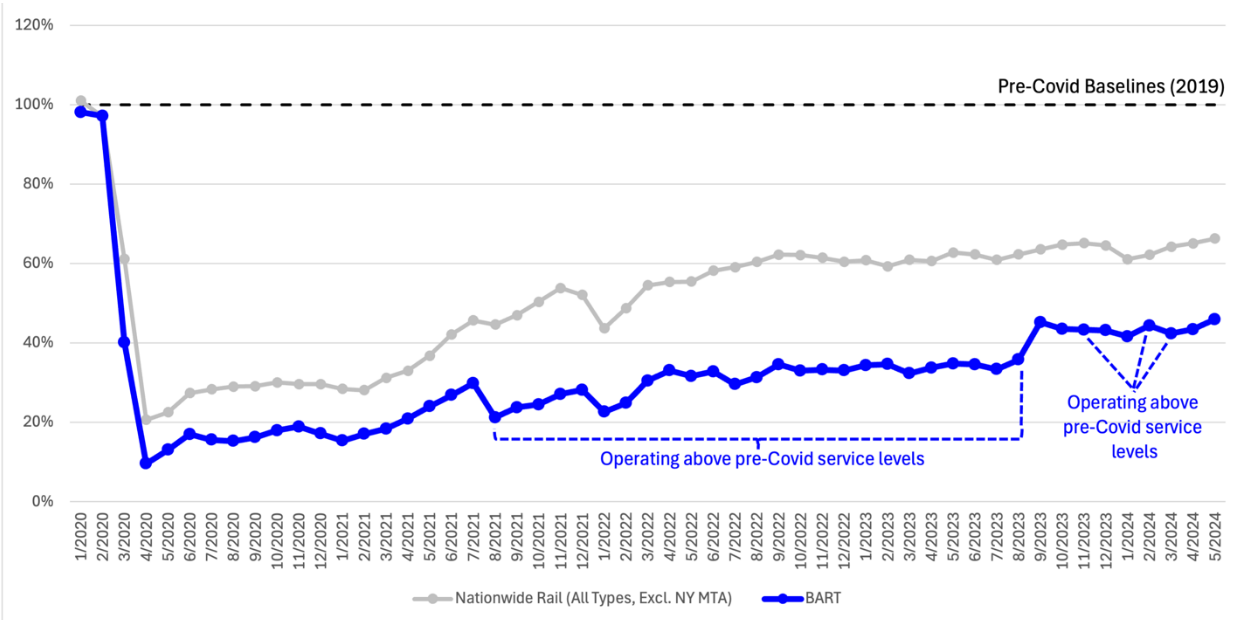


Figure 10.4 shows the productivity recovery trend for BART compared to the nationwide trend for rail operators. BART has struggled to keep up with the nationwide trend for rail productivity recovery. The gap between the trend for BART and nationwide rail widened in August 2021, when BART resumed its pre-pandemic operating schedule. It was during this point through August 2023 that the agency was operating at over 100 percent of pre-pandemic service levels. Despite this increased service, ridership for the agency remained low and productivity levels only grew from 20 percent to 35 percent of pre-COVID productivity levels. As mentioned previously, BART released a new service schedule that better aligned with higher demand for off-peak and weekend service compared to the demand for peak service.[107] Service levels dropped back down to around 100 percent of pre-COVID levels. At this point, there is a jump in productivity to just over 40 percent of pre-COVID productivity levels, which indicates that BART did not lose ridership from adjusting its service levels. However, the agency is still trailing significantly behind the nationwide trend for productivity recovery, which appears to have stabilized at around 60 percent of pre-COVID levels since 2022. This suggests that the shift in service may not be attracting increased ridership for BART, so the agency may need to explore other alternatives for recovering ridership in the post-pandemic period.

10.1.3 VTA

Figure 10.5 Monthly VTA Riders per VRH Recovery for All Available Modes Compared to the Nationwide Trend

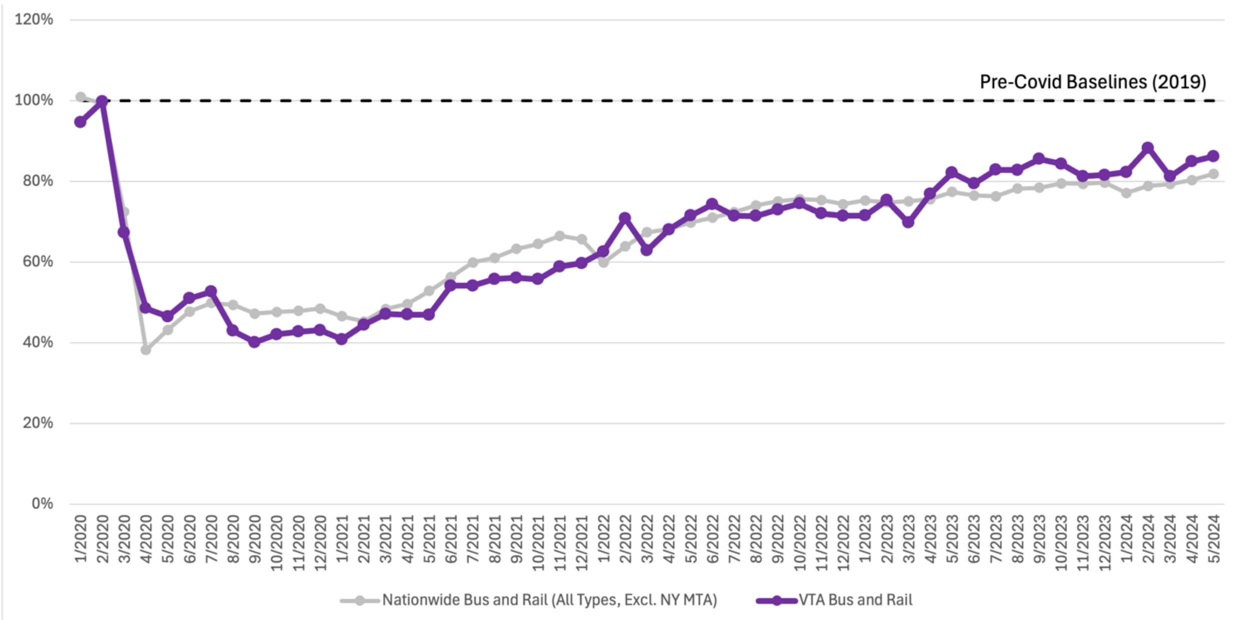


Figure 10.5 shows the productivity recovery trend for all VTA modes compared to the combined nationwide trend for bus and rail service. The overall trend for VTA productivity recovery followed the nationwide trend closely for most of the post-pandemic period and then slightly surpassed the nationwide trend for most of 2023. Even in June and July 2021, when the agency paused light rail service, productivity levels remained stable and did not decrease. The agency experienced a small peak in productivity levels around February 2022, which is interesting as other agencies experienced a dip in ridership around this time frame due to the widespread omicron variant. Generally, VTA's overall productivity recovery trend remained essentially on par with the nationwide trend for most of 2022 and 2023 and both sat between 80 to 85 percent of pre-COVID productivity levels in late 2023 and early 2024.

Figure 10.6 Monthly VTA Riders per VRH Recovery for Bus Service Compared to the Nationwide Trend

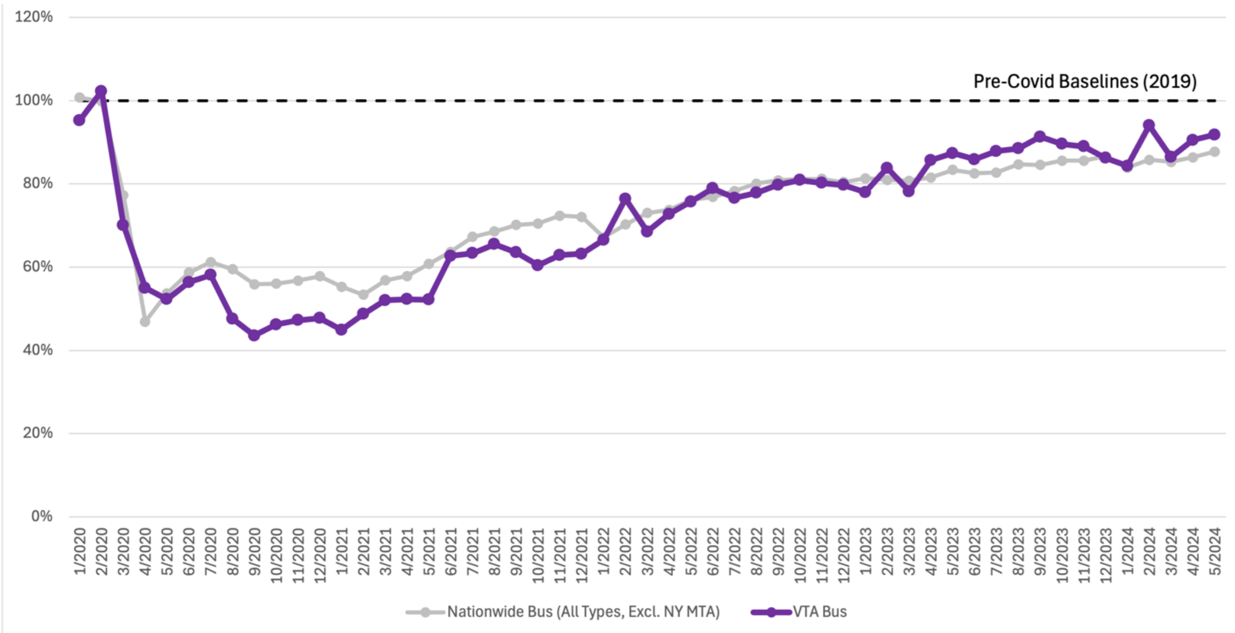


Figure 10.6 shows the productivity recovery for VTA bus service compared to the nationwide trend for bus operators. Similar to VTA's overall productivity recovery trend, the trend for their bus service follows the nationwide trend closely for the beginning stages of the pandemic and then catches up and remains fairly consistent for most of 2022 and 2023. The trend also shows the same peak in productivity in February 2022 that was seen in the overall trend for the agency. For much of 2023, productivity levels for both VTA bus and nationwide bus trends were between 80 and 90 percent of pre-COVID levels. Service levels peaked around 95 percent in February 2024 before dropping slightly to around 90 percent in the following months through May 2024.

Figure 10.7 Monthly VTA Riders per VRH Recovery for Rail Service Compared to the Nationwide Trend

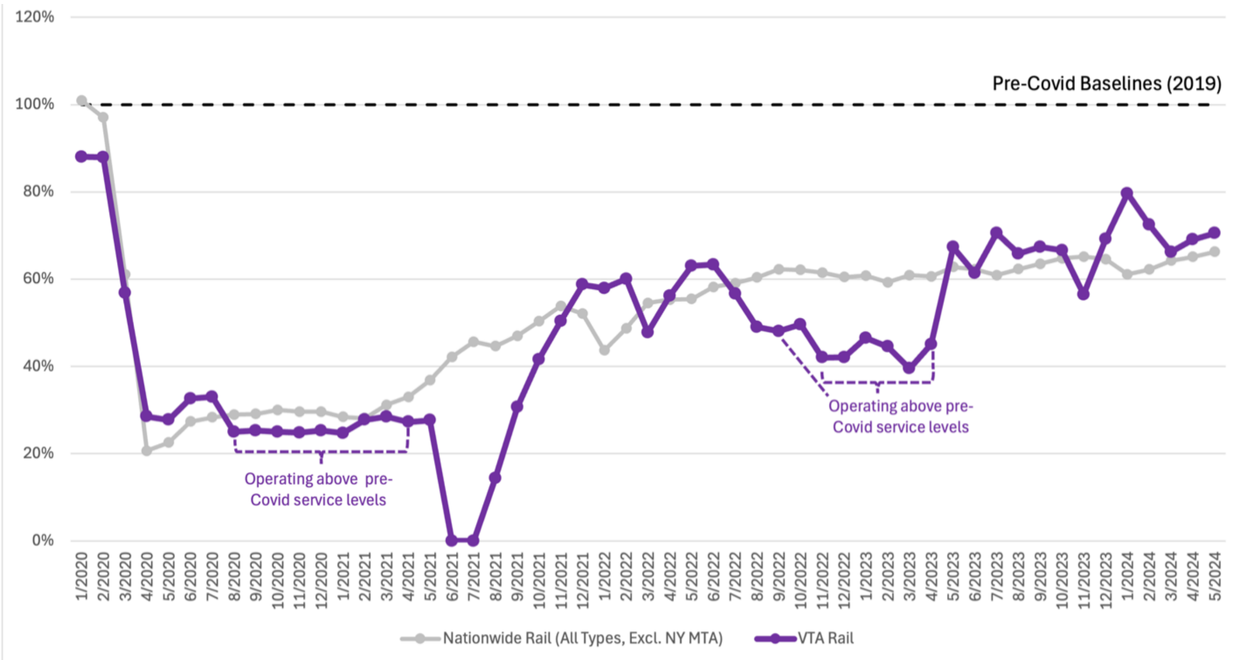


Figure 10.7 shows the productivity recovery for VTA bus service compared to the nationwide trend for rail operators. Unlike the trends for overall ridership and bus service, VTA's rail productivity recovery does not really follow the nationwide trend and is much more volatile. Initially, the trend for the agency's rail service trailed slightly behind the nationwide trend for rail, but then remained stable around 30 percent at the beginning of 2021 when the nationwide trend began to increase moderately. Then, the agency shut down rail service for two months in June and July 2021 due to the aforementioned shooting, which hampered the agency's post-COVID recovery. In the months that followed, however, VTA's rail service bounced back fairly quickly and caught up with the nationwide trend for much of the period between November 2021 and June 2022 before its productivity levels dipped again. It was during the period between July 2022 and April 2023 that VTA increased its VRH for rail, initially to around 100 percent of pre-COVID levels and then even higher to around 120 percent. Productivity levels catching back up to the nationwide trend in May 2023 coincided with VTA reducing its VRH to around 85 percent of pre-COVID levels. This suggests that higher service levels did not function to attract more riders to VTA's rail service.

10.1.4 AC Transit

Figure 10.8 Monthly AC Transit Riders per VRH Recovery Compared to the Nationwide Trend

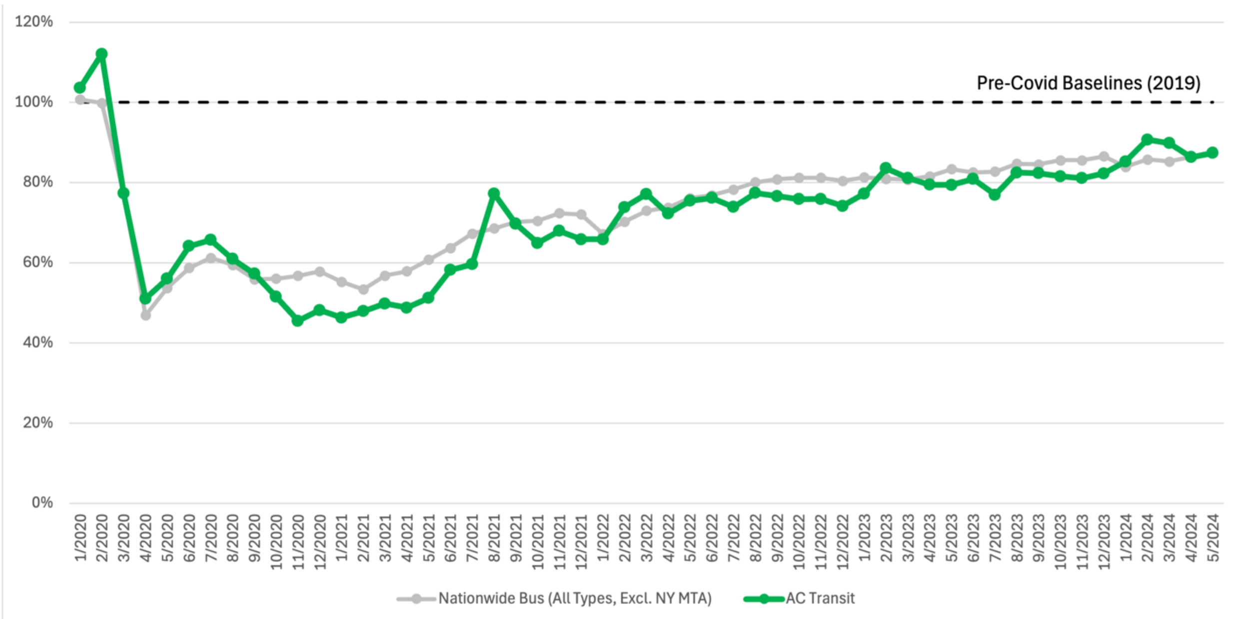


Figure 10.8 shows the productivity recovery for AC Transit compared to the nationwide trend for bus operators. The trend for AC Transit generally follows the nationwide trend closely with a few deviations. For the period between September 2020 and July 2021, AC Transit's productivity recovery levels trailed behind the nationwide trend. In August 2021, the agency saw a peak in productivity recovery which aligns with a dip in VRH for this same month. After that the agency's trend followed the nationwide trend more closely with some slight fluctuation and both remained slightly lower through early 2024, stabilizing at just above 80 percent which appears to be on par with the nationwide trend.

10.1.5 Caltrain

Figure 10.9 Monthly Caltrain Riders per VRH Recovery Compared to the Nationwide Trend

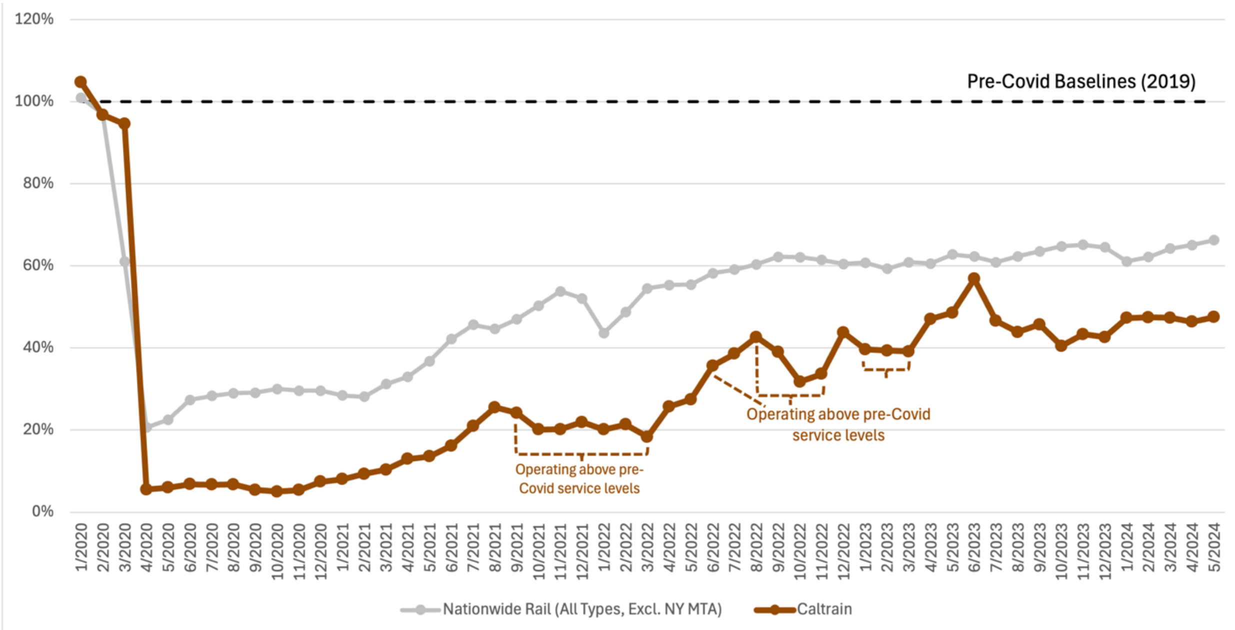


Figure 10.9 shows the productivity recovery for Caltrain compared to the nationwide trend for rail operators. Similar to BART, Caltrain has struggled to recover its productivity levels to pre-COVID levels and trails fair behind the nationwide trend for rail. Initially, the agency maintained a high productivity level and ridership for March 2023 while the nationwide trend dropped to around 20 percent. However, in April 2020 and through February 2021, Caltrain's productivity dropped to below 10 percent of pre-COVID productivity levels. In March 2021, Caltrain began a slow recovery and then saw some peaks, particularly during summer months for 2021, 2022, and 2023. Caltrain reached a peak in post-COVID productivity recovery in June 2023 when it reached around 55 percent of pre-COVID riders per VRH. Through the end of the year, however, productivity levels dropped back down to just above 40 percent. For much of 2022 and 2023, Caltrain's productivity recovery fluctuated between 30 and 50 percent of pre-COVID levels while the nationwide trend stabilized around 60 percent for this same period. In early 2024, productivity levels for Caltrain remained fairly stable at just under 50 percent of pre-COVID levels.

10.1.6 SamTrans

Figure 10.10 Monthly SamTrans Riders per VRH Recovery Compared to the Nationwide Trend

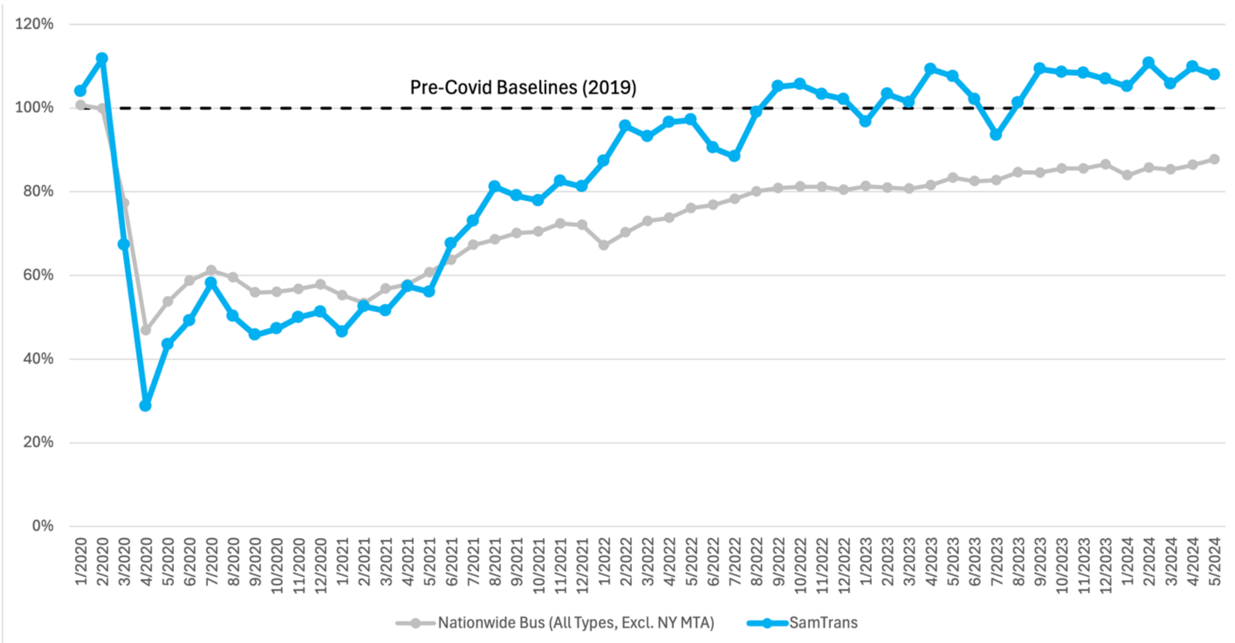


Figure 10.10 shows the productivity recovery for SamTrans compared to the nationwide trend for bus operators. Although SamTrans initially experienced a slightly more severe decline in productivity at the beginning stages of the pandemic, the agency followed closely behind the nationwide trend and surpassed it by June 2021. Since that point, the agency continued to recover its productivity to pre-COVID levels and has fluctuated around 100 percent of pre-COVID productivity since the beginning of 2022. For all of 2022 and the first half of 2023, SamTrans operated at between 70 and 80 percent of pre-COVID VRH levels and then increased to 90 percent of pre-COVID VRH for the summer of 2023 before dipping back down to around 80 percent. Despite the reduced service levels, SamTrans saw full recovery in productivity for much of 2023 and appears to have stabilized at around 110 percent of pre-COVID productivity levels toward the end of 2023 and through early 2024.

10.1.7 GGBHTD

Figure 10.11 Monthly GGBHTD Riders per VRH Recovery for All Available Modes Compared to the Nationwide Trend

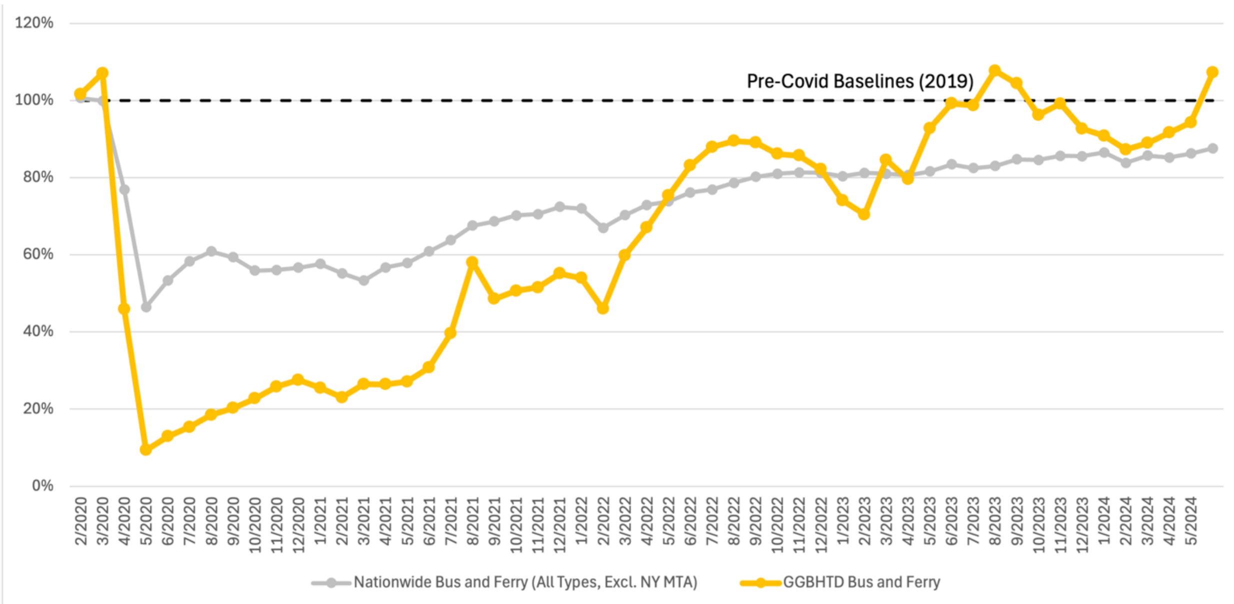


Figure 10.11 shows the productivity recovery for all GGBHTD modes compared to the combined nationwide trend for bus and ferry service. GGBHTD initially struggled to recover productivity levels compared to the nationwide trend for combined bus and ferry riders per VRH. While the nationwide trend initially dropped to around 45 percent, GGBHTD dropped to below 10 percent of pre-COVID productivity levels. Each year, the agency saw gains in productivity levels during the summer months, which is likely attributed to increased tourism during the summer leading to increased ridership. During the winter months, GGBHTD sees decreased productivity levels. In April 2022, GGBHTD productivity levels caught up with the nationwide trend. By May 2023, GGBHTD productivity levels reached 100 percent of pre-COVID levels and peaked at just under 100 percent in August and September 2023 and again in May 2024. The nationwide trend is comparatively more stable and does not appear to be as impacted by seasonal peaks and dips.

Figure 10.12 Monthly GGBHTD Riders per VRH Recovery for Bus Service Compared to the Nationwide Trend

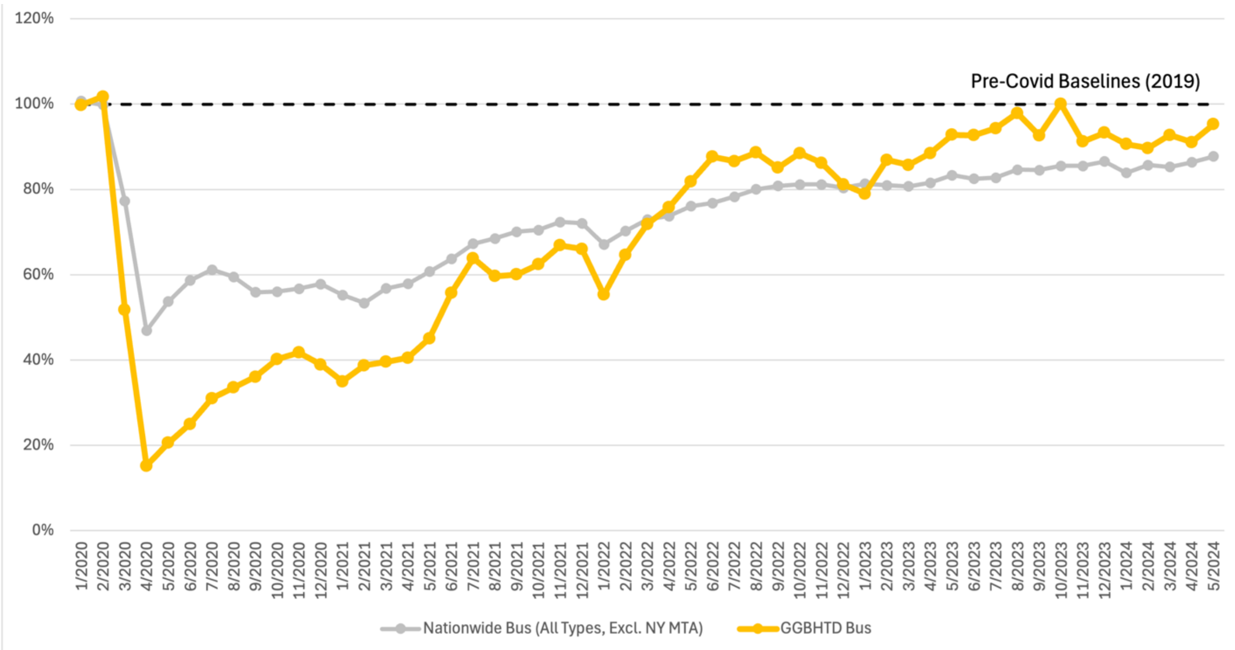


Figure 10.12 shows the productivity recovery for GGBHTD bus service compared to the nationwide trend for bus operators. It appears that productivity for GGBHTD's bus service was more heavily impacted by the pandemic than other Bay Area bus operators. Generally, other Bay Area bus operators trailed more closely behind the nationwide trend for the initial pandemic months, but GGBHTD's productivity dropped to below 20 percent of pre-COVID productivity levels. The agency did see significant recovery, however, and caught up with the nationwide productivity trend by early 2022. The agency has continued to operate at only 50 percent of pre-COVID VRH levels since December 2020, which may indicate that GGBHTD is hesitant to increase service levels to match pre-COVID VRH because there is a lack of demand for transbay trips.

Figure 10.13 Monthly GGBHTD Riders per VRH Recovery for Ferry Service Compared to the Nationwide Trend

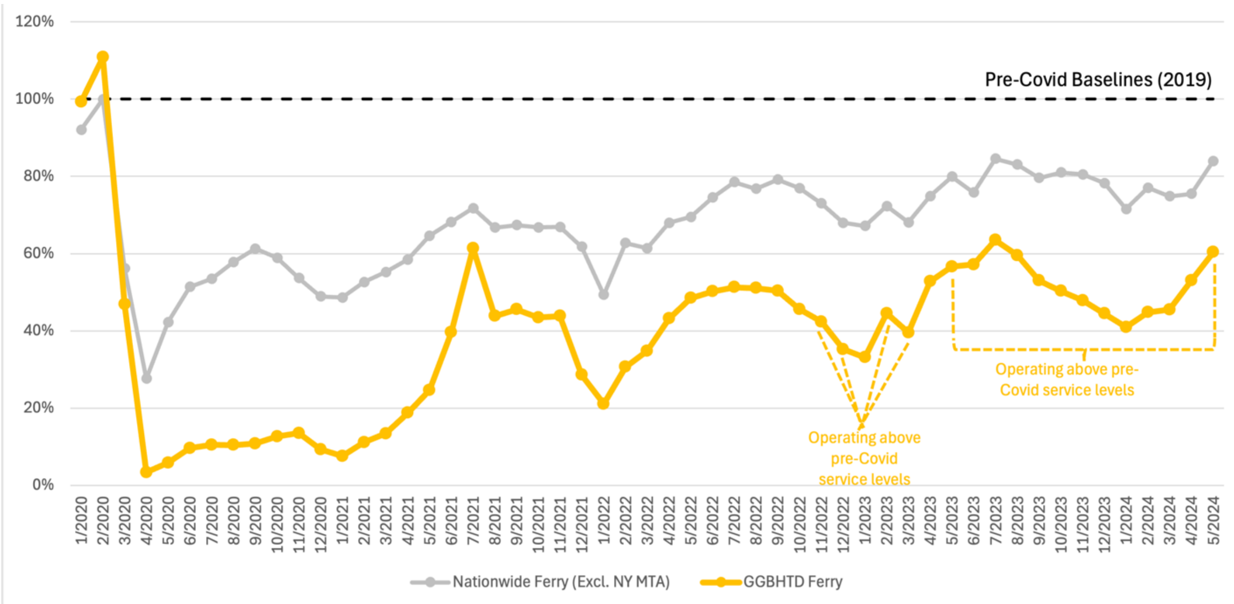


Figure 10.13 shows the productivity recovery for GGBHTD ferry service compared to the nationwide trend for ferry operators. While nationwide productivity levels for ferry service alone also appear to be impacted by seasonal peaks and dips, GGBHTD seems to be more heavily impacted by this seasonality as the peaks in the summer and dips in the winter for the agency's productivity recovery levels appear to be more severe. The agency also saw a substantially steeper decline in productivity at the beginning of the pandemic as it initially dropped to around 5 percent of pre-COVID productivity levels compared to around 30 percent nationwide. Additionally, the nationwide trend shows a peak in the summer of 2020, which suggests that other ferry operators in the country saw ridership recovery during this first summer after the start of the pandemic whereas the trend for GGBHTD remains generally steady during this same period. For the first half of the pandemic, GGBHTD limited its ferry service levels and then, starting in 2022, VRH levels recovered to levels similar to pre-COVID VRH. Despite the increase in VRH, the agency's riders per VRH remain significantly lower than the nationwide trend, which supports the narrative that demand for trans-bay trips remains low.

10.1.8 Marin Transit

Figure 10.14 Monthly Marin Transit Riders per VRH Recovery Compared to the Nationwide Trend

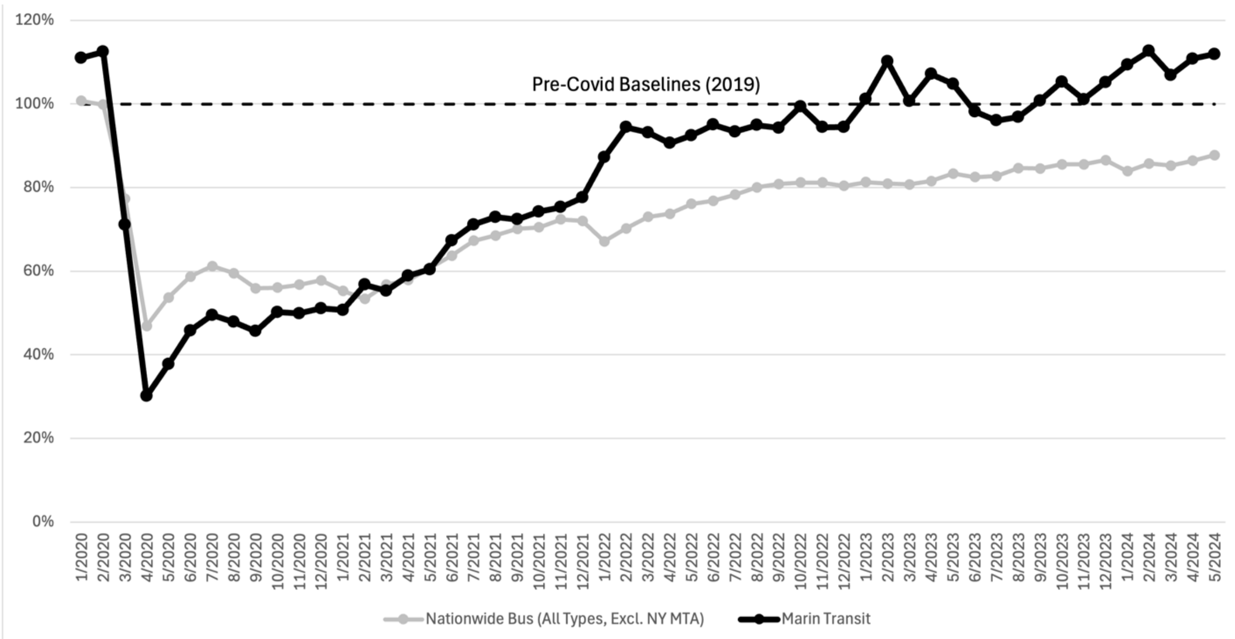


Figure 10.14 shows the productivity recovery for Marin Transit compared to the nationwide trend for bus operators. Although Marin Transit's productivity was initially more heavily impacted by the pandemic, the agency recovered quickly and caught up with the nationwide trend by the beginning of 2021. At the start of 2022, Marin Transit's productivity recovery levels began to pull away from the nationwide trend even further and was around 90 percent of pre-COVID productivity levels for most of the year. In 2023, the agency saw further productivity recovery as it fluctuated around 100 percent of pre-COVID productivity levels. During the same periods in 2022 and 2023, the nationwide trend remained steady and slowly increased from 70 to 90 percent of pre-COVID riders per VRH. In 2024, Marin Transit's productivity levels have consistently exceeded 100% of pre-COVID levels while the nationwide trend has stabilized around 90%. Marin Transit's VRH has remained consistent with nationwide VRH with both sitting at around 90 percent of pre-COVID service levels for most of 2023. This indicates a greater demand for bus trips in the areas served by Marin Transit compared to other bus operators.

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About the Authors

Richard W. Lee, PhD, AICP

Richard Lee is a lecturer in the Urban and Regional Planning Department at San José State University and a Principal with Transportation Choices for Sustainable Communities. He has been an MTI Research Associate for over 25 years and has over 35 years of experience as a transportation consultant and academic. He holds an MS in Civil Engineering, an MCP, and a PhD in City and Regional Planning, all from the University of California, Berkeley. Dr. Lee's research has focused on regional transit coordination and quantitative analysis of the efficacy of various policies in promoting transit and active transportation modes. His consulting experience includes management of regional transportation plans, corridor studies, general plan studies, high-speed rail and transit projects, as well as a wide variety of traffic impact, travel demand management, and transportation policy studies. He has taught transportation planning and conducted research at several universities, including Massey University in New Zealand; University of California, Los Angeles; Cal Poly San Luis Obispo; UC Berkeley; and San José State University.

David Reinke, MS, MRP

Mr. David Reinke is a transportation engineer/economist with over 40 years of experience in travel demand modeling, transportation economics, survey design and management, database management, and software engineering. He has worked on a number of leading-edge projects in travel demand and economics, including development of activity-based travel demand models, development of discrete-choice travel forecasting models, the development of microsimulation-based models for analysis of congestion pricing alternatives, and applications of economic methods to transportation policy analysis. His areas of expertise include policy analysis, advanced statistical methods, machine learning methods, economic analysis, survey design and management, and applications of advanced computational techniques to transportation. He is currently a Research Associate with the Mineta Transportation Institute where he has worked on studies of transit equity and transportation economics. David currently co-chairs the Education and Outreach Subcommittee for the Committee on Artificial Intelligence and Advanced Computing Applications (AED50) at the Transportation Research Board (TRB) and is a past member of TRB committees on Statistics, Economics, and Travel Behavior and Values. He is also a member of the IEEE Intelligent Transportation Systems Society.

Christopher Ferrell, PhD

Dr. Ferrell began his career in 1995 as a planner for the MTC. He completed his doctoral studies in City and Regional Planning at the University of California, Berkeley in 2005 and worked as a consultant with Dowling Associates, Inc. for 10 years before leaving to help form CFA Consultants in 2010. He is currently a principal, board member, and the executive director of

Transportation Choices for Sustainable Communities Research and Policy Institute, a 501(c)(3) non-profit. He has been the principal investigator for eight research projects for the Mineta Transportation Institute, where he has been a Research Associate since 2005. His research focuses on the relationships between transportation and land use, livability, travel behavior, transportation policy, and planning-related institutional structures. His research experience includes the study of multimodal transit and freeway corridors, the best practices for building successful transit-oriented development, the effects of transit-oriented development on surrounding property values, the effects of neighborhood crimes on transportation mode choice, and a set of methods, metrics, and strategies for evaluating transit corridor livability. As a practitioner, he has planned mixed-use, infill, and transit-oriented development projects; analyzed the impacts of specific and general plans; planned and implemented intelligent transportation systems; and developed bicycle and pedestrian plans. He has taught several quantitative methods classes in San José State University's Urban Planning Department and a course in transportation and land use in the City and Regional Planning Department at the University of California, Berkeley.

Charles R. Rivasplata, PhD, MTPS

Charles Rivasplata is a senior lecturer in the Urban and Regional Planning Department at San José State University, and is a lecturer in the Environmental Studies Department at University of California, Santa Cruz. He currently teaches courses in regional and sustainable transportation planning, urban sustainability planning, introductory urban planning and urban geography. In addition, he is a principal at Transportation Choices for Sustainable Communities, a small nonprofit organization; and is a Mineta Transportation Institute (MTI) Research Associate—he has served as the principal investigator on three projects. His research interests include sustainable transportation planning, multimodal transportation planning, transit planning, transit integration, transit regulation, impacts of transit privatization, regional governance, transport for vulnerable populations, and travel demand management (TDM). He holds an MA in Latin American Studies, an MS in Civil Engineering, and an MCP in City and Regional Planning, all from the University of California, Berkeley; and a PhD in Transportation Policy from the University of California, Davis. His doctoral dissertation explored the impacts of Labour Party policy reforms on public transport integration and coordination in the metropolitan areas of Britain. For 28 years, he was a transportation planner in the San Francisco Planning Department and the San Francisco Municipal Transportation Agency (SFMTA), involved in the regulation of downtown buildings with TDM requirements; transportation policy development (General Plan and area plans), project review as it concerns transportation policy, and interagency coordination.

John M. Eells, MCP

John Eells is a transportation planner with 44 years of experience preparing comprehensive transportation plans and developing sustainable transportation projects at the local and regional level. John's experience includes two years in the Legislative Analyst Office in the California State Legislature, five years with the California Department of Transportation (Caltrans), seven years as the Transportation Planning Coordinator for Marin County, and thirty years as a consultant. He holds a Bachelor's degree in Architecture and a Master's degree in City Planning from the University of California, Berkeley. John has assisted in the preparation of Regional Transportation Plans for Sacramento and Lake Tahoe and reviewed Regional Transportation Plans throughout California for conformance with State greenhouse gas reduction requirements for the California Attorney General's Office. He participated in a joint effort by Caltrans and the California Council on Science and Technology to develop a proposal for a new California Center for Transportation Innovation to coordinate transportation research activities in California. John has also managed major multi-modal transportation studies, evaluated the feasibility of proposed ferry services, and worked on the implementation of several rail transit projects including the Sacramento Light Rail project, the ACE Commuter Rail Service from Stockton to San José, the SMART Commuter Rail Service from Cloverdale to Larkspur, proposed AMTRAK service from Oakland to Reno, and the proposed high speed Maglev Service from Los Angeles to Las Vegas.

Luana Chen

Luana Chen is transportation planner for the California Department of Transportation (Caltrans) and a graduate student in the Urban and Regional Planning program at San José State University. She received her Bachelor's degree in Sociology and Political Science: Public Service from the University of California, Davis in 2019. Her research interests include transportation and land use planning topics with attention to equity and sustainability. Her career goals involve contributing to a better-connected, equitable, and sustainable multi-modal transportation network for the San Francisco Bay Area.

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