Operations Funding for a World-Class Transit System

A new report from Seamless Bay Area and Voices for Public Transportation

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Seamless Bay Area

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Introduction

How much transit service should be provided in the nine-county Bay Area? This research project attempts to answer that question.

Historically, the amount of service provided in the Bay Area has been based on the amount of resources available, and not necessarily on need or demand. In addition, today's transit environment has been further complicated by the COVID crisis. Battered by historically low revenues and ridership, Bay Area transit agencies have sharply curtailed service across the region, creating mobility and accessibility challenges for essential and low-income workers dependent on transit, and making it more difficult address climate change and its effects in California.

Answering the question of how much transit service that should be provided across the Bay Area can help inform decision making about the short- and long-term future of transit service in the region. This research attempts to quantify the amount of transit service that should be provided in the Bay Area in order to restore and grow transit ridership, to provide robust service in line with that provided by peer metropolitan areas around the world, and to achieve our region's long-range environmental goals.

Two methodologies have been used to develop benchmarks for service levels. One Method focuses on per capita revenue hours.[1] Past research has shown a correlation between per capita revenue hours and ridership. The other Method develops a set of principles and standards to determine where existing transit service (pre-COVID) fails to meet that standard.

Method 1

Three different approaches are used to develop benchmarks for per capita revenue hours:

- 1A: Intra Bay Area Comparison
- 1B: Comparison of Bay Area Service Levels to other Regions
- 1C: Density Categories (using best Bay Area + North American performers)

Methods 1A and 1C focus exclusively on the Bay Area transit systems providing bus service. Method 1B focuses on the aggregate of Bay Area transit service including regional rail and ferry services. For 1A and 1C, three other metropolitan regions are used – Toronto, Washington DC, and Seattle; while for 1B the six largest Canadian metro areas are used.

The reason these three regions were selected for Methods 1A and 1C:

[1] A revenue hour is any time a transit vehicle (bus, train or ferry) is scheduled and available to pick up customers. It also includes the breaks between trips. It does not include times the vehicle is unavailable to carry customers while moving between the operations base and the first or last trip or between routes.

- Canadian systems tend to have higher per capita ridership than US counterparts despite cultural, urban form and economic similarities to the US. Toronto was selected because, unlike other large Canadian metropolitan areas where the primary transit provider serves both the inner city and lower density suburbs, Toronto has multiple transit providers serving the region – and therefore is more analogous with the Bay Area.
- Washington DC was selected for the same reason Toronto was selected. It has multiple suburban providers whereas other large US metros have a single dominant system (e.g. Boston, Philadelphia) or a single suburban provider (e.g. Chicago)
- There has been significant investment in increased service in Seattle both within the city and the surrounding suburban systems, and has been experiencing ridership growth while other metro areas have been losing ridership.

The reason six Canadian metro areas are used for Method 1B is that the only US metro area with higher per capita revenue hours or per capita ridership is New York, and that is skewed by the high level of transit in New York City. Canadian metro areas are more analogous with the Bay Area in terms of density, auto ownership and other economic and social factors.

In the Bay Area, the top five transit agencies that provide bus service in terms of per capita revenue hours are also the top five transit agencies in terms of per capita ridership.[2] To illustrate the correlation between per capita revenue hours and per capita ridership:

Of the 20 Bay Area transit systems that provide local bus service:

- Five have the same rank for per capita revenue hours and per capita ridership.
- Seven have deviation of one between per capita hours and per capita ridership
- Three have a deviation of two between per capita hours and per capita ridership
- Two have a deviation of three between per capita hours and per capita ridership
- Three have a deviation of five or six between per capita hours and per capita ridership

In the other three regions, the correlation of per capita revenue hours to per capita ridership is stronger. For example:

- In Toronto, based on linked trips, six transit systems have the same rank for per capita revenue hours and per capita ridership, while two systems have a deviation of one and one system has a deviation of two. Linked trips is a more accurate way of calculating transit use, however US transit agencies typically report ridership as unlinked trips (each transfer is a separate boarding). Therefore, when using unlinked trips, three transit systems have the same rank, four have a deviation of one and two have a deviation of two.

[2] All US data used in this report is from the 2018 Federal Transit Administration National Transit Database, the most recent year in which data is available. Canadian data is from the Canadian Urban Transit Association 2018 "Canadian Conventional Transit Statistics."

- Of the six Canadian metropolitan areas (an aggregate of all transit systems in each region), two transit systems have the same rank for per capita ridership and per capita serve hours and four have a deviation of one.
- In Washington DC, all seven systems have the same rank for per capita revenue hours and per capita ridership.
- In Seattle, three systems have the same rank for per capita revenue hours and per capita ridership and two have deviation of one.

Based on the premise that an increase in per capita revenue hours will generate a comparable increase in ridership, multiple approaches are used below to determine potential options for increasing service throughout the Bay Area.

Method 1A: Intra Bay Area Comparison

Using WestCAT as a benchmark produces more proportional increases in revenue hours for each agency.

This approach raises all Bay Area suburban transit systems to the level of WestCAT, which ranks third in per capita revenue hours and fourth in per capita boardings among all Bay Area bus operators. Its service area is low density and hilly – not as transit conducive as most suburban systems. Applying WestCAT's per capita revenue hours to all other bus systems except Muni and AC Transit results in 5,773,576 additional revenue hours per year, or an increase of 43%. This is higher than the density approach described below and falls in between scenarios 1 and 2 of Method 1B described below.

Method 1B: Macro Region Comparison

Comparing the aggregate performance in six Canadian Metro Areas to the Bay Area, providing a good baseline

When comparing the Bay Area to the six largest metro regions in Canada, the Bay Area ranks 7 in both per capita ridership and per capita revenue hours.

Below is a table which summarizes three scenarios for increasing service in the Bay Area based on per capita revenue hours for Canadian Metropolitan Regions:

Table 1 Comparison of Three Scenarios

Scenario	Per Capita Hours	Net Increase in Revenue hours in Bay Area	Percent Increase	Comments
Scenario 1	1.95	1,568,639	11.6	Comparable to Calgary – the Canadian metro with the lowest per capita revenue hours
Scenario 2	2.71	7,458,639	55	Comparable to Toronto
Scenario 3	3.01	9,783,639	72	Comparable to Montreal – the metro with the highest per capita revenue hours

The above approach does not indicate how to best to allocate additional revenue hours but does provide a benchmark as to the magnitude of service increase that would be appropriate for the Bay Area.

Method 1C: Density Categories

Establishing density categories and assigning transit systems to the category that they belong is not as effective as first thought in determining how to distribute additional revenue hours.

Because land use and densities vary greatly within the Bay Area (as well as any comparable metropolitan region), another approach is to group transit systems by population density.

On the one hand, this approach results in a cumulative increase in revenue hours midway between scenario 1 and 2 of method 1B above. On the other hand, it is flawed as a method of distributing funds. Because transit systems report service area differently, it is difficult to truly compare apples with apples. For large service areas, it is difficult to delineate between denser areas warranting more service and low density areas warranting minimal service. The above table only compares Toronto area systems with Bay Area systems. Although Seattle area systems have high per capita revenue hours, large service areas result in very low densities. For example, the highest density service operator in the Seattle area is Everett Transit at 3,272 persons per square mile. The King County Transit service area, which includes Seattle, has an overall density lower than Rio Vista Transit. To determine levels of service that should be provided in eastern Solano County based on Seattle is absurd. The same is applicable for Washington DC area transit systems.

There are some obvious problems with this approach when assigning service at the transit system level. For example there are no Canadian transit systems with a density between 8,000 and 9,999. Therefore Samtrans – the Bay Area Transit System that falls in this category – appears to be providing an adequate level of service. However this isn't too likely to be true. Conversely, Golden Gate Transit is the only Bay Area system that falls in the 6,000 to 7,999 category, therefore this approach assigns all of the additional revenue hours on this one system, likely considerably more hours than is appropriate

Summary of Method 1

The three approaches above yielded five potential levels of increased transit service in the Bay Area:

Table 2 Comparison of Method 1 Results

Method	Net Increase in Revenue hours	Percent Increase in Revenue hours
Method 1A	5,773,576	43
Method 1B Scenario 1	1,568,639	11.6
Method 1B Scenario 2	7,458,639	55
Method 1B Scenario 3	9,783,639	72
Method 1C	4,935,259	36

These three methodologies lack the nuance of other factors that address the propensity to use transit, and methods 1A and 1C focus exclusively on bus systems excluding increased service for new regional services or increases to existing regional services. They do provide potential baselines for the level of additional transit service that is needed in the Bay Area.

Method 2

A second method of determining the desired level of transit service at the sub regional level – and the amount of additional service needed to implement the Seamless Bay Area vision for regional services – is to develop a set of service standards. These are a combination of principles and also service levels that specific population densities can support based on the Transit Cooperative Research Project (TCRP) Transit Capacity and Quality of Service Manual.

Method 2A: Principles/Standards

This approach is used to determine the amount of additional service that could be allocated individually to each transit provider providing local service in the Bay Area, and separately to determine the revenue hours needed to implement the Seamless vision of regional services that will tie the region together.

- The minimum level of service for an all-day route should be a 60 minute frequency operating 16 hours per day, seven days per week.
- The minimum level of service for any peak only route (excluding school trippers) should be three trips in the peak direction in each peak period.
- All routes should be bi-directional except for terminal loops not exceeding one mile in length.
- Transit routes serving post-secondary education institutions should arrive no later than 30 minutes before classes begin and leave no earlier than 15 minutes after the last class
- Transit routes serving hospitals and major medical centers should operate at least 18 hours per day seven days per week to accommodate shift changes
- Transit routes serving major retail centers should arrive no later than 30 minutes before stores open and leave no earlier than 15 minutes after stores close
- Minimum service levels based on residential and commercial density based on the TCRP Transit Capacity and Quality of Service Manual
    - 4.5 dwelling units per acre (du/a) to 7 du/a — 60 minute frequency
    - 7 du/a to 11 du/a — 30 minute frequency
    - 11 du/a to 15 du/a — 15 minute frequency
    - 15 du/a and up — 10 minute frequency
    - 5 to 8 million sq. ft. — 60 minute frequency
    - 8 to 20 million sq. ft. — 30 minute frequency
    - 20 to 50 million sq. ft. — 10 minute frequency
- Provide local transit service within ¼ mile of all areas meeting the minimum threshold for transit service as defined above.

It is unlikely that any bus route will serve a consistent residential or commercial density. Therefore the predominant density will determine minimum service levels.

The service levels identified above should be considered the "floor" or minimum level of service. The "ceiling" or maximum level of service should be based on actual demand.

This project is only focusing on identifying the transit service deficit – or how much additional service should be provided. It will not determine how the service is designed to make sure there is good connectivity, nor will it determine where micro-transit may be an appropriate alternative to fixed route transit. In order to develop a number of additional revenue hours, the above principles and standards were used to determine where increasing frequency and/or service span should be applied to existing routes, converting one way loop routes to two way service, and extending existing routes or developing new routes to serve "transit deserts." However this is merely a proxy for determining additional service levels based on what the market can support, and not a recommendation that on how additional funds should be utilized.

Furthermore, there will be growth in most regions, be it inward (preferred) or outward. Because of the high level nature of this project, once sub-region service level increases are determined they should then be increased by a percentage comparable to anticipated population growth in the sub-region.

Sub Regions

For purposes of this report the Bay Area will be divided into seven sub regions:

- San Francisco
- San Mateo County
- Santa Clara County
- East Bay – west (Crocket to Fremont)
- East Bay – east (LAVTA, County Connection, Tri Delta)
- North Bay – west (Marin and Sonoma)
- North Bay – east (Napa and Solano)

Within the East Bay and North Bay sub regions, which have multiple local transit providers, calculations will be made for each agency then aggregated for the sub region.

To develop a cost per hour, an estimate was made for the incremental or marginal cost per hour for service of 65% of the fully loaded cost per hour based on 2018 NTD data.[3] Because the cost per hour varies significantly among Bay Area transit systems, the cost for each system was weighted to reflect the percentage of overall service provided by each system. The weighted average cost per hour for the Bay Area is $144.82 in 2018 dollars.

[3] Incremental cost is the cost of adding an hour of service that excludes overhead that is not likely to change by the addition of service.

Method 2B: Seamless Vision

Since Method 2A only reflects the services provided by the 20 Bay Area transit systems that provide local bus service, a second effort was made to illustrate the amount of additional service hours needed if the Seamless Bay Area vision is implemented (which includes planned extensions in Plan Bay Area). While some extensions are easier to calculate than others (e.g. frequency increases on Caltrain as opposed to new subway or rail lines in San Francisco, or a still need to be more defined regional express bus network), this number may actually underestimate the amount of additional revenue hours needed to fully implement the vision. However, the total calculated is less than four of the five approaches used in Method 1 above.

Summary of Method 2

The increase in revenue hours under method 2 is lower than all of the method 1 approaches for the 20 transit systems providing local service, and lower that all but one of the method 1 approaches when adding in regional service expansion.

Table 3 Summary of Method 2

Method	Net Increase in Revenue hours	Percent Increase in Revenue hours
Method 2A	1,208,244	8.8
Method 2B	2,534,078	18.7

Toronto as a Model

Based on our analysis, we recommend that the Bay Area strive for a level of service on parity with Toronto, which would represent a 55% increase over the service level in the Bay Area before COVID. Toronto has a similar average density after accounting for open space, and has a similar mix of densities among city center and suburban areas, but provides higher transit ridership, in part because of its higher service level.

Conclusion

The Bay Area is underserved in the provision of transit services. This level of service limits access to opportunity – from employment and education to health care and social activities – for a large percentage of the population, and contributes to economic and environmental stress in the region. According to MTC, the region faces a 10 percentage point gap toward meeting the region's carbon emissions targets to address climate change.[4] On a national level, the Rocky Mountain Institute estimates that even with a near conversion to electric vehicles by 2030, there must still be a 30 percent reduction of vehicle miles traveled (VMT) to reach Paris Accord temperature increase targets. It will take a variety of strategies to meet the social, economic, and environmental goals of the Bay Area region, but without a robust transit network serving as a foundation, every other strategy will have far less impact.

Restoring public transportation service in the Bay Area will also be essential to help the economy recover from the impacts of COVID-19. This report shows that returning to the pre-COVID status quo will not be enough to meet the region's transportation and environmental goals. Achieving robust transit service and ridership on par with peer metropolitan areas will require not only additional service hours, but also integrated fare policy, infrastructure improvements to support walking, bicycling, and other means of getting to stations without driving, and land use with better support for transit, more density, and a greater mix of uses. Providing a much higher level of overall transit service is an essential foundation for these improvements. Individuals do not have mobility if transit service is not available at the times they need to travel, or is not easily accessible near their home. This report shows that providing a much higher level of transit service is critical in order to achieve higher ridership and lower driving miles across the region.

If the average (35%) increase in revenue hours of the seven approaches used above are to be implemented, it would require an additional $20.5 billion in 2018 dollars over 30 years to fund this level of increased service, if all additional service were implemented at the same time. To put that amount in context, if a funding measure designed to raise $100 billion over 30 years was approved, this would account for 20 percent of that funding. However, all service would not be implemented at once. This also does not account for the fare revenue that the additional service would generate. Therefore, the actual amount of new revenue that would need to be generated from new funding sources could be lower.

[4] Plan Bay Area 2050 Draft Outcomes
https://www.planbayarea.org/sites/default/files/PBA2050_Draft_BPOutcomes_071720.pdf

Table 4 Summary of All Methods

Estimate Method	Annual Increase in Revenue Hours	Percent Increase in Revenue Hours	Annual Increase in Operating Cost
Increase local service hours based on per capita service of WestCAT, best suburban Bay Area Transit system (Method 1A)	5,773,576	+ 43%	$836,129,276
Increase all service hours to match per capita service in, Calgary, lowest Canadian metro area (Method 1B)	1,568,639	+11.6%	$227,170,300
Increase all service hours to match per capita service in Toronto Metro area, most similar to Bay Area in population (Method 1B)	7,458,639	+ 55%	$1,080,160,100
Increase all service hours to match per capita service in Montreal, highest Canadian metro area (Method 1B)	9,783,639	+ 72%	$1,416,866,600
Increase all service hours based on per capita service of best performer in each density category (Method 1C)	4,935,259	+ 36%	$714,724,208
Increase local service hours based on standards/principles (Method 2A)	1,208,244	+8.8%	$174,977,896
Increase local service hours based on standards/principles plus Seamless Vision Regional links (Method 2B)	2,534,078	+ 18.7%	$366,985,176
Average	**4,740,351**	**+35%**	**$686,497,632**

Author and review team

The report was authored by Ron Kilcoyne, an experienced former transit agency General Manager with a professional specialty at increasing transit ridership, especially in suburban bus systems.

Voices for Public Transportation is a vibrant coalition of 35 groups representing transit rider and worker unions, community organizing groups, transportation policy and equity advocates, and central labor councils across the nine-county Bay Area. VPT is dedicated to achieving a Green New Deal for Transportation in the Bay Area.

Seamless Bay Area is a founding member of the VPT coalition, and seeks to create an integrated, world-class, accessible, and equitable transit system by building a grassroots movement for change and pursuing structural policy reforms to transit governance.

The review team includes Peter Straus of San Francisco Transit Riders, Bob Allen of Urban Habitat, Ian Griffiths and Adina Levin of Seamless Bay Area, Chris Lepe of TransForm, Richard Marcantonio of Public Advocates, and Vinita Goyal of Silicon Valley Community Foundation.