

2016

Major Corridors Study Final Report



Prepared for



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MAJOR CORRIDORS STUDY

FINAL REPORT

August 2016

Prepared by



Prepared for



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List of Acronyms

Acronyms	Definition
AC Transit	Alameda-Contra Costa Transit District
Alameda CTC	Alameda County Transportation Commission
ADA	Americans with Disabilities Act
BAT Lanes	Business Access and Transit Lanes or Bus and Turn lanes
BART	Bay Area Rapid Transit
BRT	Bus Rapid Transit
CCTA	Contra Costa County Transportation Authority
CEQA	California Environmental Quality Act
CO ₂	Carbon Dioxide
CTP	Countywide Transit Plan
GHG	Greenhouse Gas Emission
HOV	High-Occupancy Vehicle
FTA	Federal Transit Administration
LRT	Light Rail Transit
MTC	Metropolitan Transportation Commission
NEPA	National Environmental Policy Act
OBAG	OneBayArea Grant
O&M	Operations and Maintenance
PDA	Priority Development Area
POP	Proof of Payment
RM2	Regional Measure 2
SEP	Service Expansion Plan
SFMTA	San Francisco Municipal Transportation Agency
TAC	Technical Advisory Committee
TFCA	Transportation for Clean Air Program
TIGER	Transportation Investment Generating Economic Recovery
TPI	Transit Performance Initiative
TSP	Transit Signal Priority
ZEV	Zero Emission Vehicle

1 Executive Summary

Alameda – Contra Costa Transit District (AC Transit) operates over 150 transit routes within the district as well as providing service to neighboring cities and counties, including Union City, Milpitas, Menlo Park, Palo Alto, Foster City, San Mateo, San Francisco and Pinole. Weekday ridership on the top 12 Major Corridors is approximately 100,000, representing over 50% of the system-wide daily ridership. By focusing on those corridors and routes with the highest bus ridership, the study identifies opportunities to benefit the greatest number of customers and attract new riders.

AC Transit buses have been facing slower travel speeds and worsening on-time performance. At the same time, Plan Bay Area is projecting an increase in population and employment of 30 percent and 40 percent, respectively. As a result, transit ridership within the District is expected to double. A combination of the forecast ridership increase and slower bus speed poses a great challenge in providing efficient and reliable service to riders. The public transportation system must evolve to meet the needs of future residents and commuters. The Major Corridors Study addresses these needs and provides the basis for capital planning for the District's top corridors through 2040 to help meet these transportation demands and needs.

Like its predecessor document, the Strategic Vision, the Major Corridors Study lays out a phased approach and a menu of options to improve bus service on AC Transit's highest ridership corridors. It aims to increase transit reliability and service quality and helps to inform the District's capital improvements for the next 25 years to meet the region's anticipated growth and need for high quality, high-capacity transit. For example, existing peak hour transit travel speeds are projected to decrease by 11 percent by 2040 as a result of increased travel congestion that will slow traffic, including buses. However, implementation of corridor improvements are projected to result in transit travel speed improvements and increase ridership.

AC Transit assessed the current service, established future goals and performance measures, and developed and evaluated investment concepts for each of the study corridors. Using transportation models and other technical tools to develop projected performance for the year 2040, the alternatives were evaluated against the established goals and performance measures. Preliminary capital and operating cost estimates were calculated for each of the corridors' alternatives.

Development of Investment Alternatives Short-term and long-term capital investment strategies were developed for each corridor and included four basic modes: Enhanced Bus, Rapid Bus, Bus Rapid Transit (BRT), or Light-rail Transit (LRT). Short-term investment strategies were chosen based on improvements that could be implemented within a five-year period and that would be compatible with long-term improvements under consideration. Long-term investment strategies considered sufficient household density in 2040 to support the level of investment, available street widths (or right-of-way) to accommodate the mode evaluated, and neighborhood-level operational considerations. The investment types considered for each corridor for the short- and long-term are shown in Table A.

Table A: Short-term Investments and Initial Long-Term Investments for Evaluation

Corridor	Short-Term (by 2020)	Long-Term (by 2040)
San Pablo Avenue/Macdonald Avenue	Rapid Bus Upgrades	BRT
Shattuck Avenue/Martin Luther King Jr. Way	Enhanced Bus	Rapid Bus - Overlay Local
Broadway/College Avenue/University Avenue	Enhanced Bus	Rapid Bus - Replace Local
Adeline Street	Operational Improvements	BRT
Telegraph Avenue	Rapid Bus Upgrades	BRT or Light Rail
Fruitvale Avenue/Park Street	Enhanced Bus	Enhanced Bus Upgrades
MacArthur Boulevard/40th Street	Enhanced Bus	Rapid Bus - Replace Local
West Grand Avenue/Grand Avenue	BRT*	BRT Upgrades*
Foothill Boulevard	Enhanced Bus	Rapid Bus - Replace Local
Hesperian Boulevard	Enhanced Bus	Rapid Bus - Overlay Local
East 14th Street/Mission Boulevard/Fremont Boulevard	Enhanced Bus	BRT
International Boulevard/East 14th Street*	BRT	Extensions to BRT Service

* The Grand Avenue BRT project would likely have most features of BRT, but it may not have all BRT characteristics. See Section 5.3.1 (Page 26) for additional discussion.

Evaluation of Investment Alternatives To evaluate the alternatives tentatively selected for each of the corridors, the study team used a combination of Alameda CTC's travel demand model and elasticity-based calculations. These tools measure the impact of factors such as travel speed and service frequency on ridership. Given growth projections for jobs and housing and absent transit investments, bus service quality (travel speed and service reliability) is expected to degrade.

The transit improvements evaluated for each corridor were based on the mode (LRT, BRT, Rapid Bus, or Enhanced Bus) and on the physical characteristics unique to each corridor. To achieve the maximum transit benefit, the highest level of transit investment was evaluated, giving consideration the corridor's physical limits and future land use. Generally, the more intensive the investment, the greater the improvement to bus service, including faster transit speeds, increased reliability, and improved effectiveness and cost efficiency of the service. In other words, BRT and LRT improvements tended to result in better performance than Rapid Bus or Enhanced Bus improvements. However, all the potential investments evaluated result in improved performance measures established for this study.

As shown in Figure A, by 2040, Enhanced Bus improvements are expected to have the least impact on transit travel speed, while BRT and LRT, which include the most investment-intensive transit features including significant segments of exclusive transit lanes, would provide the greatest benefit to transit

travel speed. The BRT improvements would increase transit travel speed by an average of nearly 50 percent compared to taking no action.

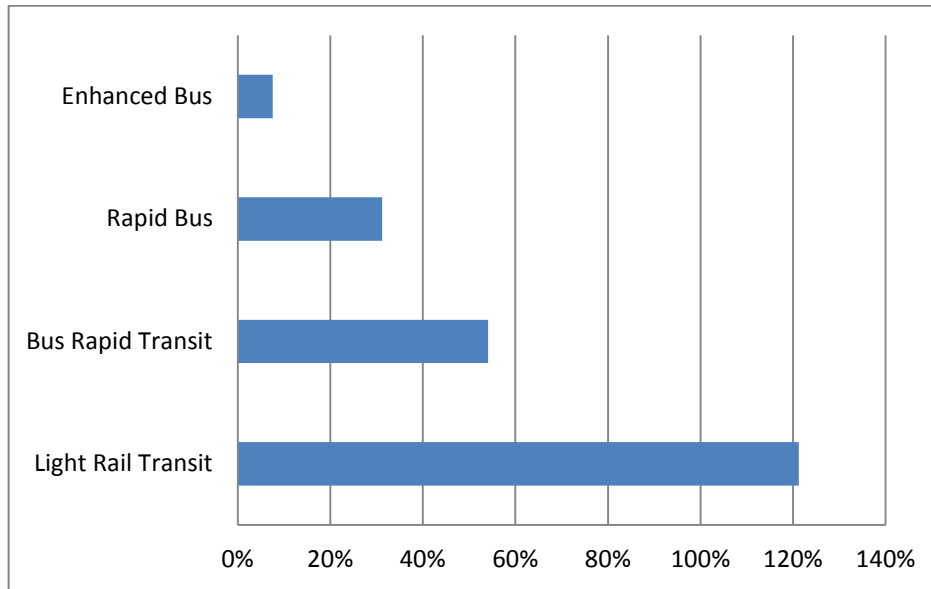


Figure A: Percent Travel Speed Increase by Mode (2040 with Project vs. 2040 Baseline)

Transit improvements that increase transit travel speed could compete well with automobiles for many trips. This is confirmed in the ridership forecasts. Figure B shows the projected percent ridership increase by mode, and Figure C shows projected ridership per route mile by mode. The modal analysis indicates that the higher the level of transit improvements in a corridor, the higher the projected ridership increase.

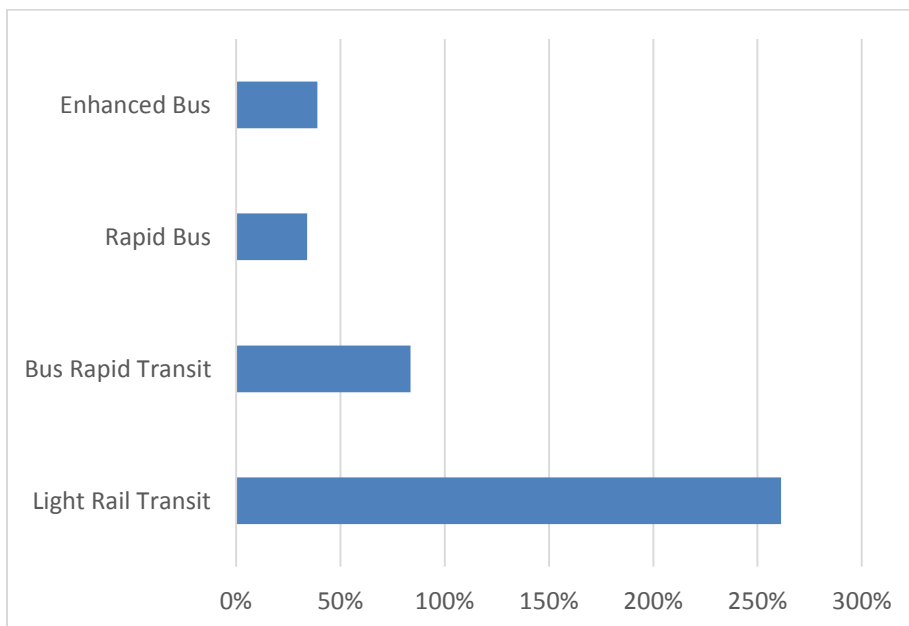


Figure B: Ridership Increase by Mode (2040 with Project vs. 2040 Baseline)

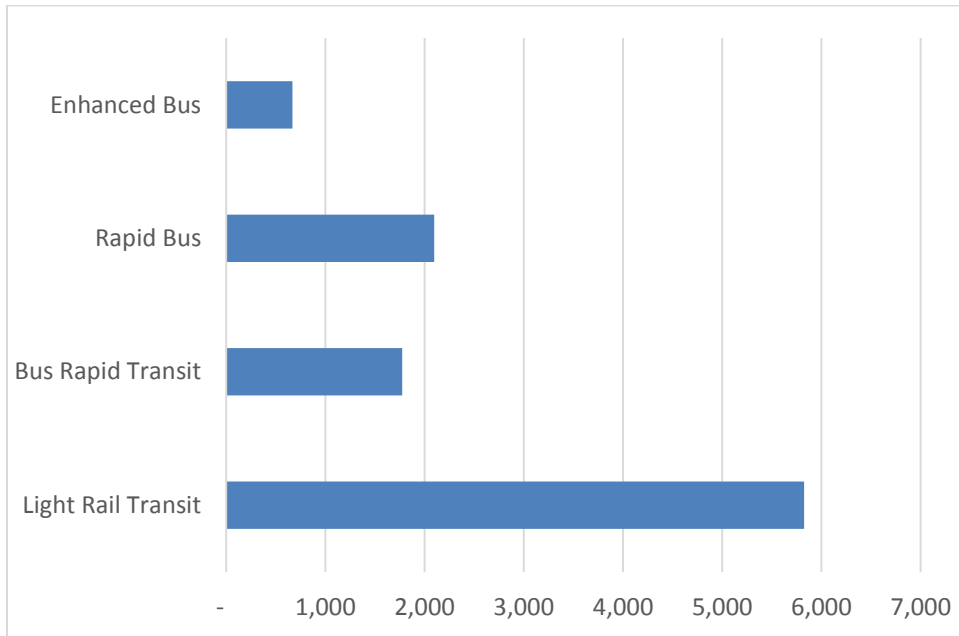


Figure C: Ridership per Route Mile by Mode (2040 with Project)

Similar results were found for service effectiveness, reliability, and cost effectiveness. Generally, a more efficient, reliable, and cost-effective service was linked with a higher level of transit investment on a corridor. An important goal of the transit improvements is to provide more cost-effective transit service. For example, the corridors with the highest ridership have a corresponding lower cost per trip. BRT is projected to have the lowest cost per trip as well as a competitive cost per mile, as shown in figures D and E, indicating a high return on investment for this transit strategy.

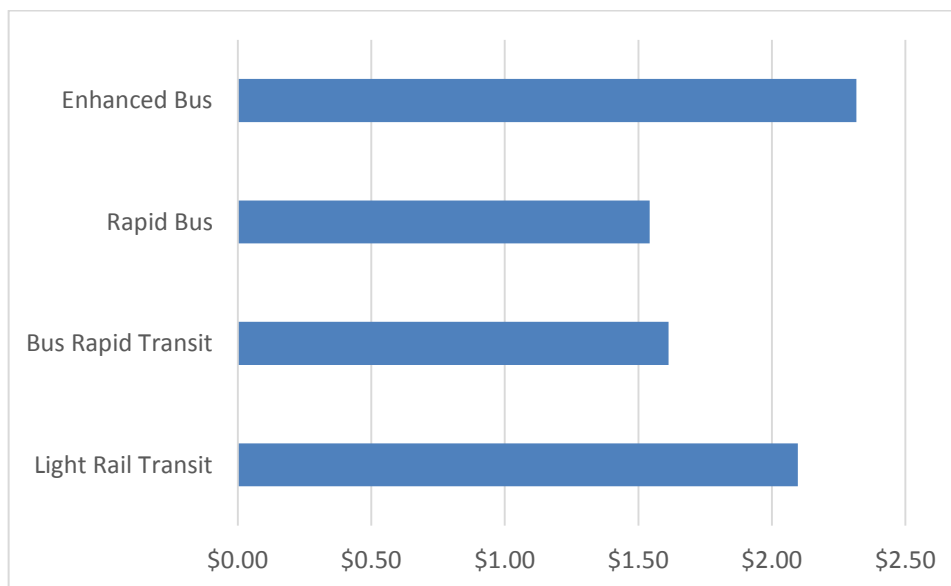


Figure D: Operating Cost per Unlinked Passenger Trip by Mode

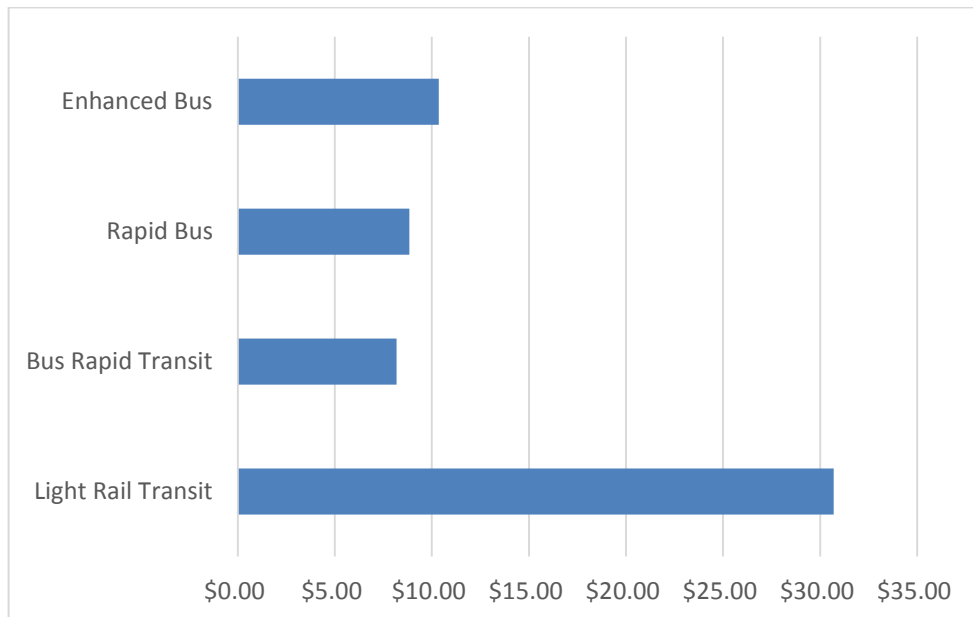


Figure E: Operating Cost per Mile by Mode

Capital cost estimates range from \$5 million to \$22 million per mile for bus-based investment strategies and \$428 million per mile for light-rail investment (in Year 2020 dollars). As shown in Figure F, Enhanced Bus and Rapid Bus costs per mile are similarly grouped, ranging from \$5 to \$11 million per mile. The difference in the estimated cost per mile was mostly due to the potential for adding transit lanes to bypass congestion. BRT costs are nearly triple or quadruple that range, given its more intensive capital improvements. Finally, rail costs are exponentially higher in comparison to the three other modes.

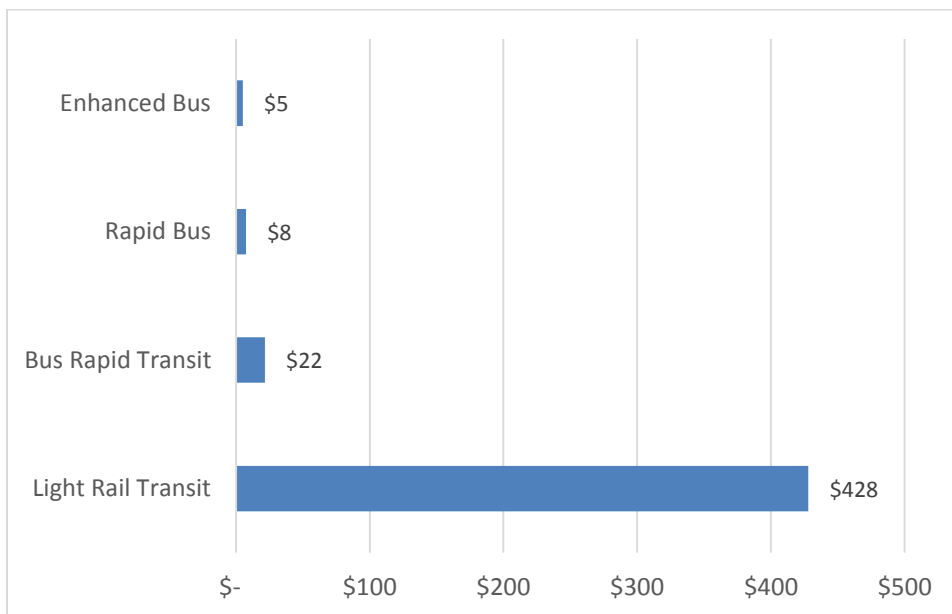


Figure F: Capital Cost per Mile by Mode (in million dollars)

Revised Short-Term and Long-Term Investment Strategies Given the findings from the evaluation and the input received on the Draft Final Report, the study team recommends that all investment strategies initially proposed be advanced for further consideration, with the following exceptions:

- The results for the Adeline Street corridor are inconclusive. The Major Corridors Study considered upgrading the corridor initially through operational improvements by 2020 and with BRT implementation by 2040. The evaluation in the Major Corridors Study and the Alameda Countywide Transit Plan showed conflicting performance for all measures, except travel time improvement and cost per vehicle mile, which were rated as having a moderate improvement. While BRT investments would improve transit service quality on this corridor, the discrepancy between modeled ridership and Alameda CTC's market analysis indicates that further research would be necessary to justify the cost of BRT. The Alameda CTC's market analysis demonstrated the trip between downtown Berkeley and Emeryville as a strong transit market, while the Alameda CTC's model indicated small ridership increase. Therefore, an Operational Improvement strategy is recommended for the short-term horizon. More detailed studies may or may not indicate that a higher level of investment is justified in the long-term.
- It is recommended that the rail option for the Telegraph Avenue corridor not be pursued and that the BRT option be advanced. Both modes fared well in this corridor's evaluation for all performance measures. While the BRT performance was lower when compared to light rail, the BRT investment is projected to yield much more cost-effective service than the LRT investment. BRT costs per trip and per mile were forecasted to be less than half that of light rail. In addition, the \$3 billion estimated total capital cost for light rail is 22 times more than the estimated \$136 million total capital cost for BRT. For these reasons, the BRT investment in this corridor is recommended as the preferred option for future consideration.
- The West Grand Avenue and Grand Avenue segment was separated from the MacArthur Boulevard Corridor. The short-term recommendation for this corridor is BRT; however, all BRT features may not be included. A critical feature in the short-term is installation of transit lanes in coordination with the MTC's Core Capacity Study and the Bay Bridge Forward project and other improvements by the City of Oakland. All transit routes, including Lines NL, 12 and other Transbay routes, could use the transit lanes to provide reliable and frequent service connecting neighborhoods along the West Grand Avenue/Grand Avenue, in downtown Oakland and near the Transbay Transit Center as well as bypassing congestion on I-580. The long-term recommendation would be for BRT upgrades. Additional BRT elements, such as all door boarding, could be added in coordination with the MacArthur Boulevard/40th Street Rapid Bus improvements.
- The MacArthur Boulevard/40th Street Corridor is recommended for Enhanced Bus for the short-term and Rapid Bus Replace Local for the long-term. Some wide right-of-way exists for potential transit lanes, especially on 40th Street and MacArthur Boulevard east of 73rd Street. Due to the challenging roadway configuration with some narrow right-of-way segments and multiple crossings of Interstate 580 (I-580), creating a consistent roadway design treatment is difficult.

Thus, Rapid Bus-Replace Local is recommended for improving the service and meeting the expected ridership increase.

Table B summarizes the Major Corridor Study's final recommendations.

Table B: Final Short-Term and Long-Term Investment Strategies for Major Corridors

Corridor	Short-Term (by 2020)	Long-Term (by 2040)
San Pablo Avenue/Macdonald Avenue	Rapid Bus Upgrades	BRT
Shattuck Avenue/Martin Luther King Jr. Way	Enhanced Bus	Rapid Bus - Overlay Local
Broadway/College Avenue/University Avenue	Enhanced Bus	Rapid Bus - Replace Local
Adeline Street	Operational Improvements	TBD
Telegraph Avenue	Rapid Bus Upgrades	BRT
Fruitvale Avenue/Park Street	Enhanced Bus	Enhanced Bus Upgrades
MacArthur Boulevard/40 th Street	Enhanced Bus	Rapid Bus – Replace Local
West Grand Ave/Grand Avenue	BRT*	BRT Upgrades*
Foothill Boulevard	Enhanced Bus	Rapid Bus - Replace Local
Hesperian Boulevard	Enhanced Bus	Rapid Bus - Overlay Local
East 14th Street/Mission Boulevard/Fremont Boulevard	Enhanced Bus	BRT
International Boulevard/East 14th Street	BRT (under construction)	Extensions to BRT Service

* The West Grand Avenue/Grand Avenue BRT project would likely have most features of BRT, but it may not have all BRT characteristics. See Section 5.3.1 (Page 25) for additional discussion.

2 Background and Context

In 2001, the Alameda-Contra Costa Transit District (AC Transit) adopted its Strategic Vision¹ and expressed its intent to provide a world-class transit system for the East Bay. The Strategic Vision set forth a phased approach to improve bus service on AC Transit's highest ridership corridors. AC Transit delivered or is in the process of delivering some of the corridor projects described in the Strategic Vision. The projects identified in the document and implemented are the East Bay BRT project in the International Boulevard/E. 14th Street corridor, Rapid Bus projects on the San Pablo Avenue and Telegraph Avenue Corridors, and the Travel Time Delay Reduction project on the Broadway/College Avenue/University Avenue corridor. The District is also in the early planning stages for a Travel Time Delay Reduction project on the Line 97 Hesperian Boulevard corridor.

At the same time, service and ridership levels have changed since 2001. Some bus lines have been rerouted, while other bus lines require modification due to District-led projects or projects sponsored by others. Thus, there is a need to update the corridor definitions and types of improvement envisioned for the major corridors.

In addition, one of the major changes in the Bay Area is adoption of Plan Bay Area. Through the designation of Priority Development Areas (PDAs) and linking transportation and land use planning, population and job growth will be directed to the inner core of the Bay Area, like AC Transit's service area.

2.1 Challenges

While the Major Corridor routes have been successfully carrying high ridership and demonstrate strong potential for ridership growth, AC Transit faces significant operational challenges.

Declining Operating Speeds

AC Transit is expected to face a continued downward trend in travel speed through 2040 if no significant improvements are made. As shown in Figure 1, districtwide average fleet speed has fallen nearly five percent in the last five years. The system wide average travel speed in fall 2015 was 10.1 mph. The

About AC Transit

The district stretches along the eastern side of San Francisco Bay from Richmond to the north of Fremont to the south, a distance of some 50 miles. AC Transit serves 13 cities and portions of unincorporated Alameda and Contra Costa Counties.

In FY 2013-14, AC Transit operated 1.7 million hours of revenue service. With Measure BB, AC Transit will increase service by 14 percent in Alameda County and provide a total of 1.9 million hours of revenue service. Service increase will be implemented over a year period with the first phase implemented in June 2016. The Measure BB funding allows AC Transit to operate at the pre-2010 service cut level.

Despite the degradation in the service network from the 2010 service cuts, ridership increased by nearly 5 percent from 2012 to 2014. AC Transit operates over 150 transit routes, including 29 Transbay routes. Systemwide weekday ridership in FY 2014-15 was 178,851, including 13,233 Transbay passengers.

¹ AC Transit. Strategic Vision 2001 – 2010.

infrastructure investment strategies evaluated in the Major Corridors Study target to reverse the trend of slower buses and make transit a more reliable and attractive modal choice.

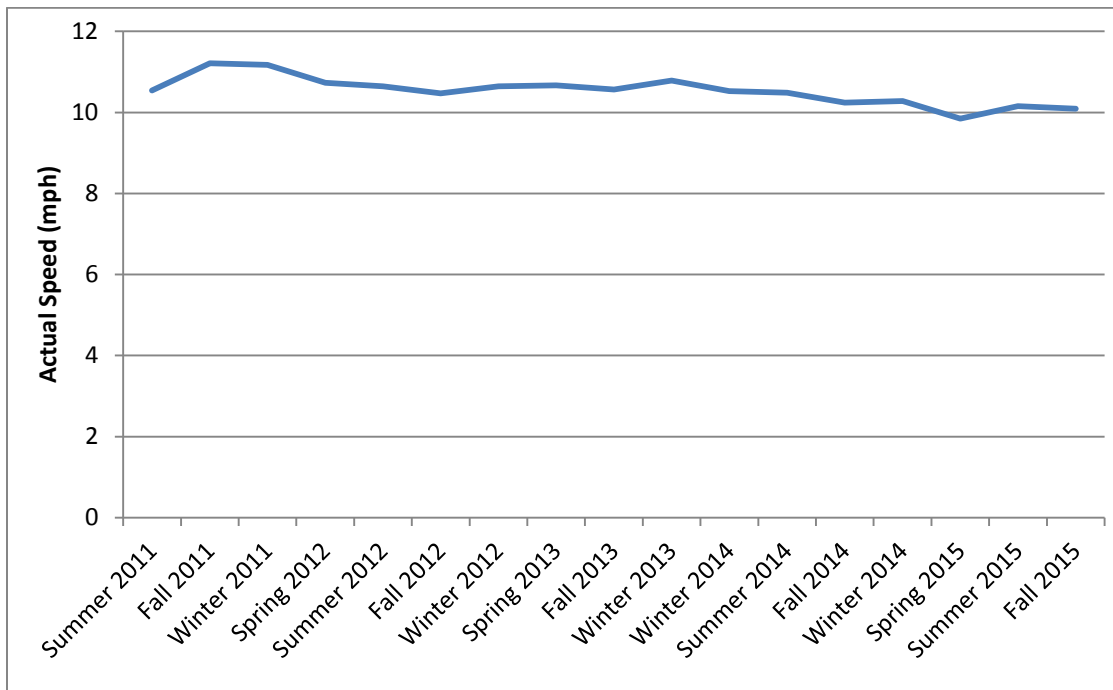


Figure 1: Historic Districtwide Average Traveling Speed (mph)

Meeting On-Time Performance Goals

Most Major Corridors routes do not meet the agency's performance goal of 72 percent on-time performance. A customer survey conducted for this study revealed that riders value good on-time performance because schedule adherence allows riders to schedule their trip. Poor reliability is a key challenge.

Future Scale of Service Delivery

The AC Transit District is expected to have a 30 percent population increase and 40 percent employment increase through 2040, but with little roadway capacity increase. Thus, ridership in the District is forecast to double ridership even without additional transit investments. This scenario presents a serious problem in transporting a significantly larger number of riders on increasingly congested roadways.

2.2 Opportunities

Focusing on investments on the Major Corridors could have the greatest benefit to the existing riders and potential future riders. Key opportunities to improve transit performance and increase transit ridership are summarized in the section below.

Strong Ridership Growth Expected

Today, ridership on the Major Corridors is strong and is forecasted to grow through Year 2040. Some areas, such as Warm Springs, Brooklyn Basin and Alameda Point, will create new neighborhoods, and the Major Corridors could be modified to serve those new markets. The Alameda CTC's Countywide Transit Plan notes strong potential transit markets throughout the District.² The plan also notes that transit may not have yet captured full potential ridership.

Many Streets Can Accommodate High Investment Levels

Seven of the 12 Major Corridors have a minimum of 70 feet width on 50 percent of their lengths. This width can accommodate an intensive transit improvement, such as BRT, and reallocates the roadway from a car-centric design to a more balanced multimodal environment with transit supportive design. This type of investment is likely to improve transit travel time significantly and attract more ridership.

Improved Coordination and Collaboration with Regional and Local Agencies

AC Transit worked closely with Alameda CTC in developing the Countywide Transit Plan and Multimodal Arterials Plan. Nine of the 12 Major Corridors are included in the Countywide Transit Plan. In addition, AC Transit coordinated with Metropolitan Transportation Commission (MTC) on the Transbay Core Capacity and Bay Bridge Forward projects as well as updates of the Plan Bay Area. There are great opportunities in coordinating and collaborating to create transit-friendly policies and work jointly to develop and implement projects.

2.3 Study Purpose and Goals

The Major Corridors Study is being carried out to refresh the capital investment recommendations in the District's Strategic Vision. The study focuses on developing and analyzing capital improvements for AC Transit's key corridors and recommends short- and long-term investment strategies to help shape AC Transit's capital investment program for the next two decades. By focusing on those corridors and routes with the highest ridership, the study is identifying the best opportunities to benefit the largest number of customers and to attract new riders by 2040.

The study continues AC Transit's efforts to improve service on its highest ridership corridors to meet the following goals:

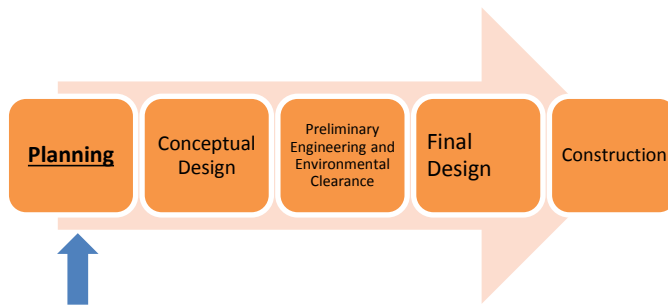
Goals:

1. Increase ridership;
2. Improve access to work, education, services, and recreation;
3. Increase effectiveness/reliability;
4. Increase cost efficiency; and
5. Reduce emissions.

² Alameda CTC, Countywide Transit Plan Final Report, Jun 2016

As depicted in Figure 2, the Major Corridors Study is an early step in project development. At this planning stage, alternatives or investment strategies are identified and evaluated before a decision is made to advance them for more focused study and development. The identified alternatives enable the District to develop and refine projects for inclusion in regional plans including the Alameda CTC's Countywide Transit Plan, Contra Costa Transportation Authority's (CCTA) Countywide Transportation Plan, and the MTC's Regional Transportation Plan, as well as start the process of seeking funding from the Federal Transit Administration (FTA).

Figure 2: Project Development Process



The Major Corridors Study is part of the planning stage

2.4 Study Process

The study was structured using an iterative process that included significant interaction and collaboration with AC Transit Planning staff and the study's Technical Advisory Committee, composed of staff from local jurisdictions and other transportation agencies; coordination with Alameda CTC's Countywide Transit Plan development; and public outreach, including three rounds of community meetings with the public and individual stakeholder meetings.

The study's early stages involved preparation of baseline studies, establishment of goals and performance measures, and the development of alternatives for each of the corridors. The alternatives were subsequently evaluated against these goals and performance measures for 2040 conditions using a travel demand modeling exercise. Preliminary capital and operating cost estimates were also developed for each of the corridors' alternatives and were included as part of the alternatives evaluation. Figure 3 graphically summarizes the study's overall development.

Figure 3: Major Corridors Study Process



2.5 Relationship to Other Studies and Planning Efforts

The Major Corridors Study's goals are aligned with those of Alameda CTC's Countywide Transit Plan and those of MTC's Transit Sustainability Project and Transit Performance Initiative (TPI). Additionally, the Major Corridors Study takes into account the development of goals outlined in the regional Plan Bay Area and the designation of Priority Development Areas (PDAs) by local jurisdictions.

The study was developed in coordination with AC Transit's other planning efforts. The AC Transit Board approved the Service Expansion Plan (SEP) in January 2016, which focuses on short-term operational improvements to increase reliability and speed. The SEP, now branded as AC Go, will be rolled out over an 18- to 24-month period beginning in June 2016. While in some cases, the SEP recommendations may change alignments on the major corridors, streets included in the Major Corridors Study would remain important streets for AC Transit, regardless. The SEP service changes were assumed in the analysis of Year 2040 Baseline conditions.

In addition, AC Transit is coordinating planning efforts on similar corridors with Alameda CTC's Multimodal Arterial Plan, West Contra Costa Technical Advisory Committee's High-Capacity Transit Study, and MTC's Transbay Core Capacity Transit Study.

3 Study Corridors and Baseline Conditions

AC Transit's Major Corridors are the highest-ridership corridors, and together, they transport over 50 percent of the District's overall ridership. Most corridors were selected because they have historically been high ridership corridors. Some corridors and modifications to the existing corridors were selected based on its transit market potential. AC Transit plans to focus infrastructure improvements on the following 12 Major Corridors:

- San Pablo Avenue/Macdonald Avenue (Lines 72, 72M, 72R)
- Shattuck Avenue/Martin Luther King Jr. Way (Line 18)
- College Avenue/University Avenue/Broadway (Lines 51A, 51B)
- Telegraph Avenue (Line 6)
- Adeline Street (Line F)
- MacArthur Boulevard/40th Street (Lines 57, NL)
- West Grand Avenue/Grand Avenue (Line NL)
- International Boulevard/East 14th Street (Lines 1, 10)
- Foothill Boulevard (Line 40)
- Fruitvale Avenue/Park Street (Lines 20, 21)
- Hesperian Boulevard (Line 97)
- Mission Boulevard/East 14th Street/Fremont Boulevard (Lines 99, 10)

The 12 Major Corridors, illustrated in Figure 4, travel on approximately 100 miles of roadway, carrying over 100,000 passengers daily. Corridor descriptions are provided in Appendix A. Details of the corridor selection process are explained in Appendix B.

While most corridors orient in a mostly north-south direction, some corridors provide east-west connections. Together they form a high frequency, high-capacity transit network stretching from Richmond to Fremont.

During the course of this study, service on some routes have been changed or will be changed in order to improve reliability and operational efficiency in a short-term. One of the major changes is splitting the International Boulevard/E. 14th Street segment (Line 1) and the Telegraph Avenue segment (New Line 6) as two independent corridors as the former will be under construction for BRT. In addition, the Mission Boulevard/East 14th Street Corridor was split into Line 10 (from the San Leandro BART Station to Hayward BART station) and Line 99 (from Hayward BART station to Fremont BART station).

3.1 Land Use Context

The estimated 2010 population of the AC Transit service area is approximately 1,404,000 persons. Population and employment in the District are forecasted to increase by 30 percent and 40 percent, respectively, between 2010 and 2040. Figures 6 and 7 illustrate population and job densities in Year 2010 and 2040 within the District. By 2040, the areas that are dense in 2010 generally either maintain or increase their level of density.

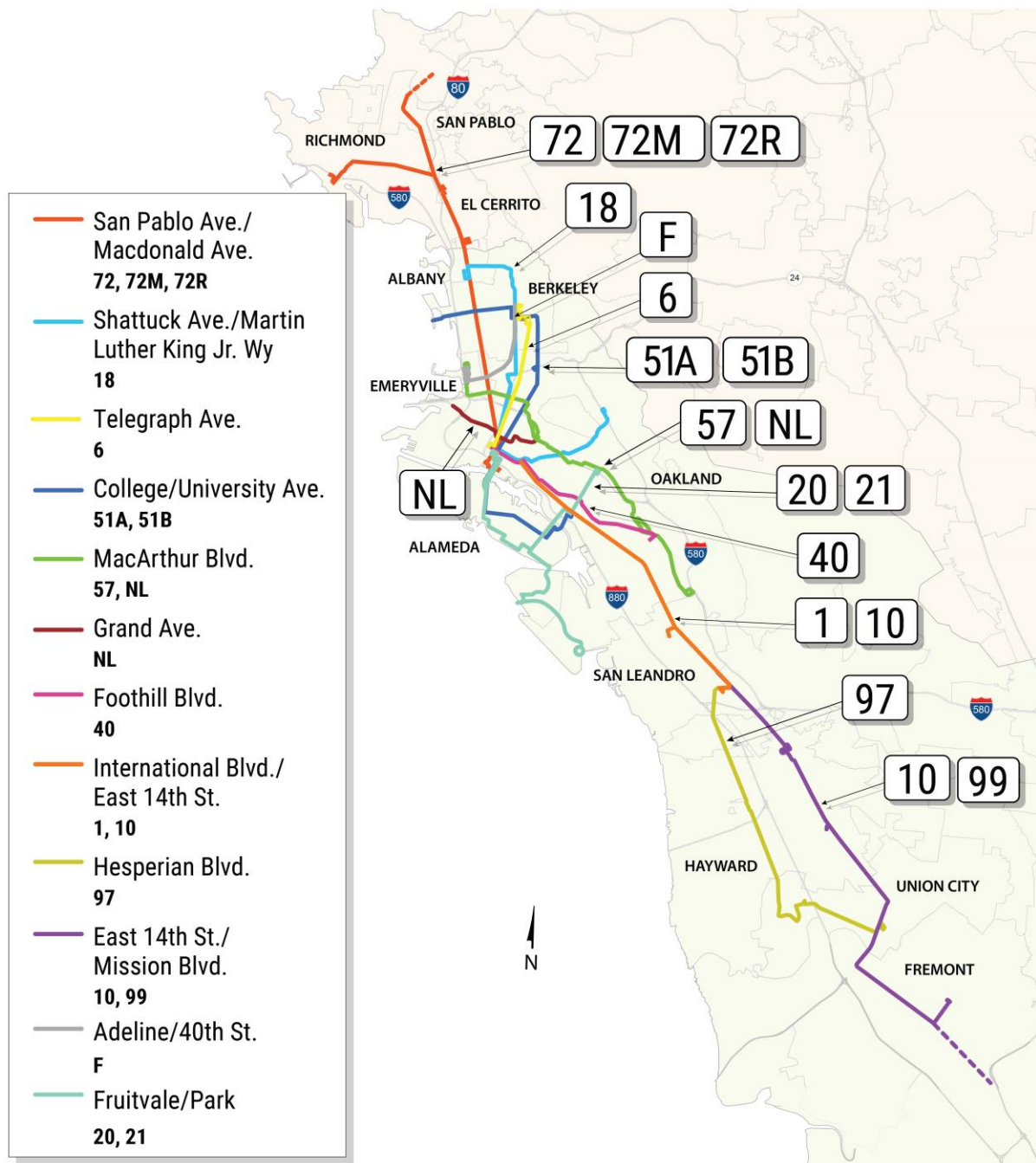


Figure 4: Map of Major Corridors

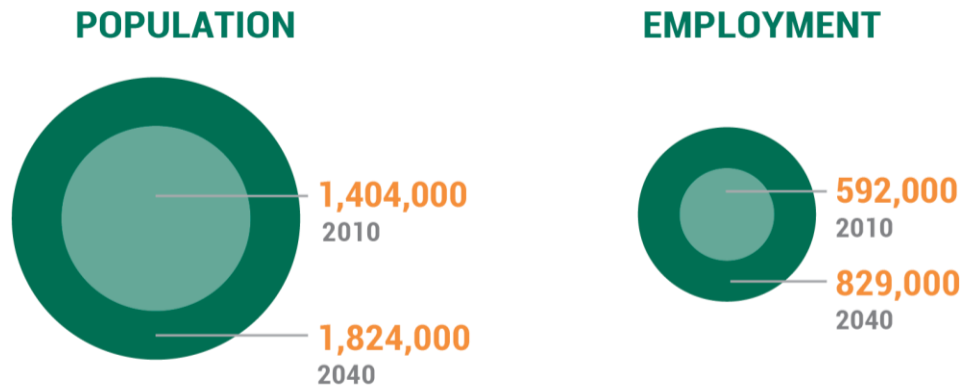


Figure 5: Population and Employment in the AC Transit's Service Area

Local jurisdictions in the Bay Area have adopted nearly 200 Priority Development Areas (PDAs), based on existing conditions and future expectations. PDAs are existing neighborhoods in the Bay Area that local jurisdictions have identified as appropriate places for development or growth that would be transit-supportive and pedestrian-friendly.

AC Transit's service area includes 40 PDAs, including a regional center that is downtown Oakland, city centers (e.g., downtown Berkeley), and new neighborhoods (e.g., Alameda Point, South Fremont/Warm Springs). These areas include locations where the East Bay's largest absolute increases in housing and population are anticipated as well as the overall job growth. Large portions of the cities of Oakland and Emeryville are designated as PDAs. Additionally, San Pablo Avenue is a PDA where it travels through the cities of San Pablo, Richmond, El Cerrito, Albany, Emeryville, and Oakland. The majority of the Major Corridors travel through multiple PDAs as shown in Figures 8 and 9. Three quarters of the projected housing and population growth within the District is forecasted to take place in areas designated as PDAs.

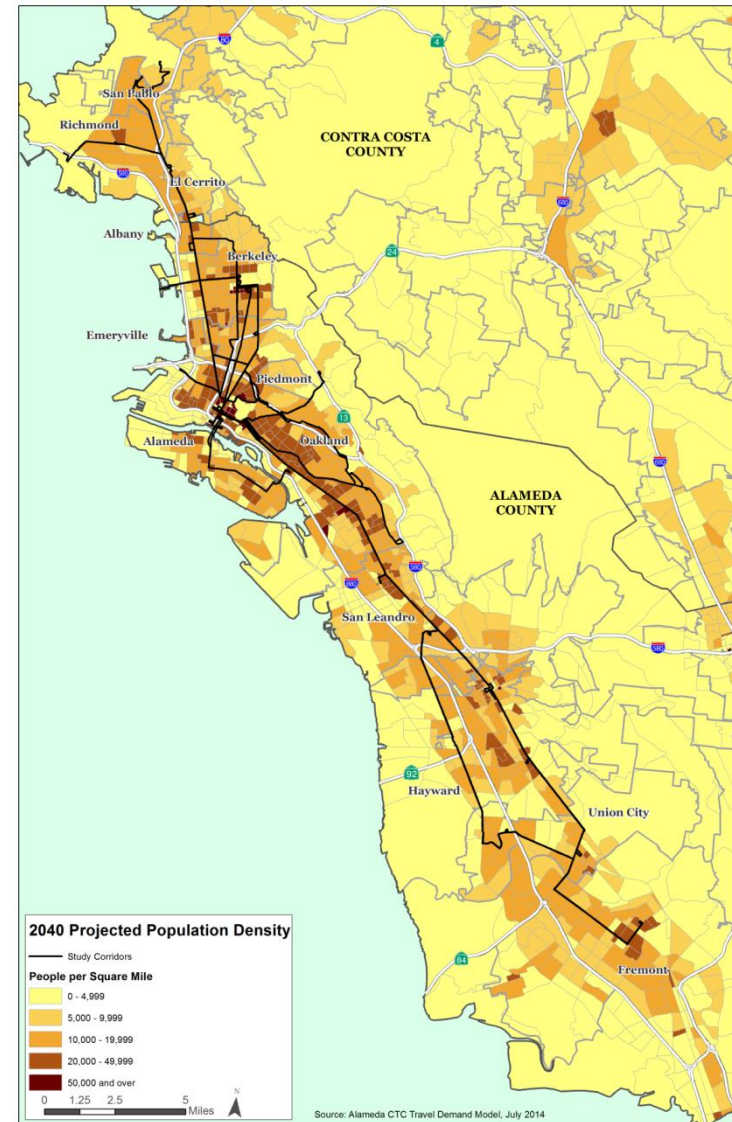
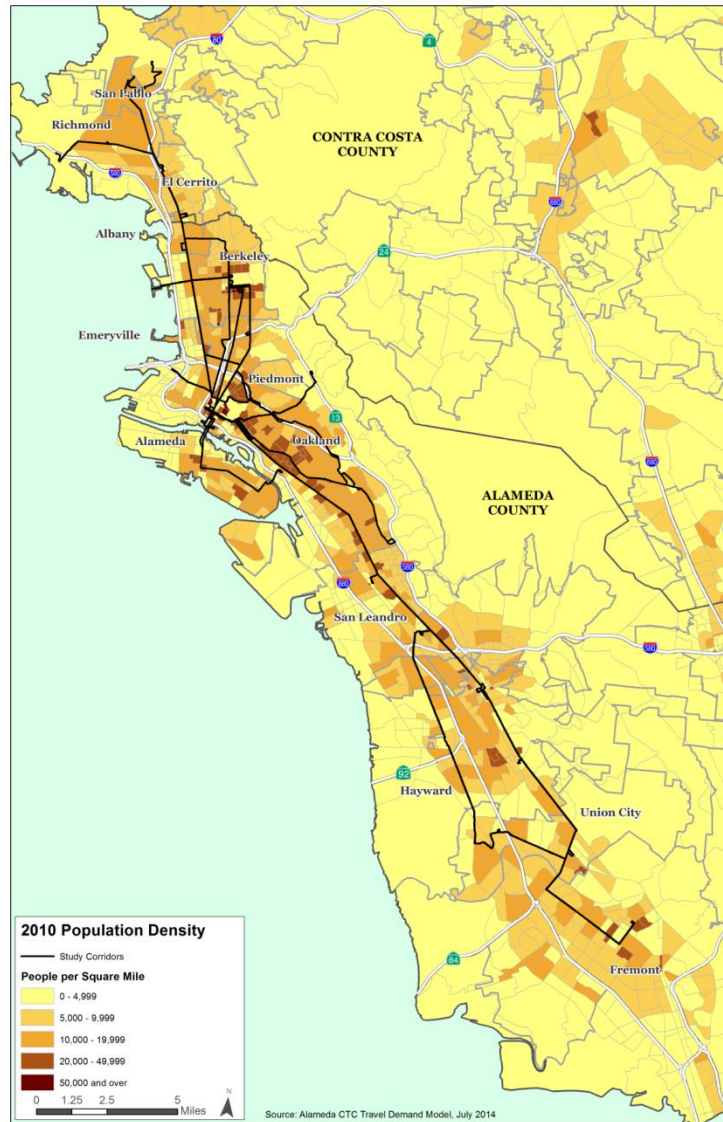


Figure 6: Year 2010 Population Density (Left) and Year 2040 Projected Population Density (Right)

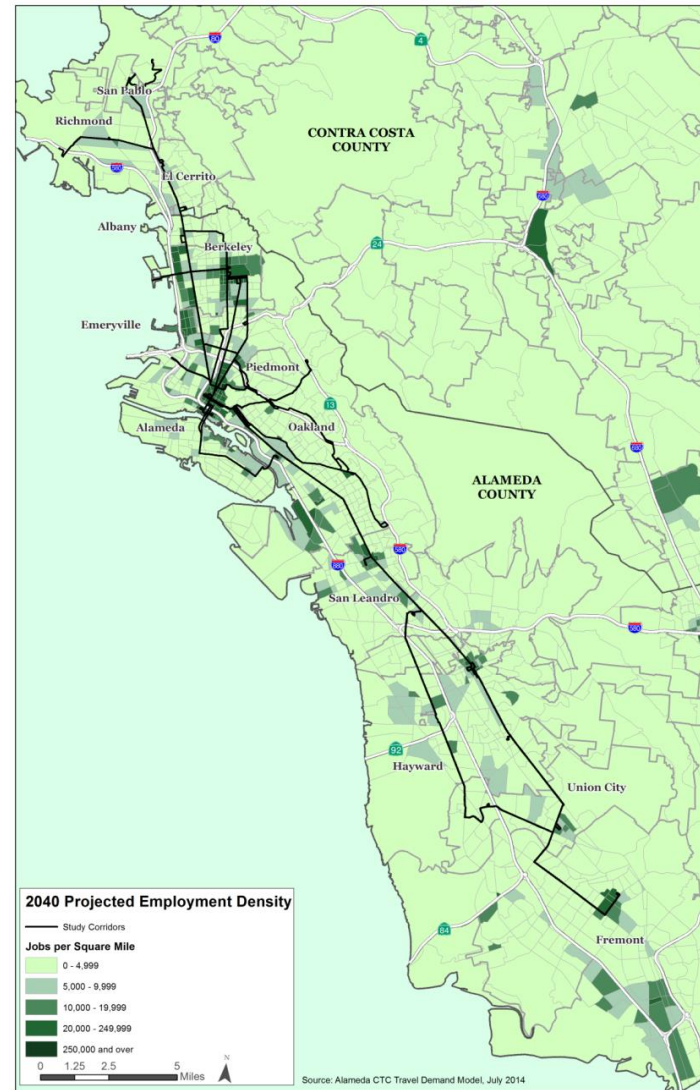
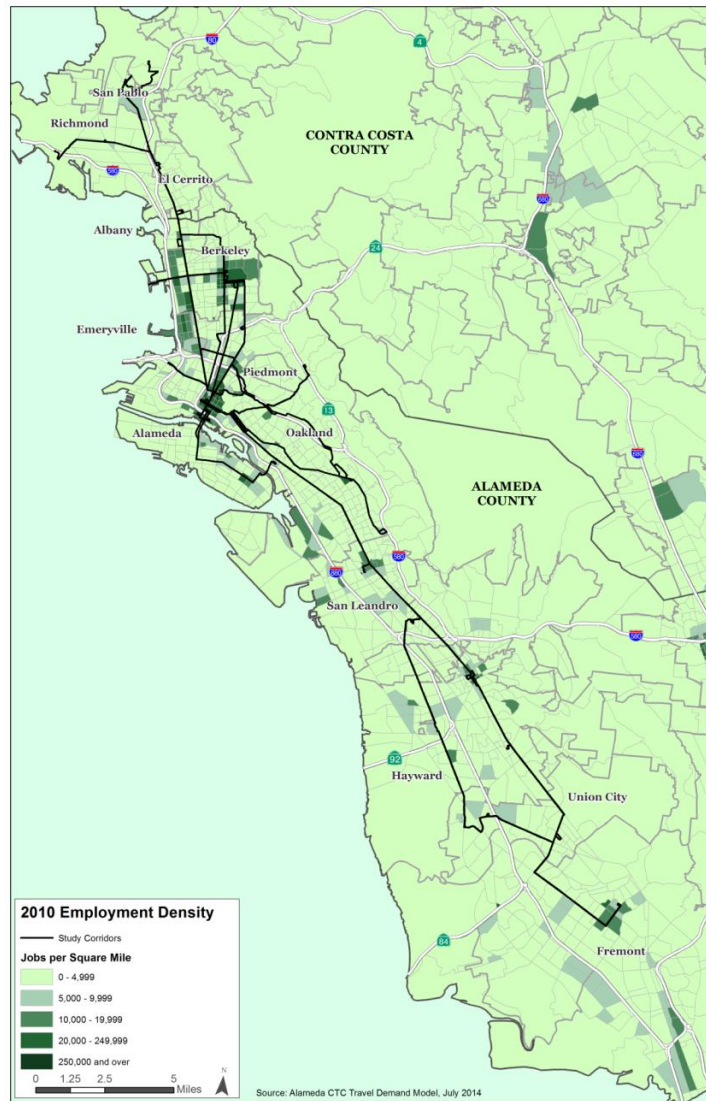


Figure 7: Year 2010 Employment Density (Left) and Year 2040 Projected Employment Density (Right)

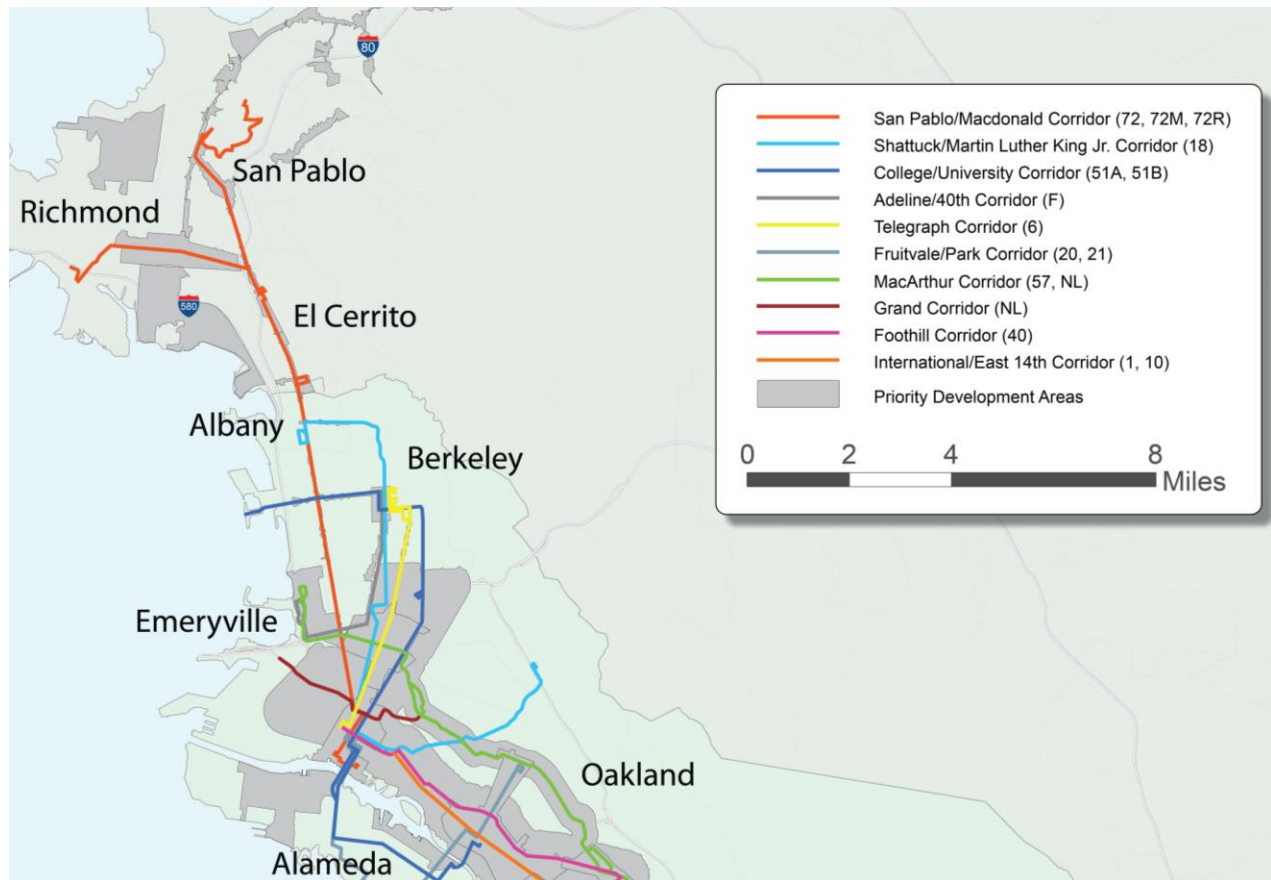


Figure 8: Priority Development Areas adjacent to Major Corridors (North)

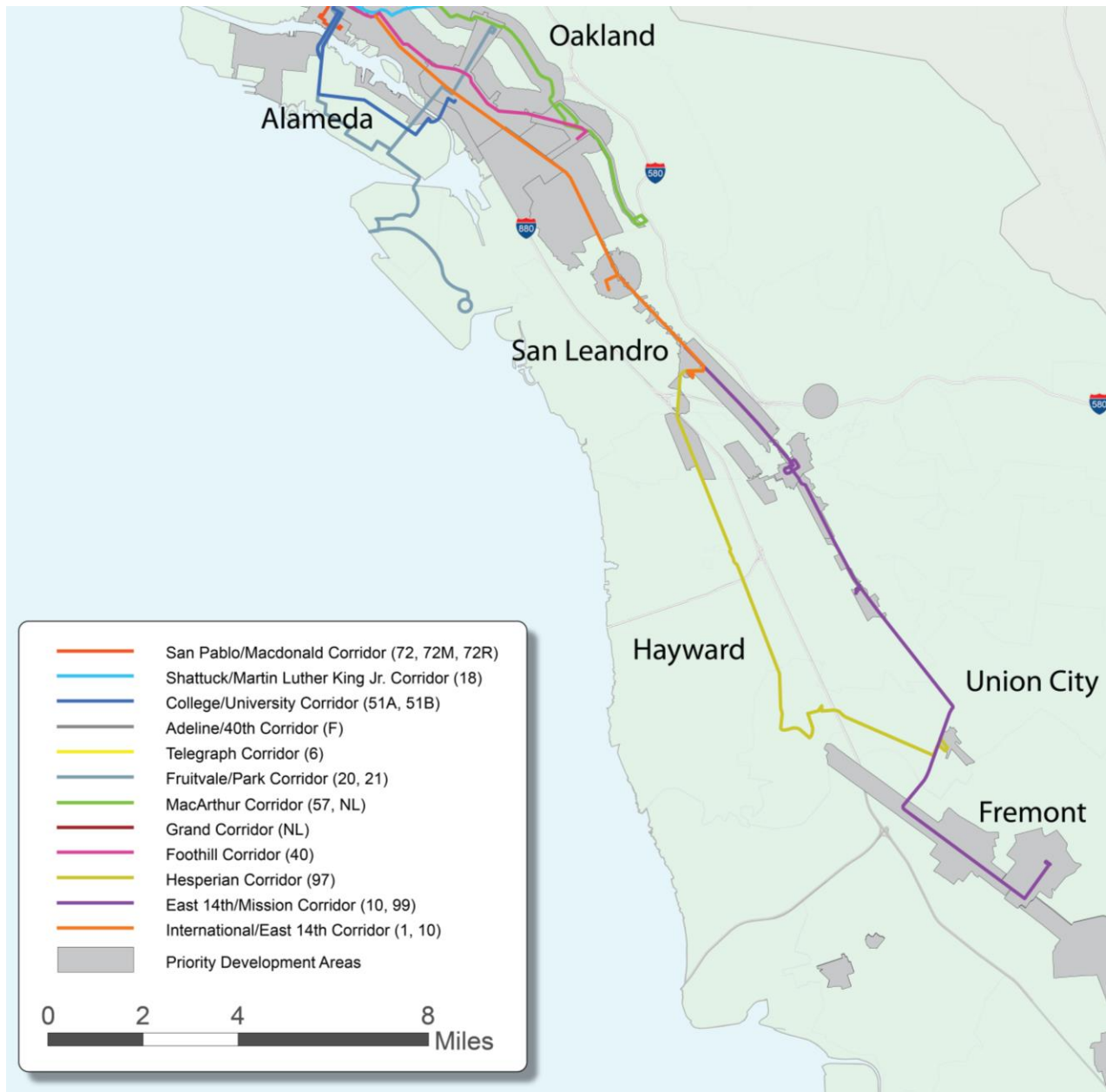


Figure 9: Priority Development Areas adjacent to Major Corridors (South)

4 Existing Transit Service

The existing transit services on the 12 major corridors examined in this study are summarized in Table 1. Routes included below are major routes within each corridor. As noted earlier, service on some routes were changed or will be changed in order to improve reliability and operational efficiency in the short-term. One of the major changes is splitting the International Boulevard/E. 14th Street segment (Line 1) and the Telegraph Avenue segment (New Line 6) into two independent corridors as the former will be under construction for BRT.

For the West Grand Avenue/Grand Avenue corridor, the number of passengers who would benefit from the West Grand Avenue/Grand Avenue improvements is reported under the average daily ridership column in Table 1. Those riders include Lines NL, 12 and many Transbay routes.



Uptown Transit Center, Oakland

Table 1: Summary of Existing Weekday Service on Study Corridors

Line	Average Daily Ridership ¹	On-Time Performance ^{1, 2}	Average Passengers Per Revenue Hour ¹	Average Passengers Per Revenue Trip ¹	Average Operating Speed mph ³
San Pablo Ave/Macdonald Ave Corridor					
72	4,534	55%	36	61	12.0
72M	4,233	55%	39	60	11.3
72R	6,998	63%	42	52	13.1
Shattuck Avenue/Martin Luther King Jr. Way Corridor					
18	8,293	65%	43	61	10.8
Telegraph Avenue/International Boulevard Corridor					
1	12,005	58%	50	95	11.0
1R	10,964	52%	55	84	12.7
Broadway/College Avenue/University Avenue Corridor					
51A	10,587	71%	55	54	10.8
51B	10,532	69%	75	54	8.6
MacArthur Boulevard/40th Street Corridor					
57	7,543	50%	48	53	11.1
58L	1,107	64%	28	23	12.5
NL	3,193 (systemwide)	61%	34	34	18.0
West Grand Avenue/Grand Avenue Corridor⁴					
NL	1,668 boardings (include SF)	61%	34	34	18.0
12	591 boardings	—	—	—	—
Transbay lines ⁵	3,500	—	—	—	—
Foothill Boulevard Corridor					
40	10,558	70%	53	55	11.5
Hesperian Boulevard Corridor					
97	4,550	63%	37	41	13.6
East 14th Street/Mission Boulevard/Fremont Boulevard Corridor					
99	2,786	55%	27	40	13.7

¹ AC Transit, 2013 Annual Performance Report.

² AC Transit defines on-time performance as the percentage of trips that arrive no more than one minute early and departs no more than five minutes late.

³ Average speed data for all bus routes from December 2011 and December 2013, provided by AC Transit. Some of Major Corridor Routes have been changed or scheduled changes in order to achieve a short-term operational improvements and efficiency.

⁴ Boardings on the 3.3-mile corridor including boardings in San Francisco.

⁵ Transbay routes potentially re-routed to from I-580 to the West Grand Avenue/Grand Avenue corridor per the MTC's Core Capacity. Those routes include Lines C, B, CB, E, NX1, NX2, NX3, NX4, NXC, P and V.

5 Investment Alternatives

The capital investment strategies considered are three bus investment strategies: Enhanced Bus service, Rapid Bus, and BRT service. In addition, AC Transit considered whether any of the Major Corridors could benefit from rail. Table 2 summarizes features typically associated with these four investment concepts. Table 3 presents the minimum right-of-way requirements for each investment strategy. Descriptions of each element presented in Table 2 are summarized in Appendix C.

Table 2: Elements of Investment Concepts Evaluated in Study

Features	Enhanced Bus	Rapid Bus	BRT	Rail
Bus stops and stations				
Stop relocations or consolidations	✓	✓	✓	✓
Longer stops or stations	✓	✓		✓
Curb extensions or bus bulbs	✓	✓		
Enhanced bus stops or stations		✓	✓	✓
Level boarding (raised platforms)			✓	✓
Intersections and signals				
Queue jump signals	✓	✓	✓	
Transit signal priority	✓	✓	✓	✓
Signal modernization and coordination	✓	✓	✓	✓
Running way				
Queue bypass lane	✓	✓	✓	
Transit lane ¹	✓	✓	✓	✓
Other				
Real-time information		✓	✓	✓
Branding		✓	✓	✓
All-door boarding		✓	✓	✓
Signage and wayfinding		✓	✓	✓
Proof of payment		✓	✓	✓

- ^{1.} Enhanced Bus and Rapid Bus may include transit lanes to bypass congestions for less than 50 percent of the corridor. A BRT corridor would require transit lanes for at least 50 percent of the corridor. A Rail corridor would require its own dedicated right-of-way for at least 90 percent of the corridor.

Table 3: Minimum Right-of-Way Requirements for Investment Concepts

	Enhanced Bus	Rapid Bus-Overlay Local	Rapid Bus-Replace Local	BRT	Rail
Right-of-way requirements	None	Majority of segments operate in roadway with 2 or more lanes in each direction	None	70 feet for at least 50% of corridor	70 feet for at least 90% of corridor

5.1 Enhanced Bus

Enhanced Bus improvements increase reliability and reduce travel delays by providing signal improvements, minor roadway improvements, and bus stop optimization. These changes can be applied relatively quickly, often in a three-year period or less. Potential treatments include sidewalk extensions, transit signal priority (TSP) and/or adaptive signal control, queue-jump lanes and signals, longer bus stops or bus loading zones, and bus stop optimization. Enhanced Bus improvements do not typically require minimum right-of-way and could be implemented on any of the corridors.

AC Transit implemented these types of improvements on the Broadway/College Avenue/University Avenue corridor and is planning for implementation of Enhanced Bus improvements on the Hesperian Boulevard corridor.

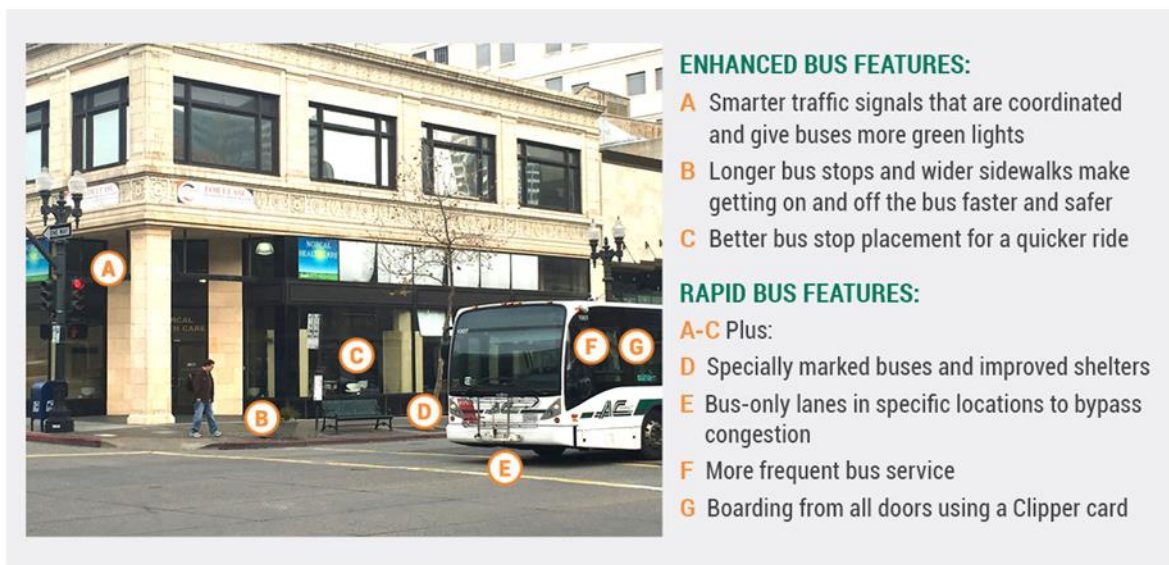


Figure 10: Enhanced Bus and Rapid Bus Features

5.2 Rapid Bus

Rapid Bus service operates at a faster speed than Enhanced Bus service by having wider bus stop spacing and more extensive infrastructure improvements than Enhanced Bus service. In addition, Rapid Bus service is expected to provide higher quality passenger amenities and can have bus lanes in selected locations. All-door boarding using a Clipper card is not part of the existing Rapid Bus service but is recommended for all future Rapid Bus lines. This feature would shorten passenger loading time and overall travel time. The right-of-way requirements depend on the type of Rapid bus service, as discussed below. Implementation takes approximately three to five years from planning to service start.

Operationally, a Rapid Bus corridor could be served by one of two basic service patterns, described below and summarized in Table 4:

- 1) **Rapid Bus-Overlay Local**, in which both a local line and Rapid line operate on the corridor, with the Local line serving all stops and the Rapid line serving select stops, or

- 2) **Rapid Bus-Replace Local**, in which a Rapid line replaces other routes on the corridor. Under this option, the Rapid line would have shorter stop spacing compared to a Rapid Bus-Overlay Local option so that acceptable access to stops along the corridor is maintained.

The two Rapid Bus options have advantages and disadvantages that should be evaluated against ridership demand, rider travel patterns, and the physical constraints of each corridor. The Rapid Bus-Replace Local option would generally have lower operating costs because there is only one route operating in the corridor. However, because it stops more frequently, it would have a longer travel time. The added operational costs of the Rapid Bus-Overlay Local option is warranted in very high ridership corridors that can productively support both Local and Rapid Bus routes and on corridors that have a high percentage of longer-distance travel that benefits most from the faster travel time of a limited stop service.

The lane configuration of the street is an important consideration in determining the Rapid Bus option to be applied on a corridor. The Rapid Bus-Replace Local option does not require four travel lanes and, thus, can be implemented on narrow streets such as College Avenue.

Table 4: Operating Characteristics for Rapid Bus Service

Characteristics	Rapid Bus - Overlay Local	Rapid Bus - Replace Local
Typical Application	<ul style="list-style-type: none"> Majority of segments operate in a roadway with more than 2 lanes in each direction Enhanced bus stop, including shelter, bench, and real-time information Branding and enhanced to stops to distinguish Rapid service and stops 	<ul style="list-style-type: none"> Operates in constrained areas where a Rapid bus would not be able to pass a Local bus Branding and enhanced to stops to distinguish Rapid service and stops
Typical Stop Spacing	<ul style="list-style-type: none"> Rapid: 1/2 to 2/3 mile apart Local: 800 feet to 1300 feet apart 	<ul style="list-style-type: none"> Rapid: 1/3 mile apart
Typical Headways	<ul style="list-style-type: none"> Rapid: 10-12 minutes Local: 15-20 minutes 	<ul style="list-style-type: none"> Rapid: 8-12 minutes
Right-of-way requirements	<ul style="list-style-type: none"> Majority of segments operate in roadway with 2 or more lanes in each direction 	<ul style="list-style-type: none"> None

Rapid Bus-Overlay Local service requires two or more travel lanes in each direction for a large portion of the corridor. The multiple travel lanes allow the Rapid Bus to pass the Local service because of the different stop spacing configuration for each service type. If there are corridor segments with only a single lane in each direction, special considerations must be taken to operate Rapid Bus in combination with Local service. One option would be to create bus pull-outs for Local stops that allow the Rapid Bus to pass Local service. Another option would be to simply have the Rapid and the Local service serve the same stops along the restricted portion of the corridor.

For corridors where a significant portion of the route has only as single lane in each direction, it is recommended that the Rapid Bus-Replace Local option be applied. It should be noted that under a Rapid Bus-Replace Local option, the “replacement” applies to the existing primary local route that operates along the corridor. Long corridors are likely to include some segments that would be used by other local bus routes, which may continue to operate in the corridor. These situations could create potential delays to the Rapid Bus in corridor sections that have only a single travel lane in each direction. This issue should be addressed on a case-by-case, corridor-by-corridor basis during project development. Options to address the conflict include: re-routing of the local service, creating bus pull-outs to allow the Rapid Bus to pass the local service or, if the overlapping segment is short, simply tolerating the delay to the Rapid Bus should it get caught behind a Local line.

AC Transit currently operates Rapid Bus-Overlay Local service on the San Pablo Avenue/Macdonald Avenue Corridor and recently operated the service on the International/Telegraph/E. 14th Corridor.

5.3 Bus Rapid Transit

BRT is a high-quality, high-capacity bus transit system designed to emulate light rail operation. Elements for a BRT-level of investment for a major corridor include:

- Bus-only lanes for at least 50 percent of the corridor;
- TSP and/or adaptive signal systems that reduce delays from traffic signals;
- Off-board fare payment that allows boarding through any door, avoiding on-board payment delays;
- High-platform stations to allow level boarding that facilitates and speeds boarding;
- High-amenity stations, including: shelters, real-time passenger information, and lighting;
- New or improved pedestrian infrastructure (e.g., new crosswalks, boarding islands) to facilitate access to the station;
- Zero or ultra-low emission BRT vehicles with special livery and features such as door bridge plates that would be designed to support BRT operations; and
- Unique brand identification.

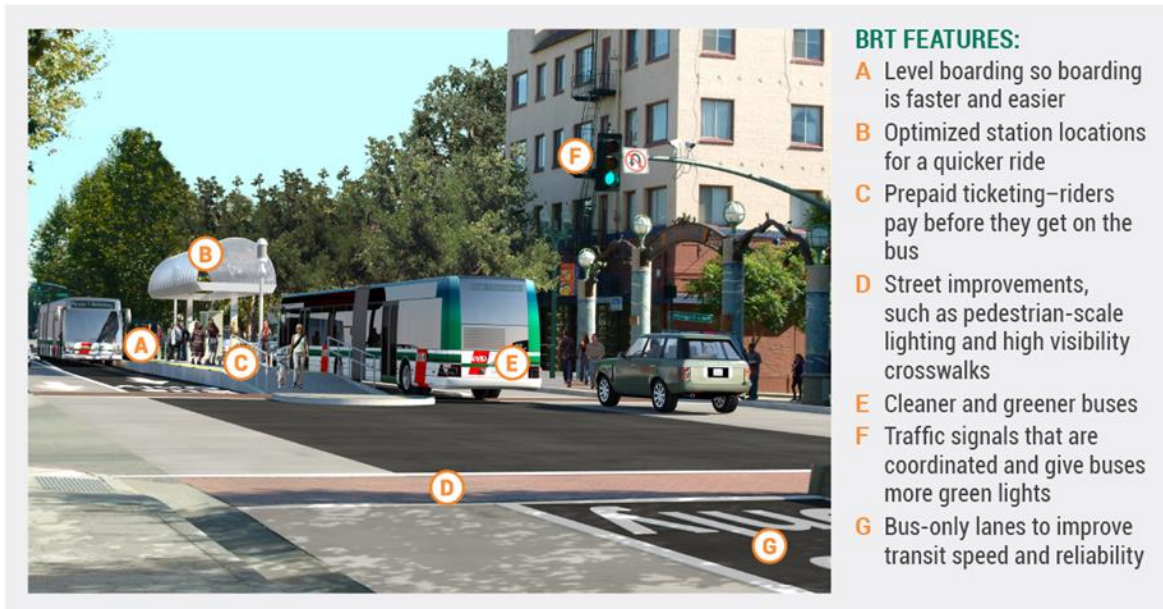


Figure 11: BRT features

BRT projects can include additional corridor investments, including lighting, wayfinding, and safety improvements that support the transit investment. BRT's intensive capital and operating features typically involve an implementation timeline of seven years or more.

Bus-only lanes can be located in the center of a roadway or curbside. Bus-only lane placement (center vs. curbside) will be determined during the project development phase. Median-running bus lanes produce the highest benefits for transit operations because they would be less affected by turning traffic than curbside lanes. Curbside bus lanes are typically shared with right-turning vehicles. Both types of bus-only lanes count towards the 50 percent requirement. Median-running bus-only lanes comprise 80 percent of AC Transit's East Bay BRT's running way.

5.3.1 West Grand Avenue/Grand Avenue BRT

While a new BRT project should strive to have all typical BRT elements described in Section 5.3 for efficient and reliable operations, the West Grand Avenue/Grand Avenue BRT project would likely differ from a typical BRT project. The West Grand Avenue/Grand Avenue BRT project would likely be used by Lines NL and 12 as well as other routes, including AC Transit's Transbay buses traveling on I-580 (i.e., Lines B, C, CB, E, NX1, NX2, NX3, NX4, NXC, P and V) and potential Express Bus Service to Oakland by other transit agencies. In order to allow all transit vehicles to use this corridor, design of the West Grand Avenue/Grand Avenue BRT project would not have level boarding as summarized in Table 5. All door payment and proof of payment could be added in coordination with the MacArthur Boulevard/40th Street Rapid Bus project. The Transbay buses, except NL, would use the corridor to avoid congestion on I-580 and make limited stops along the corridor until the corridor ridership increases.

Table 5: Typical BRT Elements vs. Potential West Grand Ave/Grand Ave BRT Elements

Features	Typical BRT	West Grand Ave/ Grand Ave BRT
Bus stops and stations		
Stop relocations or consolidations	✓	✓
Longer stops or stations		✓
Curb extensions or bus bulbs		✓
Enhanced bus stops or stations	✓	✓
Level boarding (raised platforms)	✓	
Intersections and signals		
Queue jump signals	✓	✓
Transit signal priority	✓	✓
Signal modernization and coordination	✓	✓
Running way		
Queue bypass lane	✓	✓
Transit lane	✓	✓
Other		
Real-time information	✓	✓
Branding	✓	
All-door boarding*	✓	✓
Signage and wayfinding	✓	✓
Proof of payment*	✓	

* All-door boarding and proof of payment could be added to Line NL with the MacArthur Corridor project's implementation of all-door boarding and proof of payment.

5.4 Rail

Rail investments involve transit vehicles that operate on tracks and, for this purpose, include such technologies as light rail transit and streetcars. In addition to tracks and rail vehicles, a rail investment would have similar features as BRT (e.g., enhanced stations, off-board fare collection), require the same minimum, curb-to-curb right-of-way of 70 feet, and involve an implementation timeline of nine years or more. To justify the added capital cost of a rail investment, an initial assumption would be that rail would operate on its own dedicated right-of-way for at least 90 percent of the corridor to enhance operating speed and reliability. While streetcar and light-rail transit may have some differing operational and investment characteristics, this study does not distinguish between the modes at this point of project development.

As AC Transit has not operated any rail services, a rail strategy may pose an institutional challenge and would require a substantial initial investment in support services and facilities, such as a rail maintenance yard adjacent to the rail corridor.

6 Right-of-Way Requirements

There are two lane treatments or configurations that would be applied to the study's four capital investment alternatives: mixed-flow lanes and transit lanes (e.g., bus-only lanes). To the greatest extent possible, lane configurations that give the highest benefit to transit were evaluated.

In general, Enhanced Bus would operate primarily in mixed-flow lanes, with some possible queue-jump lanes at high-volume intersections. Rapid Bus would operate primarily in mixed-flow lanes, with some use of transit lanes or with queue jumps similar to Enhanced Bus. BRT would primarily operate in transit lanes, though some sections may be in mixed-flow. The rail options are assumed to operate with at least 90 percent in exclusive transit right-of-way. Table 6 presents the minimum right-of-way requirements for each of the four investment strategies.

Mixed-flow lanes have buses and non-transit vehicles sharing lanes. These lanes may include transit-priority elements within the existing right-of-way, such as TSP, curb extensions, and queue-jump lanes. Enhanced Bus service and Rapid Bus service would typically operate in mixed-flow lanes.

Transit lanes would be used exclusively by bus or rail vehicles. Some systems allow use by emergency vehicles or other types of vehicles, such as taxis. Although it's not required, the lanes can be segregated from other traffic with a physical barrier such as a rumble strip, curb or narrow landscape strip. For maximum benefit, exclusive transit lanes should be located in the median, which requires a minimum curb-to-curb right-of-way of 70 feet.

A popular but less efficient design of transit lanes are curbside or right-side bus lanes. Buses would have to share a lane with turning vehicles in curbside lanes. With right-side bus lanes, the bus would also have to share the lane with motorists accessing on-street parking. The bus would be allowed to travel straight through on the lane, while autos and other vehicles can only use the lane to make turns into driveways or the next street, but cannot travel through an intersection. Right-side bus lanes are sometimes called Business Access and Transit (BAT) lanes or Bus and Turn (BAT) lanes. If placed on both sides of the street, BAT lanes would require a minimum curb-to-curb right-of-way of 48 feet (e.g., four 12-foot lanes).

The BAT lane configuration is not expected to be used as a primary treatment on any of the four investment alternatives examined in this study. However, they may be beneficial in situations where transit priority would be useful, but physical constraints preclude an exclusive transit lane, e.g., insufficient right-of-way. In a Rapid Bus or BRT level of investment, BAT lanes may be applied in select locations and usually for short lengths.

A few limited street segments could be designated as **Transit Priority Zones**. This designation is intended for street segments that have very high transit use by multiple routes and serve major activity centers, usually downtown business/commercial districts. In these locations, accommodating transit would be the priority. Pedestrian facilities and amenities, which are critical to supporting transit, would be also a priority in these zones. Automobile, freight, and bicycle travel can or cannot be allowed, and would be secondary to the transit function. As a result, it would be important to identify parallel streets that can serve as alternate auto, freight, and bicycle routes.

Transit Priority Zones are typically relatively short (usually one mile or less). A Transit Priority Zone includes design elements to minimize delays to bus transit, including single or double transit lanes, off-board payment area, boarding islands, parking and turn restrictions, pedestrian enhancements, as well as features from the four investment strategies discussed earlier, e.g., stop optimization, sidewalk extensions, TSP, and others.^{3,4} Essentially, a Transit Priority Zone is a cluster of intensive transit improvements concentrated in a relatively short segment of space. Depending on the design elements chosen for implementation, Transit Priority Zones can entail a relatively low to high level of capital investment. For a purpose of capital cost estimates for the Major Corridors Study, only elements that directly benefit transit were included. Thus, the cost estimates provide a lower-end estimate for such facility as it only included transit elements of Transit Priority Zones.

Examples of existing Transit Priority Zones include 5th and 6th Avenues in Portland, Oregon; Nicollet Mall in Minneapolis, Minnesota; and Market Street in San Francisco. The Major Corridors Study recognizes the importance of Transit Priority Zone treatments in two locations: downtown Berkeley and downtown Oakland.



Transit Preferential Street, Portland, Oregon

³ City of Portland, Oregon, "Transit-Preferential Streets Program," 1997. <http://www.portlandoregon.gov/transportation/article/370340>

⁴ TCRP Synthesis 83, 2010, "Bus and Rail Transit-Preferential Treatments in Mixed Traffic," http://onlinepubs.trb.org/onlinepubs/tcrp/tcrp_rpt_118.pdf.

7 Alternatives Development

In the course of developing their respective studies, Alameda CTC and AC Transit coordinated the development of transit alternatives and evaluation methodology for the Countywide Transit Plan and the Major Corridors Study, respectively. The Major Corridors also included in the Alameda CTC's Countywide Transit Plan are shown with an asterisk in Table 6 below.

7.1 Screening Process

To identify appropriate capital improvement alternatives for further evaluation, the study considered both the existing ridership and the changes to the future land use conditions. Short-term investment strategies were determined based on feasible improvements that could be implemented by 2020 and by their potential compatibility with long-term infrastructure alternatives. The long-term strategies (by 2040) evaluated in this study were selected through a screening process illustrated in Figure 12 that included projected household density in 2040, right-of-way width, and operational considerations. This alternatives development process is further described in Appendix B. Table 6 lists the short- and long-term alternatives selected for evaluation for each study corridor.

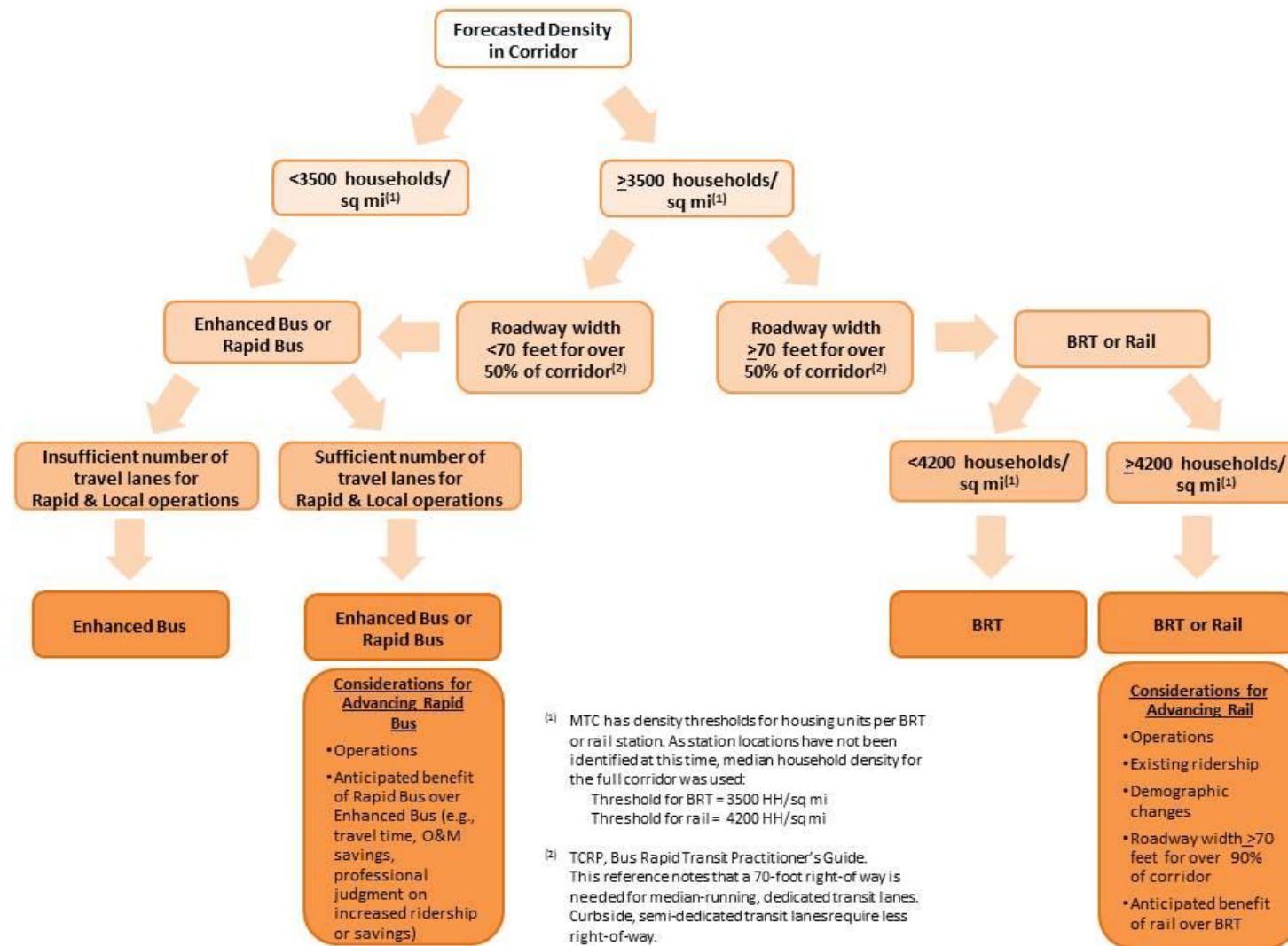
Table 6: Short-Term Investments and Initial Long-Term Investments for Evaluation

Corridor	Short-Term (by 2020)	Long-Term (by 2040)
San Pablo Avenue/Macdonald Avenue*	Rapid Bus Upgrades	BRT
Shattuck Avenue/Martin Luther King Jr. Way	Enhanced Bus	Rapid Bus - Overlay Local
Broadway/College Avenue/University Avenue*	Enhanced Bus	Rapid Bus - Replace Local
Adeline Street*	Operational Improvements	BRT
Telegraph Avenue*	Rapid Bus Upgrades	BRT or Light Rail
Fruitvale Avenue/Park Street	Enhanced Bus	Enhanced Bus Upgrades
MacArthur Boulevard/40th Street*	Enhanced Bus	Rapid Bus – Replace Local
West Grand Avenue/Grand Avenue*	BRT**	BRT Upgrades**
Foothill Boulevard*	Enhanced Bus	Rapid Bus - Replace Local
Hesperian Boulevard*	Enhanced Bus	Rapid Bus - Overlay Local
East 14th Street/Mission Boulevard/Fremont Boulevard*	Enhanced Bus	BRT
International Boulevard/East 14th Street*	BRT (under construction)	Extensions to BRT Service

* Corridors included in Alameda CTC Countywide Transit Plan

** The Grand Avenue BRT project would likely to have many features of BRT, but it may not have all BRT characteristics. See Section 5.3.1 (Page 26) for additional discussion.

Figure 12: Initial Alternatives Screening Process



8 Corridor Evaluation

Each corridor's performance was evaluated relative to the performance measures developed jointly by AC Transit and the Alameda CTC, which are listed in Table 7. Key findings are described below. The evaluation methodology for assessing long-term corridor investment alternatives is presented in Appendix D.

8.1 Performance Measures

Performance measures were developed that were explicitly tied to the study's goals and are outlined in Table 7. The performance measures were used to evaluate potential investment alternatives and inform decisions on which alternatives should be advanced into consideration for implementation.

Table 7: Goals and Performance Measures

Study Goal	Performance Measure
1) Increase ridership	<ul style="list-style-type: none"> Weekday boardings
2) Improve access to work, education, services, and recreation	<ul style="list-style-type: none"> PM peak hour average transit operating travel speed
3) Increase effectiveness/reliability	<ul style="list-style-type: none"> Effectiveness measured by boardings per service hour; Reliability measured by differences between congested and non-congested transit travel speeds
4) Increase cost efficiency	<ul style="list-style-type: none"> Operating cost per unlinked passenger trip Operating cost per vehicle mile
5) Reduce emissions	<ul style="list-style-type: none"> Greenhouse gas emissions

8.2 Evaluation of Goal 1: Improve Access to Work, Education, Services, and Recreation

Performance Measure: PM Peak Hour Transit Travel Speed

Transit travel speed is a key performance indicator for corridor improvements. In addition to supporting the goal of improving access to various destinations by making the service more attractive and time efficient for users, faster transit travel speeds would improve the efficiency of transit operations, potentially allowing operational savings to provide a greater overall level of service.

Table 8 shows current transit travel speeds on each corridor and the forecast 2040 travel speeds with and without improvements. Transit travel speeds are projected to decline through 2040 because of growing traffic congestion that will slow buses. However, proposed corridor improvements could reverse the trend and result in transit travel speed improvements. The extent of the travel speed improvement depends on the specific characteristics of the corridor and the type and extent of planned improvements. As expected, the more extensive the investment in transit improvements, the greater the transit speed, as illustrated in Figure 13.

BRT and LRT, which include the most capital-intensive transit features including long segments of exclusive transit lanes, would provide the greatest benefit to transit travel speed. The BRT improvements would increase transit travel speed by an average of nearly 50 percent, which would have

a direct impact on transit ridership by making the service more attractive and on operating cost by making the service more efficient. Enhanced Bus improvements are expected to decrease travel time in the short-term. However, the speed improvements of Enhanced Bus improvements are likely to erode over time.

Table 8: Average PM Peak Hour Transit Travel Speed by Corridor (miles per hour)

Corridor	Long-Term Strategy	Current Average Travel Speed	Year 2040 Baseline Average Travel Speed	Year 2040 Project Average Travel Speed	Percent Change: Baseline to Project
San Pablo Ave/Macdonald Ave	BRT	10.6	8.0	14.5	81%
Shattuck Ave/Martin Luther King Jr. Way	Rapid Bus-Overlay	8.9	8.5	11.5	35%
Broadway/College Ave/University Ave	Rapid Bus-Replace Local	9.0	7.4	9.0	22%
Adeline Street	BRT	13.2	11.0	13.4	22%
Telegraph Ave	BRT	9.6	8.0	13.0	63%
	Rail	9.6	8.0	17.7	121%
Fruitvale Ave/Park St	Enhanced Bus	12.2	9.0	9.7	8%
MacArthur Blvd/40th St	Rapid Bus-Replace Local	9.4	9.9	12.7	28%
West Grand Ave/Grand Ave	BRT	9.0	8.4	11.7	39%
Foothill Blvd	Rapid Bus-Replace Local	10.8	10.8	15.1	40%
Hesperian Blvd	Rapid Bus-Overlay	11.1	9.9	12.7	28%
East 14th St/Mission Blvd/Fremont Blvd	BRT	12.6	11.2	19.2	71%
International Boulevard/East 14th Street	BRT	9.6	12.1	13.6	12%

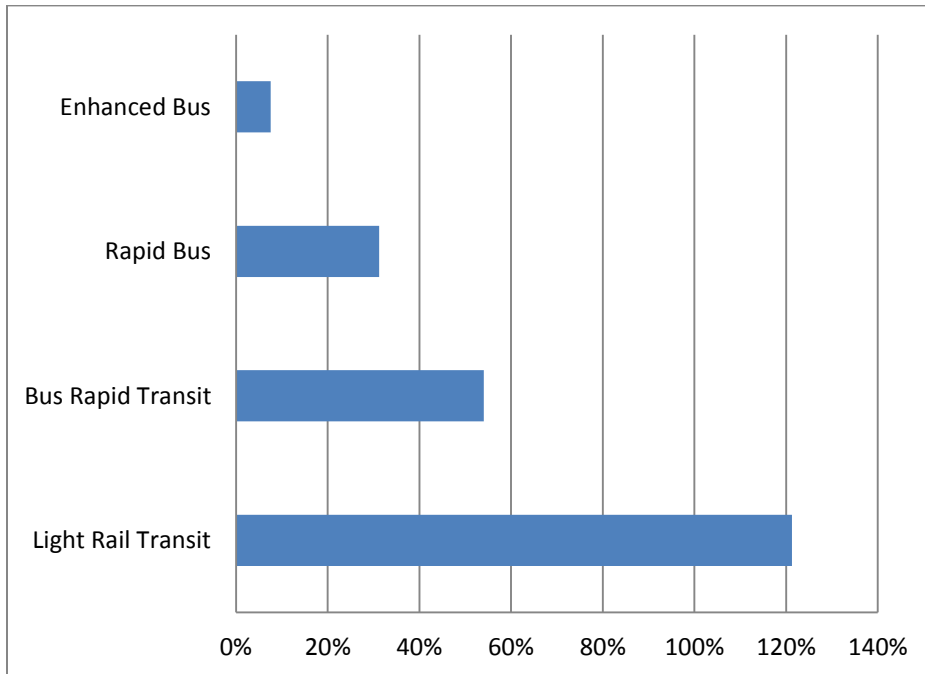


Figure 13: Percent Travel Speed Increase by Mode (2040 with Project vs. 2040 Baseline)

8.3 Evaluation of Goal 2: Increase Ridership

Performance Measure: Weekday Boardings

A primary goal of any transit corridor improvement is to increase transit ridership. Table 9 summarizes existing and estimated future ridership for both the 2010 Baseline and 2040 with project options. The use of “boardings by route mile” allows comparison of routes of different lengths.

Transit services that reduce travel time can compete with the auto for many trips. This opportunity is confirmed in the ridership forecasts. As illustrated in Figure 14, more intensive transit investment, such as BRT and Light Rail, would have a larger ridership increase than less the intensive investments of Enhanced Bus and Rapid Bus strategies. Figure 15 shows projected ridership per route mile by mode. The analysis yields predictable results: the higher the level of transit improvements in a corridor, the higher the projected ridership increase per route mile.

The Telegraph Avenue corridor, for both the BRT and LRT options, and the International Boulevard/East 14th Street corridor show the largest projected increase in transit ridership and also are forecasted to have the highest ridership per route mile. The Adeline Street, Fruitvale Avenue/Park Street, and Hesperian Boulevard corridors, by contrast, have relatively low ridership per route mile among the Major Corridors. The low ridership by route mile for the Adeline Street corridor, which was evaluated for possible BRT service, suggests that the high service frequency and intensive capital improvements that are associated with BRT may not be appropriate for that corridor according to this study.

The San Pablo Avenue/Macdonald Avenue, Telegraph Avenue, MacArthur Boulevard, International Boulevard/East 14th Street, and East 14th Street/Mission Boulevard/Fremont Boulevard corridors include

extensions of the current service, which add to the Year 2040 ridership. For example, approximately half of the East 14th Street/Mission Boulevard corridor's total ridership in 2040 (approximately 10,000 boardings), with project, is accounted for by the extension to Warm Springs.

Table 9: Current and 2040 Corridor Ridership (Boardings) by Corridor

Corridor	Long-Term Strategy	Existing	2040 Baseline (No Project)	2040 + Project	% Change: 2040 Baseline to 2040+Project	2040+ Project Ridership per Route Mile
San Pablo Ave/Macdonald Ave	BRT	14,800	27,500	43,600	59%	2,137
Shattuck Ave/Martin Luther King Jr. Way	Rapid Bus-Overlay	4,800	10,000	14,700	47%	1,598
Broadway/College Ave/University Ave	Rapid Bus-Replace Local	20,300	29,400	38,300	30%	2,503
Adeline St	BRT	3,100	4,200	6,400	52%	421
Telegraph Ave	BRT	6,600	13,700	35,600	160%	4,188
	Rail	6,600	13,700	49,500	261%	5,824
Fruitvale Ave/Park St	Enhanced Bus	5,100	8,200	11,400	39%	667
MacArthur Blvd /40th St	Rapid Bus-Replace Local	8,800	19,600	25,300	29%	1,992
West Grand Ave/Grand Ave*	BRT	6,100	12,600	14,700	17%	4,454
Foothill Blvd	Rapid Bus-Replace Local	10,400	13,900	19,100	37%	1,458
Hesperian Blvd	Rapid Bus-Overlay	4,400	6,700	9,300	39%	699
East 14th St/Mission Blvd/ Fremont Blvd	BRT	4,200	6,400	20,700	223%	976
International Blvd/East 14th St	BRT Extensions	13,500	25,700	44,400	73%	2,902

* Ridership for the West Grand Avenue/Grand Avenue includes passengers boarding on the corridor and at the Transbay Transit Center as well as many Transbay routes traveling through the corridor.

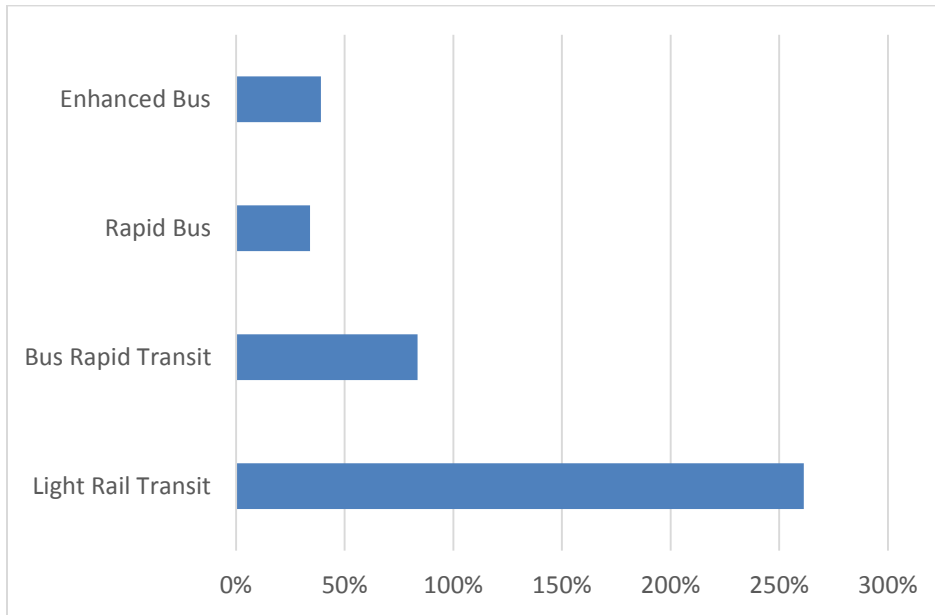


Figure 14: Ridership Increase by Mode (2040 with Project vs. 2040 Baseline)

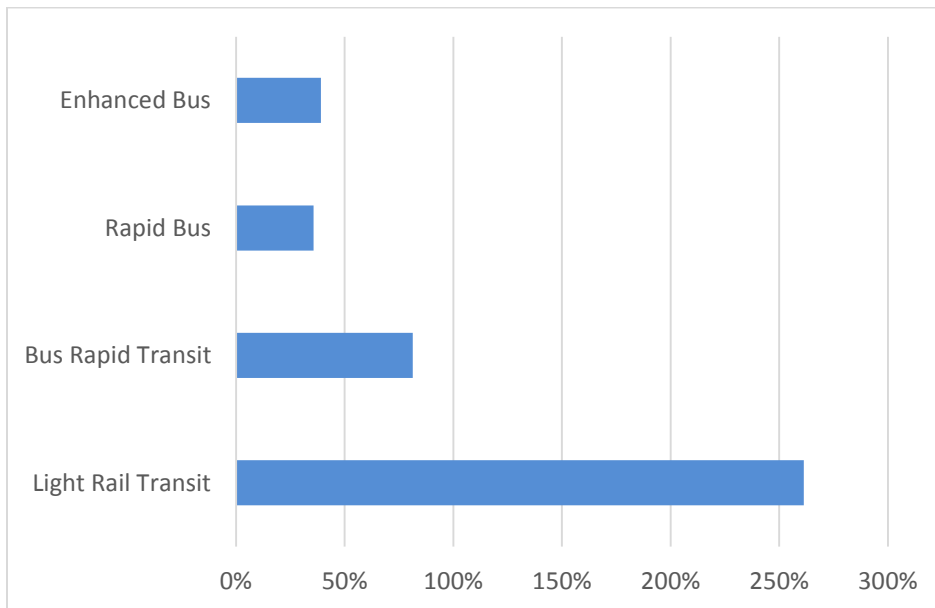


Figure 15: Ridership Increase per Route Mile by Mode (2040 with Project)

8.4 Evaluation of Goal 3: Increase Effectiveness and Reliability

Effectiveness Performance Measure: Boardings per Service Hour

Boardings per service hour is a key measure of the effectiveness (or productivity) of transit service and investments. As shown in Table 10, ridership productivity varies between corridors. Generally, as shown in Figure 16, a larger investment in transit improvements is correlated with higher ridership productivity.

The Telegraph Avenue corridor has the highest ridership productivity for both BRT and LRT. By contrast, the Adeline Street corridor is projected to have the lowest productivity, despite the screening results that indicate it should be evaluated as a BRT corridor in 2040. This suggests that the level of service assumed for the Adeline Street corridor would be too high.

Table 10: Corridor Ridership (Boardings) per Service Hour; Year 2040 with Project Improvements

Corridor	Long-Term Strategy	Year 2040 Average Weekday Boardings	Year 2040 Weekday Service Hours	Year 2040 Boardings per Service Hour
San Pablo Ave/Macdonald Ave	BRT	43,600	334	131
Shattuck Ave/Martin Luther King Jr. Way	Rapid Bus-Overlay	14,700	189	78
Broadway/College Ave/University Ave	Rapid Bus-Replace Local	38,300	361	106
Adeline Street	BRT	6,400	285	22
Telegraph Ave	BRT	35,600	195	183
	Rail	49,500	190	261
Fruitvale Ave/Park St	Enhanced Bus	11,400	197	58
MacArthur Blvd /40th St	Rapid Bus-Replace Local	25,300	157	170
West Grand Ave/Grand Ave	BRT	7,700 (NL) 14,700 (all)*	168 (NL)	88 (NL)
Foothill Blvd	Rapid Bus-Replace Local	19,100	237	80
Hesperian Blvd	Rapid Bus-Overlay	9,300	243	38
East 14th St/Mission Blvd/Fremont Blvd	BRT	20,700	372	56
International Blvd/East 14th St	BRT Extensions	44,400	360	123

* Ridership for the West Grand Avenue/Grand Avenue includes passengers boarding on the corridor and at the Transbay Transit Center as well as many Transbay routes traveling through the corridor.

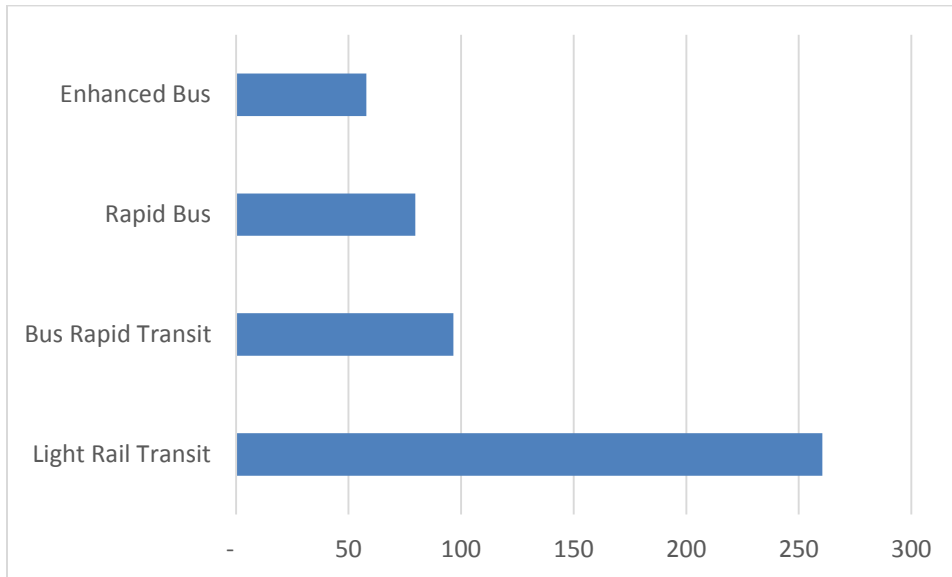


Figure 16: Average Weekday Boardings per Service Hour by Mode

Reliability Performance measure: Difference between congested and non-congested transit travel speeds

The reliability of transit service is an important factor in many people's decision to use transit. Unpredictability of schedules presents an obstacle to growing ridership.

To measure reliability, travel speeds were compared during congested and non-congested times, expressed as a percent of travel speed during congested times to speeds during non-congested times. This percentage, shown in Table 11, varies considerably by corridor. This is explained in large part by the type of transit improvements and the variability of travel speeds in the corridor. The higher the percentage of between congested speeds to uncongested speeds, the better the performance since this suggests that the transit improvements addressed the impacts of traffic congestion.

Figure 17 shows this reliability measure by mode. The modes that include significant amounts of exclusive transit lanes, i.e., BRT and Light Rail, have the highest reliability. Enhanced Bus and Rapid Bus, which have no exclusive lanes or only limited amounts, would be more susceptible to the impacts of traffic congestion, which compromises reliability.

Table 11: Corridor Non-Congested vs. Congested Travel Speeds (miles per hour)

Corridor	Long-Term Strategy	Year 2040 Non-Congested Travel Speed	Year 2040 Congested Travel Speed	Congested Travel time as Percentage of Non-Congested Travel Speed
San Pablo Ave/Macdonald Avenue	BRT	18.6	14.5	78%
Shattuck Ave/Martin Luther King Jr. Way	Rapid Bus-Overlay	16.8	11.5	68%
College Ave/University Ave	Rapid Bus-Replace Local	16.0	9.0	56%
Adeline Street	BRT (Full corridor)	22.8	13.4	59%
	BRT (Local streets only)	15.7	12.0	76%
Telegraph Avenue	BRT	18.9	13.0	69%
	Rail	19.0	17.7	93%
Fruitvale Ave/Park St	Enhanced Bus	15.2	9.7	64%
MacArthur Blvd/40th St	Rapid Bus-Replace Local	17.8	12.7	71%
West Grand Ave/Grand Ave	BRT(Full corridor)	23.4	18.3	78%
	BRT (Local streets only)	11.8	11.7	99%
Foothill Blvd	Rapid Bus-Replace Local	19.8	15.1	76%
Hesperian Blvd	Rapid Bus-Overlay	21.4	12.7	59%
East 14th St/Mission Blvd/Fremont Blvd	BRT	21.7	19.2	88%
International Blvd/East 14th St	BRT	17.0	13.6	80%

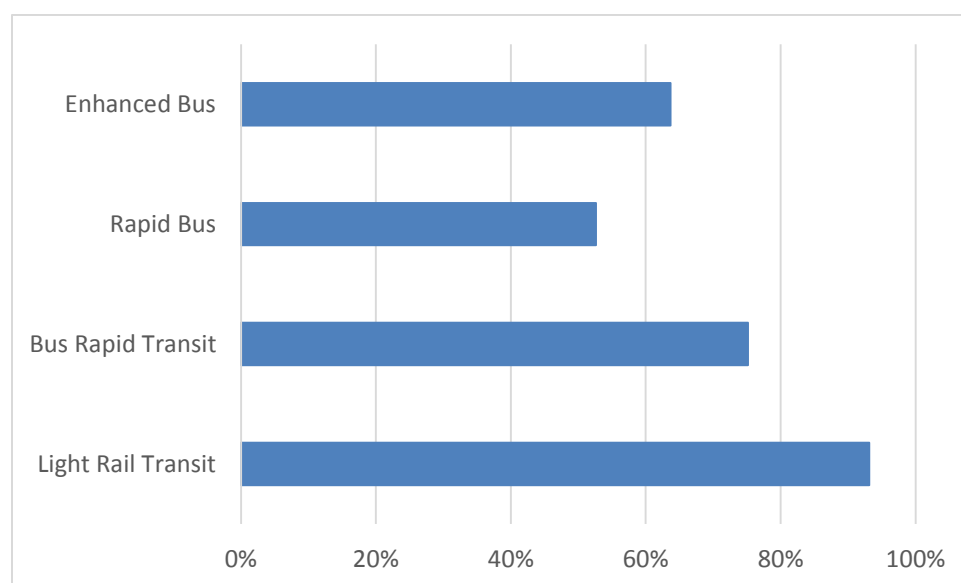


Figure 17: Percentage of Congested Travel Speed to Non-Congested Travel Speed by Mode

8.5 Evaluation of Goal 4: Increase Cost Efficiency

A corridor's performance relative to this goal is evaluated using two performance measures: 1) operating cost per unlinked passenger trip and 2) operating cost per vehicle mile.

Performance Measure: Operating Cost per Unlinked Passenger Trip

The operating cost calculations for bus-based service assume the direct cost of service and do not include overhead or administrative costs. Direct costs are typically used for service modifications because they more realistically reflect the cost impact to the organization. However, the operating costs in the table do add unique items for each mode. For example, costs for fare enforcement and collection are included for the possible BRT corridors. The operating costs for light-rail service, by contrast, are fully burdened; that is, they include the direct cost of service as well as overhead, administrative, and personnel costs. The fully burdened rate is used because AC Transit does not currently operate rail service and would incur all administrative and overhead costs in managing a new mode. Details of operating costs and operating assumptions are included in Appendix F.

Table 12 summarizes operating cost per passenger trip for each of the corridors. The corridors with the highest ridership generally have lower costs per trip. The Adeline Street corridor has the highest cost per trip and a low cost-efficiency. This finding underscores the aforementioned statement that a BRT level of investment for this corridor may not be justified. For the Telegraph Avenue corridor, the BRT option has a significantly lower cost per trip than the Light Rail option.

Cost per trip by mode is illustrated in Figure 18. Enhanced Bus has the highest cost per trip, while BRT has the lowest cost per trip.

Table 12: Weekday Operating Cost (2016 dollars) per Unlinked Passenger Trip

Corridor	Long-Term Strategy	2040+Project Weekday Operating Cost	2040+Project Weekday Unlinked Trips	2040 + Project Operating Cost per Unlinked Passenger Trip
San Pablo Ave/Macdonald Ave	BRT	\$50,400	43,600	\$1.15
Shattuck Ave/Martin Luther King Jr. Way	Rapid Bus-Overlay	\$26,100	14,700	\$1.77
Broadway/College Ave/University Ave	Rapid Bus-Replace Local	\$50,800	38,300	\$1.33
Adeline St	BRT	\$46,500	6,400	\$7.26
Telegraph Ave	BRT	\$30,400	35,600	\$0.85
	Rail	\$103,800	49,500	\$2.10
Fruitvale Ave/Park St	Enhanced Bus	\$26,400	11,400	\$2.32
MacArthur Blvd /40th St	Rapid Replace Local	\$20,400	25,300	\$0.81
West Grand Ave/Grand Ave*	BRT	\$22,700	7,700	\$2.94
Foothill Blvd	Rapid Bus-Replace Local	\$31,500	19,100	\$1.65
Hesperian Blvd	Rapid Bus-Overlay	\$35,800	9,300	\$3.85
East 14th St/Mission Blvd/Fremont Blvd	BRT	\$53,600	20,700	\$2.59
International Blvd/East 14th St	BRT Extensions	\$52,000	44,400	\$1.17

*Line NL Only.

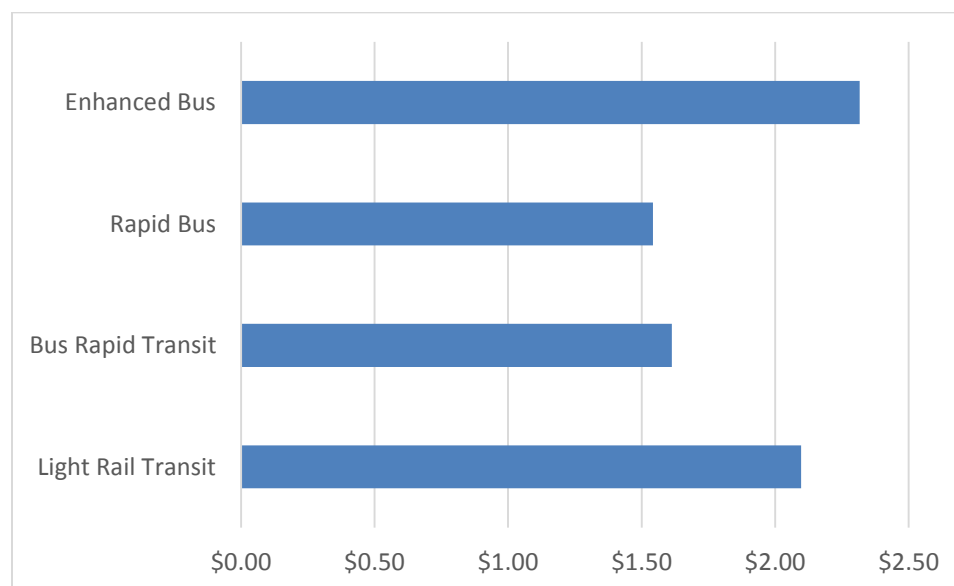


Figure 18: Operating Cost per Unlinked Passenger Trip by Mode

Performance Measure: Operating Cost per Revenue Vehicle Mile

Operating cost per revenue vehicle mile is a measure of operational efficiency. This measure is influenced primarily by the ability of the improvements to reduce bus travel time, thereby allowing a bus to travel more miles and provide more service per service hour. Because many costs, such as the wages for a bus operator, are linked to the hours of service, service that has higher average travel speeds would cost less to operate on a per-mile basis.

Table 13 shows the operating cost per revenue mile for each corridor (in 2016 dollars). The costs are tightly grouped, with the exception of the LRT option for the Telegraph Avenue corridor, which has a cost per mile about triple the bus-based options. The corridor transit improvements would reduce operating cost by about 25 percent compared to the Baseline options. The average cost per revenue mile for the bus-based modes *with* the transit corridor improvements is \$8.45, compared to an average cost of \$10.52 for the bus-based modes *without* the transit corridor improvements.

Table 13: Corridor Operating Cost per Vehicle Mile (2016 dollars)

Corridor	Long-Term Strategy	Project Annual Operating Cost	Project Annual Revenue Miles per Corridor	Project Operating Cost per Revenue Service Mile
San Pablo Ave/Macdonald Ave	BRT	\$16.5 M	2,006,000	\$8.20
Shattuck Ave/Martin Luther King Jr. Way	Rapid Bus-Overlay	\$8.4 M	903,000	\$9.27
Broadway/College Ave/University Ave	Rapid Bus-Replace Local	\$16.7 M	1,542,000	\$10.81
Adeline Street	BRT	\$14.8M	1,606,000	\$9.21
Telegraph Ave	BRT	\$10.0M	1,059,000	\$9.42
	Rail	\$32.5M	1,059,000	\$30.69
Fruitvale Ave/Park St	Enhanced Bus	\$9.5M	919,000	\$10.36
MacArthur Blvd /40th St	Rapid Bus-Replace Local	\$7.2M	913,000 (Line 57)	\$7.89
West Grand Ave/Grand Ave	BRT	\$7.7M	947,000 (Line NL)	\$8.13
Foothill Blvd	Rapid Bus-Replace Local	\$10.2M	1,426,000	\$7.19
Hesperian Blvd	Rapid Bus-Overlay	\$12.6M	1,451,000	\$8.69
East 14th St/Mission Blvd/Fremont Blvd	BRT	\$17.5M	2,642,000	\$6.62
International Blvd/East 14th St	BRT Extensions	\$16.8M	1,907,000	\$8.82

Notes: The cost estimates above include cost associated bus operations, maintenance of operator restrooms, TSP maintenance, maintenance of transit stops and stations for Rapid and BRT, as well as fare enforcement and collection for BRT service

Figure 19 shows the operating cost per mile by mode. There would be little difference between the three bus-based modes since the cost-efficiency advantages of the faster BRT service would be partially offset by the additional operating costs specific to BRT, such as fare enforcement and fare collection.

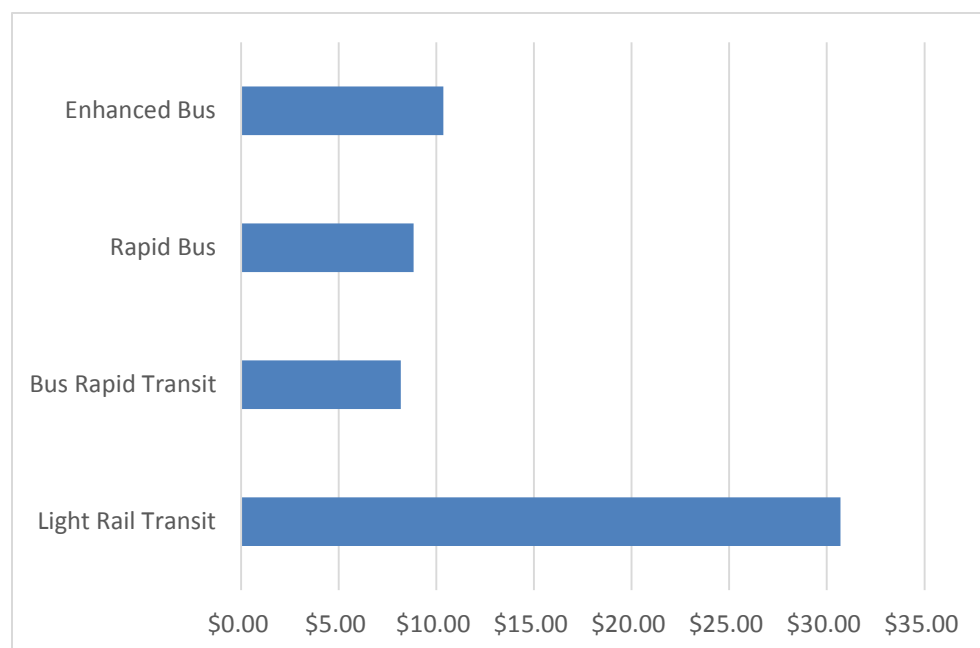


Figure 19: Operating Cost per Mile by Mode

8.6 Evaluation of Goal 5: Reduce Emissions

Performance Measure: Greenhouse Gas Emissions

The annual 2040 Baseline GHG emissions from all cars would be about 4.24 million metric tons of carbon dioxide (CO₂). With this set of projects, that number could be reduced to 4.19 million metric tons of CO₂, for a reduction of 55,000 metric tons of CO₂ per year (see Table 14). These values assume AC Transit's shift to zero-emission vehicles on all routes. Without this shift, the reduction would be 40,000 metric tons of CO₂ per year for the transportation sector.

Table 14: Estimated Annual Changes in GHG Emissions (metric tons)

Mode	2010 Baseline	2040 Baseline	2040 Project	Percentage Difference
Auto	5,513,443	4,243,391	4,187,979	-1.3%
Bus	40,863	0	0	0
Total	5,554,306	4,243,391	4,187,979	-1.3%

8.7 Cost Estimates

Planning-level operating and capital costs were calculated for each corridor. Although not formal performance measures on their own, capital costs and operating costs are important factors to consider

when deciding whether to move forward with the corridor improvements. In addition, these costs must be incorporated into budgeting and funding plans.

8.7.1 Capital Cost Estimates

Planning-level capital costs for the investment strategies for each corridor are summarized in Table 15. Capital costs include all project costs, including: design and engineering, construction, vehicles (number required above today's service level), permits, project management, and a 35 percent contingency to account for the risks associated with the conceptual nature of the current corridor plans. Details of capital cost estimate assumptions are included in Appendix E.

The corridors overlap in some areas and some costs are included more than once. For example, the Transit Priority Zone in downtown Oakland or Berkeley would be part of seven corridors. This redundancy in costs is needed because the order in which the corridors would be developed is not known at this time and it is important to include all potential costs in each corridor cost estimate.

Capital costs by corridor vary significantly. The variation is attributed to the length of the corridor, the level of planned improvements (largely tied to the transit mode) and the number of vehicles added above current levels. Calculations of capital cost per mile of corridor correct for differences attributed only to the length of the corridor. Using this data, there is more consistency between the capital costs by mode.

As summarized in Figure 20, Enhanced Bus capital costs would average \$5 million per mile, while Rapid Bus cost would average \$8 million per mile. BRT costs an average of about \$22 million per mile; and LRT costs more than \$400 million per mile. The LRT costs include some elements unique to that mode, such as a new maintenance facility to accommodate rail cars.

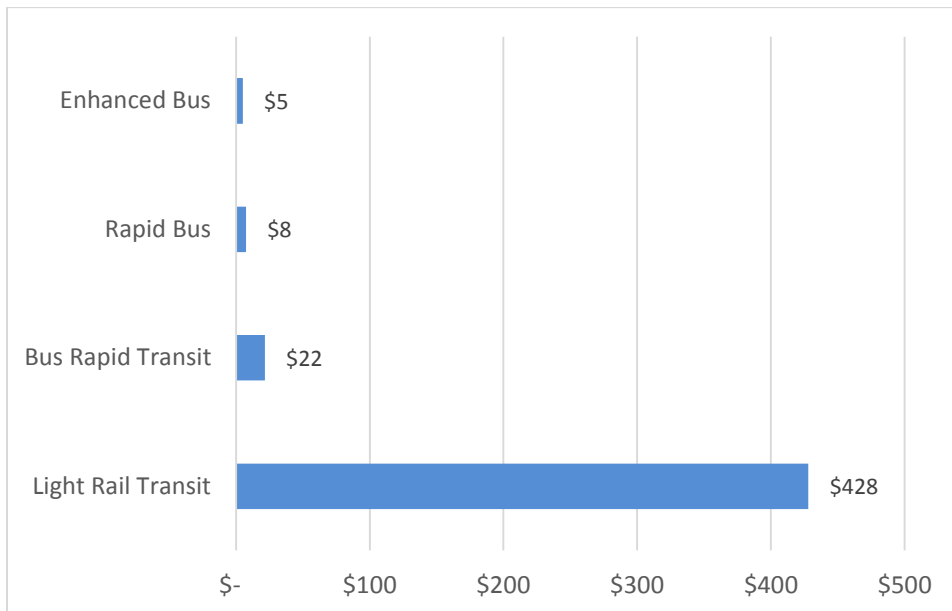


Figure 20: Capital Cost per Mile by Mode (in million dollars)

The cost estimates per mile is higher than recently completed and on-going AC Transit projects as additional elements, such as operators restrooms, adaptive signal control and signal communication upgrades, state-of-art information displays, and enhanced shelters, were included as part of corridor investments. In addition, construction costs were shown in 2020 dollars.

Table 15: Corridor Capital Cost Estimates (2020 dollars)

Corridor	Long-Term Strategy	Corridor Length (miles)	Capital Cost (in million dollars)	Capital Cost per Mile (in million dollars)
San Pablo Ave/Macdonald Ave	BRT	16.0	\$312	\$20
Shattuck Ave/Martin Luther King Jr. Way	Rapid Bus-Overlay	9.5	\$57	\$6
Broadway/College Ave/University Ave	Rapid Bus-Replace Local	14.6	\$111	\$8
Adeline Street	BRT	6.4	\$160	\$25
Telegraph Ave	BRT	7.0	\$148	\$21
	Rail	7.0	\$2,996	\$428
Fruitvale Ave/Park St	Enhanced Bus	11.9	\$61	\$5
MacArthur Blvd/40 th St	Rapid Bus-Replace Local	12.7	\$145	\$11
West Grand Ave/Grand Ave	BRT	3.3	\$83	\$25
Foothill Blvd	Rapid Bus-Replace Local	7.0	\$50	\$7
Hesperian Blvd	Rapid Bus-Overlay	13.7	\$69	\$5
East 14 th St/Mission Blvd/Fremont Blvd	BRT	16.0	\$380	\$24
International Blvd/East 14 th St	BRT	4.7	\$157	\$33

Notes: Cost of building a transit lane on Ralph Appezato Memorial Parkway (RAMP) in Alameda is excluded from the Telegraph Avenue Corridor since it will be paid by others. Estimated capital cost for the International Blvd/E. 14th Corridor is for the potential extensions.

8.7.2 Preliminary Operating Cost Estimates

Corridor operating costs, shown in Table 15, are defined as the total costs to operate and maintain the transit service. The estimates include costs associated with operating the vehicle, such as: driver wages, fuel, and vehicle maintenance, as well support costs, such as supervisor time and driver training. They also include costs unique to the corridor mode. For example, the operating cost for a BRT corridor includes costs for fare collection and enforcement required by the off-board fare collection system, as well as additional facilities cleaning and maintenance for the new stations. Although not a performance measure itself, operating cost factors into two of the performance measures: cost per unlinked passenger trip and cost per vehicle mile. Details for operating cost estimates are provided in Appendix F.

Table 16: Corridor Operating Cost Estimates (2016 dollars)

Corridor	Long-Term Strategy	Annual Operating Cost (2016\$)
San Pablo Avenue/Macdonald Avenue	BRT	\$16.5 M
Shattuck Avenue/Martin Luther King Jr. Way	Rapid Bus-Overlay	\$8.4 M
Broadway/College Avenue/University Avenue	Rapid Bus-Replace Local	\$16.7 M
Adeline Street	BRT	\$14.8M
Telegraph Avenue	BRT	\$10.0M
	Rail	\$32.5M
Fruitvale Avenue/Park Street	Enhanced Bus	\$9.5M
MacArthur Boulevard/40 th Street	Rapid Bus-Replace Local	\$7.2M
West Grand Avenue/Grand Avenue	BRT	\$7.7M
Foothill Boulevard	Rapid Bus-Replace Local	\$10.2M
Hesperian Boulevard	Rapid Bus-Overlay	\$12.6M
East 14th Street/Mission Boulevard/Fremont Boulevard	BRT	\$17.5M
International Boulevard/East 14th Street	BRT Extensions	\$16.8M

Notes: The cost estimates above include cost associated bus operations, maintenance of operator restrooms, TSP maintenance, maintenance of transit stops and stations for Rapid and BRT, as well as fare enforcement and collection for BRT service

8.8 Key Findings by Corridor

The following section describes the corridor performance assessment. A graphic rating for each corridor's performance is also provided, where each cell indicates the corridor's performance with respect to evaluation measures. The criteria rating scale is shown below:

- = Best relative performance (higher travel time reduction, higher ridership, less cost)
- = Moderate relative performance (moderate travel time reduction, moderate ridership, moderate cost)
- = Poorest relative performance (lower travel time reduction, lower ridership, higher cost)

Table 17 on the next page summarizes the overall findings from the corridor evaluation process. It provides the results of each corridor's performance for each performance measure, estimated annual operating costs, and preliminary capital costs per mile.

Table 17: Data Summary of Performance Measures

Corridor	Long-Term Strategy	Goal 1 Average Weekday Ridership	Goal 2	Goal 3		Goal 4		Annual Operating Cost (2016\$)	Capital Cost per Mile (2020\$)
			Peak Travel Speed Improvement (2040 Base vs. 2040 + Project)	Effectiveness (Boardings per Service Hour)	Reliability (Congested vs. Non-Congested)	Operating Cost per Boarding	Operating Cost per Vehicle Mile		
San Pablo Ave/ Macdonald Ave	BRT	43,600	8.0 mph → 14.5mph	131	78%	\$1.15	\$8.20	\$16.5 M	\$20M
Shattuck Ave/ Martin Luther King Jr. Way	Rapid Bus-Overlay	14,700	8.5 mph → 11.5mph	78	68%	\$1.77	\$9.27	\$8.4 M	\$6M
Broadway/College Ave/ University Ave	Rapid Bus-Replace Local	38,300	7.4 mph → 9.0mph	106	56%	\$1.33	\$10.81	\$16.7 M	\$8M
Adeline Street	BRT	6,400	11.0 mph → 13.4mph	22	59%	\$7.26	\$9.21	\$14.8M	\$25M
Telegraph Avenue	BRT	35,600	8.0 mph → 13.0mph	183	69%	\$0.85	\$9.42	\$10.0M	\$21M
	Rail	49,500	8.0 mph → 17.7mph	261	93%	\$2.10	\$30.69	\$32.5M	\$428M
Fruitvale Ave/ Park St	Enhanced Bus	11,400	9.0 mph → 9.7mph	58	64%	\$2.32	\$10.36	\$9.5M	\$5M
MacArthur Blvd/40 th St	Rapid Bus-Replace Local	25,300	9.9 mph → 12.7mph	170	71%	\$0.81	\$7.89	\$7.2M	\$11M
West Grand Ave/ Grand Ave	BRT	7,700 (NL) 14,700 (All)	8.4 mph → 11.7mph	49	99%	\$2.94	\$8.13	\$7.7M	\$25M
Foothill Blvd	Rapid Bus-Replace Local	19,100	10.8 mph → 15.1mph	80	76%	\$1.65	\$7.19	\$10.2M	\$7M
Hesperian Blvd	Rapid Bus-Overlay	9,300	9.9 mph → 12.7mph	38	59%	\$3.85	\$8.69	\$12.6M	\$5M
E. 14th St/ Mission Blvd/Fremont Blvd	BRT	20,700	11.2 mph → 19.2mph	56	88%	\$2.59	\$6.62	\$17.5M	\$24M
International Blvd/E. 14th St	BRT	44,400	12.1 mph → 13.6mph	123	80%	\$1.17	\$8.82	\$16.8M	\$33M

8.8.1 San Pablo Avenue/Macdonald Avenue Corridor

Mode Evaluated: BRT

Conclusion: A BRT investment in the San Pablo Avenue/Macdonald Avenue corridor would yield significant improvements in ridership, travel speed, and ridership productivity, and result in more efficient service.

In 2003, AC Transit introduced the 72-Rapid line to increase ridership, reduce travel time and increase reliability. While travel time on the 72-Rapid is about 23 percent faster than local buses in the same corridor, its on-time performance is low as San Pablo Avenue is heavily congested at many times of the day and on weekends.

BRT investments would amplify the Rapid Bus improvements on this corridor. With this type of investment, it would be one of the highest-performing alternatives by 2040, with significant projected improvements in transit travel speed, ridership, ridership productivity, and service efficiency. The potential northern extension would provide an opportunity for passengers to transfer to/from WestCAT. The potential southern extension could serve the Brooklyn Basin project, which is under construction.

County- and regional-level planning efforts have also identified San Pablo Avenue as a key corridor with the need and potential for transit investments. A BRT strategy is being explored by the West Contra Costa Transportation Advisory Committee's High-Capacity Transit Study and is included as an investment recommendation in Contra Costa Transportation Authority's Comprehensive Transportation Plan Update. Alameda CTC is planning to take a lead role in multi-modal planning efforts for this corridor. In addition, BRT on San Pablo Avenue is currently being evaluated in MTC's Plan Bay Area update.



Summary Table of Performance Measures

Long-Term Strategy Evaluated	Average Weekday Ridership	Travel Speed Improvement	Effectiveness (Boardings per Service Hour)	Reliability (Congested vs. Non-Congested)	Efficiency (Cost per Boarding)	Efficiency (Cost per Vehicle Mile)	Capital Cost per Mile (millions)
BRT	●	●	●	●	●	●	●

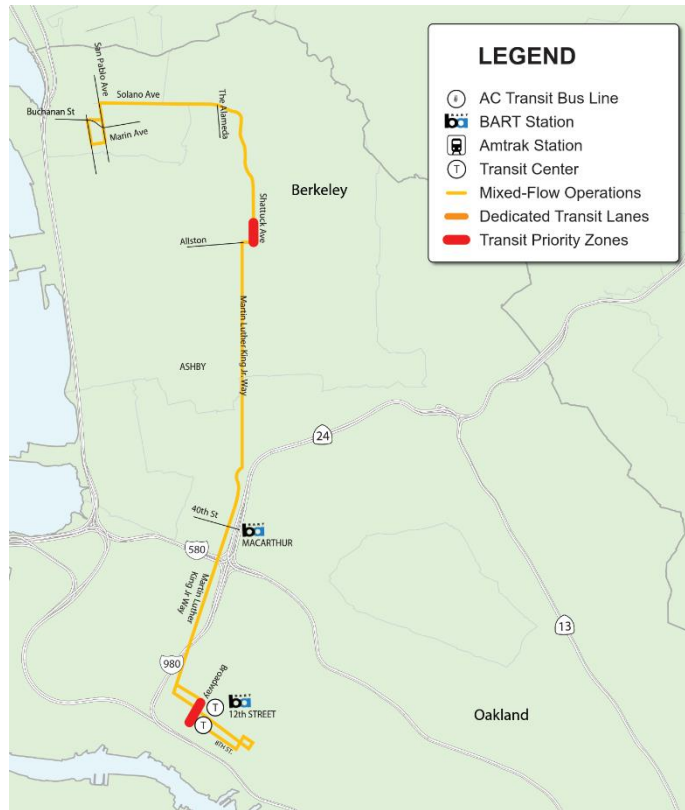
8.8.2 Shattuck Avenue/Martin Luther King Jr. Way Corridor

Mode Evaluated: Rapid Bus-Overlay Local

Conclusion: Rapid Bus enhancements in this corridor would yield moderate improvements in most of the performance measures.

This corridor is one of three that serve both downtown Berkeley and downtown Oakland, locations that the Alameda CTP identified as having strong transit markets. To increase service reliability, immediate-term improvements were implemented by AC Transit's SEP – AC Go, where portions of the route was moved from Shattuck Avenue to Martin Luther King Jr. Way. The segments from downtown Oakland to the Montclair neighborhood shifted to another route.

This corridor was evaluated as a Rapid Bus-Overlay Local corridor for 2040. Results showed moderate improvement for all the performance measures. Given the corridor's physical dimensions and projected ridership, Rapid Bus investments would be appropriate to maintain an ideal level of service quality in this corridor. To further improve reliability, the District may want to consider some additional transit enhancements, such as limited segments of exclusive transit lanes. Bus-only lanes could help improve efficiency and effectiveness indicators by increasing travel speed and ridership.



Summary Table of Performance Measures

Long-Term Strategy Evaluated	Average Weekday Ridership	Travel Speed Improvement	Effectiveness (Boardings per Service Hour)	Reliability (Congested vs. Non-Congested)	Efficiency (Cost per Boarding)	Efficiency (Cost per Vehicle Mile)	Capital Cost per Mile (millions)
Rapid Bus-Overlay	●	●	●	●	●	●	●

8.8.3 Broadway/College Avenue/ University Avenue Corridor

Mode Evaluated: Rapid Bus-Replace Local

Conclusion: Rapid Bus improvements would be critical to accommodate the high ridership on this corridor. It is also recommended that the University Avenue segment of the corridor be linked with the Telegraph Avenue Corridor.

As the District's highest ridership corridor, there has been the focus of several efforts to increase speed and improve reliability. In 2010, Line 51 was split into two lines (51A and 51B) in order to increase reliability. The Line 51 Corridor Delay Reduction and Sustainability Project implemented Enhanced Bus improvements, including creating better placement of bus stops, and installing queue-jump lanes and TSP.



Initially Enhanced Bus or Rapid Bus-Replace Local modes were considered as Year 2040. However, the ridership projections for the corridor made it clear that the Enhanced Bus option could not accommodate expected ridership. Thus, only the Rapid Bus-Replace Local option was evaluated for 2040, and the projected results are mixed. While ridership and effectiveness measures rated high, service reliability is expected to be one of the lowest of all the major corridors even with Rapid Bus improvements. Faced with a strong ridership increase but with poor speed and reliability, this corridor could benefit from large-scale improvements typically not associated with a Rapid Bus investment, such as bus lanes on University Avenue, upper Broadway in Oakland, and Fruitvale Avenue to the Fruitvale BART Station.

The District may also want to consider shifting the University Avenue segment from this corridor to the Telegraph Avenue corridor. Bus-only lanes on University Avenue would be more consistent with the BRT strategy evaluated for Telegraph Avenue than the Rapid Bus strategy for this corridor. Additionally, this would shorten the corridor's overall length, which also may help improve reliability.

Summary Table of Performance Measures

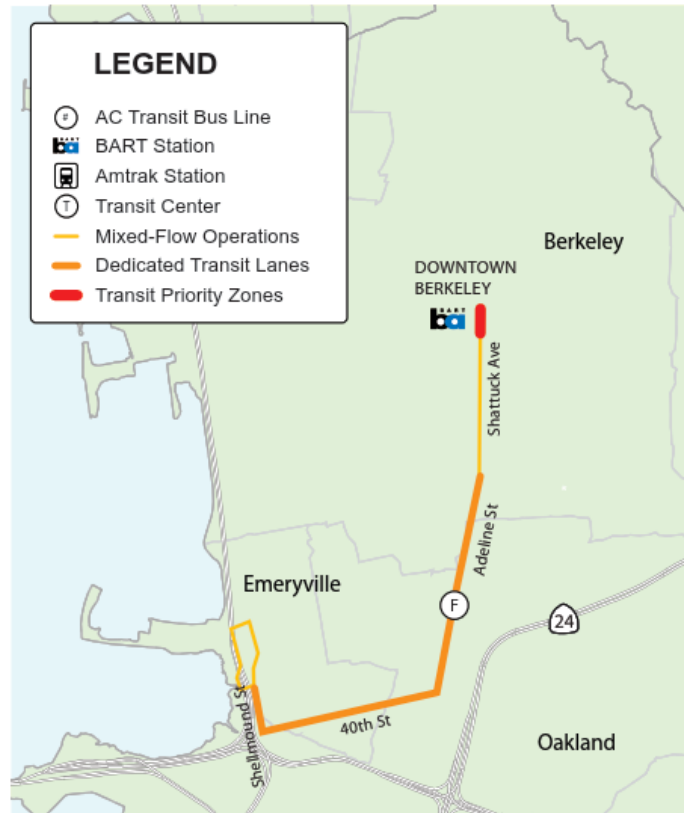
Long-Term Strategy Evaluated	Average Weekday Ridership	Travel Speed Improvement	Effectiveness (Boardings per Service Hour)	Reliability (Congested vs. Non-Congested)	Efficiency (Cost per Boarding)	Efficiency (Cost per Vehicle Mile)	Capital Cost per Mile (millions)
Rapid Bus-Replace Local	●	◐	●	○	●	○	●

8.8.4 Adeline Street

Mode Evaluated: BRT

Conclusion: While BRT investments would improve transit service quality on this corridor, the discrepancy between the low level of forecasted ridership and Alameda CTC's market analysis, indicates that further research would be necessary to justify higher level of investment. Therefore, only operational improvements are recommended for the short-term horizon.

Originally not part of the study's Major Corridors, the Adeline Street corridor was added because the Alameda CTC's CTP identified the corridor to serve a strong transit market between Berkeley, Oakland, and Emeryville in 2040. Additionally, slow transit travel speeds indicated that its bus service could benefit from operational improvements or capital investment.



A BRT strategy was tested for the Adeline Street corridor for 2040, which resulted in low performance for all measures, except travel time improvement and cost per vehicle mile, which were rated as having a moderate improvement. The 2040 projection of 6,400 passengers is the lowest of all the corridors. While BRT investments would improve transit service quality on this corridor, the poor results for ridership, reliability, and efficiency measures suggest that benefits from BRT improvements would not justify the cost. The discrepancy between modeled ridership and the findings of Alameda CTC's market analysis indicates that further research would be necessary to justify investment beyond strictly operational improvements. Therefore, only operational improvements are recommended for the short-term horizon. More detailed studies may or may not indicate that a higher level of investment is justified. It is recommended that AC Transit consider frequency improvements for the short-term horizon or, possibly, re-consideration of additional improvements when updating the Major Corridors Study in the future.

Summary Table of Performance Measures

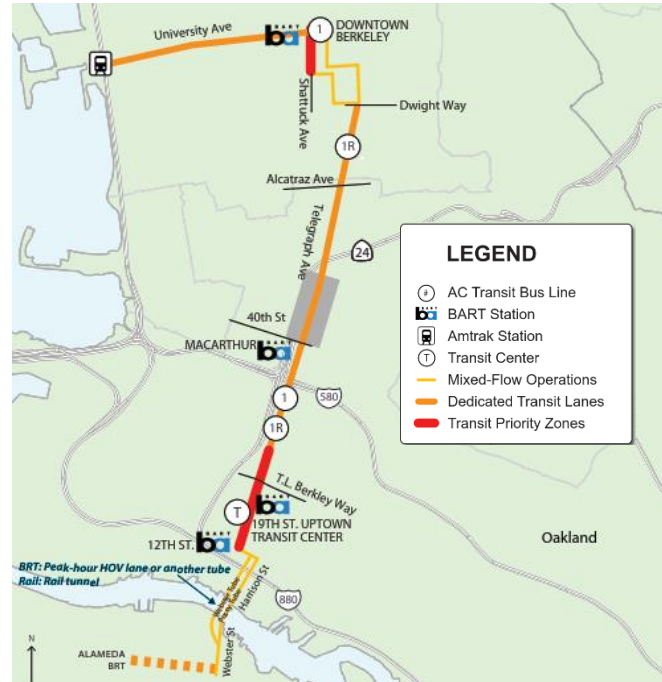
Long-Term Strategy Evaluated	Average Weekday Ridership	Travel Speed Improvement	Effectiveness (Boardings per Service Hour)	Reliability (Congested vs. Non-Congested)	Efficiency (Cost per Boarding)	Efficiency (Cost per Vehicle Mile)	Capital Cost per Mile (millions)
BRT	○	◐	○	○	○	◐	◐

8.8.5 Telegraph Avenue Corridor

Mode Evaluated: BRT or Light Rail

Conclusion: The Telegraph Avenue Corridor would benefit greatly from a BRT investment. Light Rail, however, has very high capital and operating costs, and is not recommended. It is further recommended that University Avenue be linked with Telegraph Avenue as a combined BRT line.

Formerly part of the International Boulevard/ East 14th Street corridor, Telegraph Avenue from downtown Berkeley to downtown Oakland will become an independent corridor as part of the SEP. The study assumed that this corridor would continue south to serve the Alameda Point development using the BRT infrastructure to be built by the City of Alameda.



This corridor was one of the stronger performers in the study for both the BRT and Light Rail options. Light Rail, in particular, rated the highest of all the corridors in most of the performance measures reviewed, including the highest ridership and travel speeds in terms of absolute numbers as well as percentage increase. It also had the highest reliability performance – almost 100 percent. Unlike urban streetcars operating in mixed-flow traffic, this corridor was assumed to have exclusive right-of-way for its entire length.

The BRT investment also fared well in the evaluation for all performance measures. While its performance was lower when compared to Light Rail, the BRT investment is projected to yield much more efficient service than the LRT investment. BRT costs per trip and per mile were forecasted to be less than half that of Light Rail. In addition, the \$3 billion estimated capital cost for Light Rail is 22 times more than the estimated \$136 million capital cost for BRT. For these reasons, the BRT investment in this corridor is recommended as the preferred option for future consideration.

The District may also want to consider connecting the University Avenue segment of the Broadway/College Avenue/University Avenue corridor to the Telegraph Avenue corridor. Bus-only lanes on this segment would be consistent with the BRT strategy evaluated for Telegraph Avenue.

Summary Table of Performance Measures

Long-Term Strategy Evaluated	Average Weekday Ridership	Travel Speed Improvement	Effectiveness (Boardings per Service Hour)	Reliability (Congested vs. Non-Congested)	Efficiency (Cost per Boarding)	Efficiency (Cost per Vehicle Mile)	Capital Cost per Mile (millions)
BRT	●	●	●	◐	●	◐	◐
Rail	●	●	●	●	◐	○	○

8.8.6 Fruitvale Avenue/Park Street Corridor

Mode Evaluated: Enhanced Bus

Conclusion: The Fruitvale Avenue/Park Street Corridor is a good candidate for Enhanced Bus improvements. Relatively low projections for ridership and other performance measures suggest that a higher level of transit investment, such as Rapid Bus, is not appropriate in this corridor.

This corridor was originally not part of the initial study corridors and added to provide a needed network function in the east-west, cross-town direction.

An Enhanced Bus strategy is proposed for 2020 for the Fruitvale Avenue/Park Street corridor, with upgrades being made to those improvements by 2040 to keep pace with

changing technologies. These improvements would be focused on the common segments where Lines 20 and 21 overlap, namely along Fruitvale Avenue in Oakland and Park Street in Alameda.

The forecast results showed that this corridor would have relatively low performance on all measures. For example, transit travel speeds in 2040 with the Enhanced Bus improvements were anticipated to increase 8 percent over 2040 speeds without the improvements though the speeds would be slower in 2040 than they are today (9.7 mph in 2040 with the project compared to 12.2 mph today). This indicates a limit to current Intelligent Transportation System technology in moving traffic significantly faster and smoother during the peak periods.

While this corridor rates relatively low for the performance measures, the Enhanced Bus strategy is important here to preserve operating speeds to the maximum extent possible. Large infrastructure investments, such as a peak-hour High Occupancy Vehicle (HOV) lane in the Posey and Webster tubes or a new transit tube, are not typically associated with an Enhanced Bus strategy, but as a cumulative benefit, it could boost performance on multiple Major Corridors, other AC Transit bus service as well as the new Alameda Point BRT, and may justify the cost.



Summary Table of Performance Measures

Long-Term Strategy Evaluated	Average Weekday Ridership	Travel Speed Improvement	Effectiveness (Boardings per Service Hour)	Reliability (Congested vs. Non-Congested)	Efficiency (Cost per Boarding)	Efficiency (Cost per Vehicle Mile)	Capital Cost per Mile (millions)
Enhanced Bus	○	○	○	◐	○	○	●

8.8.7 MacArthur Boulevard/40th Street Corridor

**Mode Evaluated: Rapid Bus
Replace Local**

Conclusion: Rapid Bus improvements would be critical to accommodate the high ridership on this corridor.

During the study's alternatives development stage, both Rapid Bus and BRT strategies were considered for the MacArthur Boulevard/40th Street corridor based on the future household density being one of the highest in the AC Transit's district. Through a technical analysis, the study team confirmed that the corridor could accommodate transit



lanes; however, it is not physically sufficient to become a full BRT corridor given the right-of-way and alignment challenges due to the freeway. Given the existing high-ridership and future household density, Rapid Bus Replace Local with a relatively high level of investment was therefore evaluated for that corridor. With Line NL overlaying Transbay service on MacArthur Boulevard between Lakeshore Boulevard and 73rd Avenue, a frequent local and Transbay service is available on this corridor.

This corridor consists of various width segments, and potential roadway improvements would vary by segment. Wide right-of-way segments are generally located on 40th Street and MacArthur Boulevard east of 73rd Avenue, as well as one-way couplet segments.

Summary Table of Performance Measures

Long-Term Strategy Evaluated	Average Weekday Ridership	Travel Speed Improvement	Effectiveness (Boardings per Service Hour)	Reliability (Congested vs. Non-Congested)	Efficiency (Cost per Boarding)	Efficiency (Cost per Vehicle Mile)	Capital Cost per Mile (millions)
Rapid Bus-Replace Local	●	●	●	●	●	●	●

8.8.8 West Grand Avenue/Grand Avenue Corridor

Mode Evaluated: BRT

Conclusion: A BRT investment in the West Grand Ave/Grand Avenue corridor is supported by projected significant improvements in service reliability, ridership productivity, and improved service efficiency.

The West Grand Avenue/Grand Avenue corridor has a relatively wide right-of-way and could accommodate transit lanes and other multimodal improvements. In addition, this corridor is strategically located to provide access to the Bay Bridge and downtown Oakland.

The short-term recommendation for this corridor is BRT; however, not all BRT features may be included. A critical feature in the short-term is the installation of transit lanes in coordination with the MTC's Core Capacity Study, the Bay Bridge Forward project and other improvements proposed by the City of Oakland. The Core Capacity Study proposes some Transbay routes, such as Lines C, B, CB, NX series, P and V, to use West Grand Avenue and Grand Avenue to bypass congestions on I-580. As ridership builds up on this corridor, additional routes could pick up and drop off passengers to provide frequent service in West Oakland, especially during peak hours.

The long-term recommendation would include upgrading the corridor improvements for adding additional BRT elements, such as all door boarding and proof of payment. The long-term improvements should be coordinated with timing of the MacArthur Boulevard and 40th Street corridor Rapid Bus improvements. With BRT improvements, this corridor is projected to be one of the highest-performing alternatives in 2040 for almost all of the performance measures, especially considering the number of transit passengers boarding and passing through this corridor. Reliability is high for bus operations on local streets, and the corridor has high ridership and ridership productivity.

The West Grand Avenue segment could accommodate BRT-level improvements. However, the potential design could be distinct from that of the East Bay BRT project on International Boulevard/East 14th Street in the following ways: 1) The design needs to accommodate any bus vehicle model so the platform can be no higher than 10.5 inches; 2) Because it could be used by a mix of BRT, Transbay, regional express buses and private buses, the design would need to enable two buses to pass each other. The roadway near the stations would have three transit lanes including a reversible passing lane that is open in the peak direction and could allow express buses to continue to San Francisco without



stopping. In effect, West Grand Avenue could serve as a transit spine for the District's local and Transbay buses as well as for future express buses linking outlying residential areas in West Contra Costa County and beyond with downtown Oakland.

Summary Table of Performance Measures

Long-Term Strategy Evaluated	Average Weekday Ridership	Travel Speed Improvement	Effectiveness (Boardings per Service Hour)	Reliability (Congested vs. Non-Congested)	Efficiency (Cost per Boarding)	Efficiency (Cost per Vehicle Mile)	Capital Cost per Mile (millions)
BRT	○	●	●	●	◐	●	◐

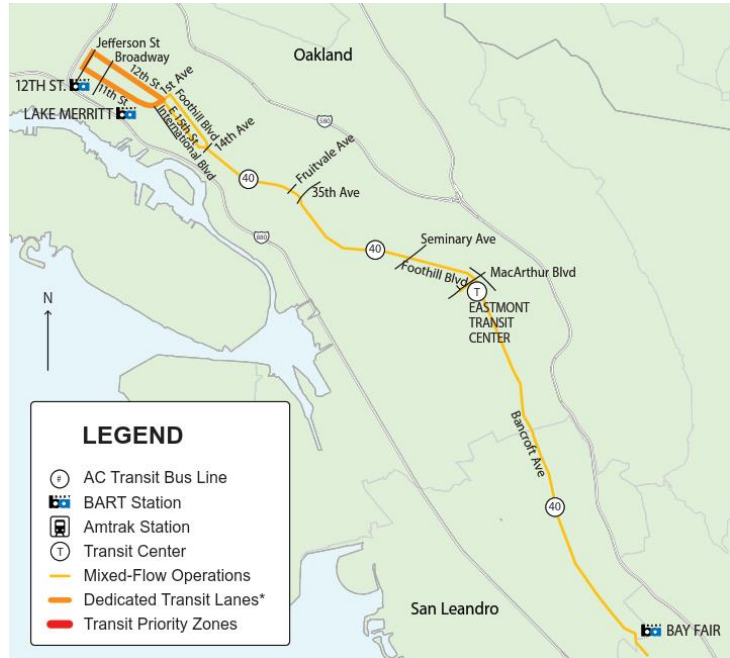
8.8.9 Foothill Boulevard Corridor

Mode Evaluated: Rapid Bus-Replace Local

Conclusion: A Rapid Bus investment in this corridor is appropriate given its projected performance.

Transit riders on this corridor experience unreliable schedules and slow travel speeds. The corridor could benefit from bus-only lanes on the 11th and 12th Street couplet in downtown Oakland to be constructed as part of the East Bay BRT project.

The Foothill Boulevard corridor was evaluated for Rapid Bus-Replace Local improvements for 2040. Results showed moderate improvement for all the performance measures, which could be sufficient to stem decreases in transit speed given the area's projected growth. Ridership is forecast to increase 37 percent and travel speeds 40 percent from 2040 baseline to 2040 with project improvements. It is recommended that ridership patterns be re-assessed in this corridor after opening the East Bay BRT project in 2017. During the project development phase, AC Transit may want to consider additional improvements, such as bus lanes to bypass congested areas to further improve reliability and transit speeds.



Summary Table of Performance Measures

Long-Term Strategy Evaluated	Average Weekday Ridership	Travel Speed Improvement	Effectiveness (Boardings per Service Hour)	Reliability (Congested vs. Non-Congested)	Efficiency (Cost per Boarding)	Efficiency (Cost per Vehicle Mile)	Capital Cost per Mile (millions)
Rapid Bus-Replace Local	●	●	●	●	●	●	●

8.8.10 Hesperian Boulevard Corridor

Mode Evaluated: Rapid Bus-Overlay Local

Conclusion: The corridor is wide enough for Rapid Bus-Overlay Local investment. A Rapid Bus-Overlay Local investment in this corridor would yield relatively low improvements in most performance measures. A Rapid Bus-Replace Local option could be considered because that would result in higher ridership productivity than Rapid Bus-Overlay Local.

This corridor is currently in the design phase for the installation of adaptive signal control systems and/or TSP as part of a Transit Performance Initiative (TPI) grant from MTC. These signal enhancements would be applied to all signalized intersections in San Leandro, Hayward, and parts of unincorporated Alameda County and Union City. Implementation is scheduled for 2017.



The Hesperian Boulevard corridor was evaluated as a Rapid Bus-Overlay Local corridor for 2040. While the corridor has relatively low performance for most of the measures, projections show that ridership would increase 39 percent and travel speeds 28 percent when comparing 2040 Baseline to 2040 Project. These improvements indicate the potential to improve transit travel in this corridor.

AC Transit should consider a gap closure project to add adaptive traffic signals in Union City in the near-term. Upon implementation of the signal improvement project, AC Transit should re-assess the corridor's performance in light of the TPI improvements and determine whether there are additional infrastructure needs, such as bus lanes to bypass congestion, worth pursuing.

Summary Table of Performance Measures

Long-Term Strategy Evaluated	Average Weekday Ridership	Travel Speed Improvement	Effectiveness (Boardings per Service Hour)	Reliability (Congested vs. Non-Congested)	Efficiency (Cost per Boarding)	Efficiency (Cost per Vehicle Mile)	Capital Cost per Mile (millions)
Rapid Bus-Overlay	○	◐	○	○	○	●	●

8.8.11 East 14th Street/Mission Boulevard Corridor

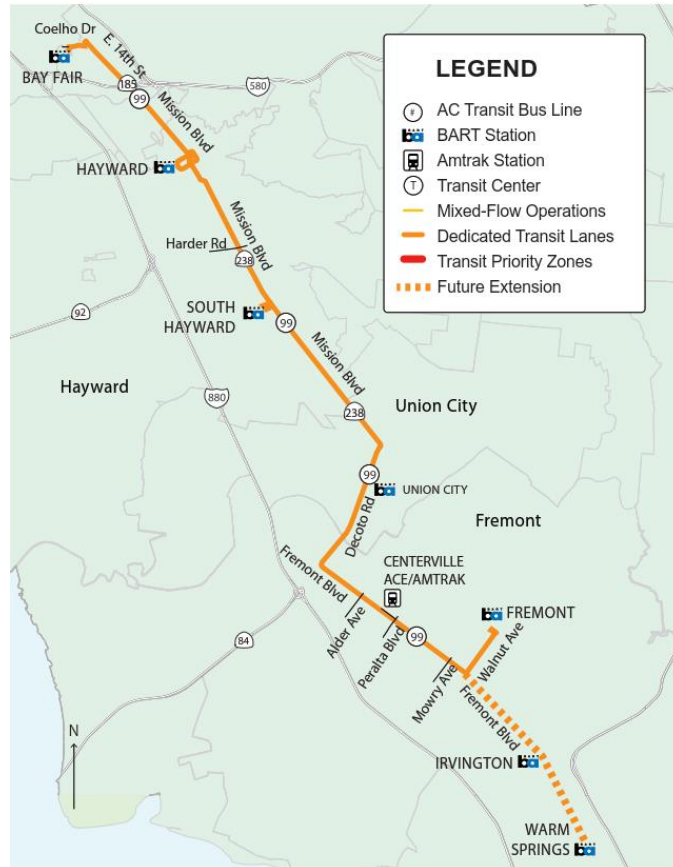
Mode Evaluated: BRT

Conclusion: A BRT investment in this corridor is supported by good performance on most measures and by planned development and growth in the Warm Springs area.

Anticipated growth in the Warm Springs area would create the land use conditions for effective transit investments like BRT. An extension of bus service southward would be considered as ridership demand increases and BART service expands to the Irvington and Warm Springs BART stations.

BRT improvements were evaluated for this corridor for 2040, with modeling results showing strong performance for travel time and reliability, and moderate performance for ridership increases, boardings per service hour and cost per boarding. The projected 223 percent increase in ridership is largely attributable to assumed new service between the Fremont and Warm Springs BART stations, which is scheduled to open in late 2016.

While a BRT investment performed well in the 2040 scenario, existing conditions do not necessarily support BRT given the low residential densities and mix of land uses. This corridor could be re-assessed in a future update of this study, especially to gauge how development may have occurred and if transit would be competitive in this area. Alternately, improvements could be implemented in phases. Any near-term improvements and other strategies be considered for implementation should be compatible with BRT.



Summary Table of Performance Measures

Long-Term Strategy Evaluated	Average Weekday Ridership	Travel Speed Improvement	Effectiveness (Boardings per Service Hour)	Reliability (Congested vs. Non-Congested)	Efficiency (Cost per Boarding)	Efficiency (Cost per Vehicle Mile)	Capital Cost per Mile (millions)
BRT	●	●	●	●	●	●	●

8.8.12 International Boulevard/East 14th Street

Mode Evaluated: BRT

Conclusion: BRT extensions on this corridor are supported by positive results in the projected performance measures and they extend benefits to adjacent communities.

Extensions to the East Bay BRT project were evaluated on the northern and southern ends. These extensions were identified as strong transit markets in the market assessment conducted as part of the Alameda CTC's Countywide Transit Plan. On the northern end, the BRT extension could become part of a transit spine along the length of West Grand Avenue, which includes the west end of this corridor. The extension on the southern end would continue BRT operations along East 14th Street to the Bay Fair BART station, which was one of the alignments studied earlier.



With BRT extensions, this corridor performed well for all performance measures. The West Grand Avenue segment may become an independent project that could benefit multiple Major Corridors, other AC Transit routes, future regional express buses, and/or buses operated by other agencies or companies.

Summary Table of Performance Measures

Long-Term Strategy Evaluated	Average Weekday Ridership	Travel Speed Improvement	Effectiveness (Boardings per Service Hour)	Reliability (Congested vs. Non-Congested)	Efficiency (Cost per Boarding)	Efficiency (Cost per Vehicle Mile)	Capital Cost per Mile (millions)
BRT	●	○	●	●	●	●	●

Note: Speed improvement over the 2040 baseline is limited as the study assumes the East Bay BRT as the base condition. However, the projected travel speed for the entire corridor would be similar to other BRT corridors and would provide a competitive transit service.

9 Revised Short- and Long-Term Investment Strategies

The evaluation results affirm the efficacy of a majority of the short- and long-term alternatives that were selected for each of the corridors with two the following exceptions: Adeline Street and Telegraph Avenue. As discussed above, the following changes are recommended for each corridor:

- The results for the Adeline Street corridor are inconclusive. The Major Corridors Study approached upgrading the corridor by initially considering operational improvements and BRT implementation by 2040. The evaluation in the Major Corridors Study and the Alameda Countywide Transit Plan showed conflicting performance measures, except travel time improvement and cost per vehicle mile, which were rated as having a moderate improvement. While BRT investments could improve transit service quality on this corridor, the discrepancy between modeled ridership and Alameda CTC's market analysis, indicates that further research would be necessary to justify pursuing BRT. Therefore, operational improvements, focused on frequency and reliability improvements, are recommended for the short-term horizon and a fresh look at long-term options at a later date. More detailed studies may or may not indicate that a higher level of investment is justified.
- BRT and Light-Rail improvements were examined for the Telegraph Avenue corridor. Given the evaluation results which showed much higher operating and capital cost for the rail option, the BRT option is recommended as the long-term strategy for this corridor.

Final recommended short-term and long-term investment strategies are summarized in Table 18.

Table 18: Final Short-Term and Long-Term Investment Strategies for Major Corridors

Corridor	Short-Term (by 2020)	Long-Term (by 2040)
San Pablo Avenue/Macdonald Avenue	Rapid Bus Upgrades	BRT
Shattuck Avenue/Martin Luther King Jr. Way	Enhanced Bus	Rapid Bus - Overlay Local
Broadway/College Avenue/University Avenue	Enhanced Bus	Rapid Bus - Replace Local
Adeline Street	Operational Improvements	TBD
Telegraph Avenue	Rapid Bus Upgrades	BRT
Fruitvale Avenue/Park Street	Enhanced Bus	Enhanced Bus Upgrades
MacArthur Boulevard/40th Street	Enhanced Bus	Rapid Bus - Replace Local
West Grand Avenue/Grand Avenue	BRT	BRT Upgrades
Foothill Boulevard	Enhanced Bus	Rapid Bus - Replace Local
Hesperian Boulevard	Enhanced Bus	Rapid Bus - Overlay Local
East 14th Street/Mission Boulevard/Fremont Boulevard	Enhanced Bus	BRT
International Boulevard/East 14th Street*	BRT (under construction)	Extensions to BRT Service

10 Outreach

District staff engaged the public and public agencies throughout the duration of this 18-month study. This included convening meetings with the study's Technical Advisory Committee (TAC), three rounds of transportation open houses in collaboration with Alameda CTC and additional stakeholder meetings and presentations. Two rounds of surveys were administered, and the majority of survey respondents were AC Transit riders. The survey results are summarized in Appendix G.

More than half of the public outreach meetings were co-sponsored by the Alameda CTC. Thus, we received comments from local residents who do not ride buses on a regular basis, nevertheless have a keen interest in transportation issues. Some important comments raised during the outreach process cannot be adequately addressed through the framework of the Major Corridors Study. Those issues and concerns are summarized in Appendix H.

Outreach by the Numbers

12 public outreach meetings with over 500 attendees

4 meetings with stakeholder agencies

2 surveys with over 700 participants

750 riders met at bus stops

430 comments received (including comment sections in the surveys)

10.1 Most Frequently Heard Themes

There were themes were consistently heard more frequently and more strongly than others, surfacing at nearly every meeting throughout the District. In general, riders strongly support project elements to increase service reliability, reduce travel time, as well as elements that improve travel experience.

10.1.1 Service Reliability

Service reliability is one of the top issues raised by the public throughout the outreach events. Today, many routes on the Major Corridors have poor on-time performance. Riders want a reliable bus schedule so that they can plan their trips better. Many respondents noted that buses are often bunched together. Riders want consistent headways. Project elements that increase transit reliability are well-received by survey respondents.

10.1.2 Accuracy of Real-Time Arrival Information

Many riders responded that real-time arrival displays at their bus stops are important. May said that the real-time arrival information displays provide inaccurate information. There seems to be a high level of frustration for inaccurate information, broken displays and lack of displays. The survey respondents selected availability of accurate real-time arrival displays is very important, but also noted dissatisfied with the existing system.

10.1.3 Bus Stop Access

There were both support and concern regarding potential changes to bus stop spacing. People who support increasing bus stop spacing want to speed up their trips even if they have to walk a little to reach a bus stop. However, there was also strong concern about increasing bus stop spacing as they felt accessing bus stops would be more difficult, especially for seniors and people with disabilities. Overall, better placement of bus stops, extension of red curbs and bus stop relocation to the far side, had a strong support.



Transportation Open House, Hayward

10.1.4 Bus Stop Amenities

Many people mentioned that there are not enough amenities, such as benches and shelters, at bus stops. Results of the fall 2015 survey indicated that riders were not satisfied with availability of shelters and benches, but they also responded that those elements were less important when compared to service reliability or frequent service. Where shelters and benches are available, cleanliness and maintenance were noted as an issue.

10.1.5 Fare Payment

All door boarding with a Clipper Card had strong support as many people already have them and believe that using them would shorten boarding time and travel time. While there was strong support for all door boarding, many respondents expressed that AC Transit should keep a cash payment option for people who do not have a Clipper Card or do not have good access to a vendor who sell and add value to a Clipper Card.

10.2 Recurring Issues and Concerns

The section below summarizes other “recurring issues and concerns” heard throughout the outreach process, although not as frequently or at the same level of intensity as those previously identified. Tissues and concerns in this section are elements related with infrastructure, but do not directly affect transit operations. In general, elements in this category typically affected a smaller group of people.

10.2.1 Availability of Real-Time Information and Signs

In addition to accurate real-time arrival information, riders expressed that receiving major delay and service disruption alerts en route via texting or email would be extremely helpful. This type of alerts could give an alternate travel option for some. Many riders urged for improved visibility of bus stops,

especially at night. Better readability of bus stop signs and other passenger information will help riders identify a direction of travel, destination and transfer points.

10.2.2 Safety

Lighting was an important issue for some riders, as it would increase riders' sense of security at night as well as visibility of passengers waiting for buses. Concern for security onboard buses and during daytime was less prevalent.

10.2.3 Multimodal Improvements

While the majority of those surveyed supported transit improvements to increase reliability and frequency and reduce bus travel time, there were questions about how transit improvements could potentially affect other modes. Comments and concerns included the following:

- A transit project should be part of a multimodal improvement project, including bicycle and pedestrian access and safety.
- Signal improvements as part of a transit project should not negatively affect pedestrian safety and street crossing experience. Some members of the public have misunderstandings or misconceptions about elements of transit projects (i.e., transit signal priority, queue jump signals etc.). AC transit should make conscious efforts to make educational materials to the public.
- There were some concerns that transit improvements may increase traffic delays or traffic diversion to nearby residential neighborhoods.
- There were some concerns that transit improvements may affect ADA accessibility. Elements that raised concerns were mostly transit station design for BRT and bus stop spacing



Transportation Open House, Oakland

11 Policy and Design Considerations

New investment and technology identified in the Major Corridors Study introduces new features for AC Transit that may need to be instituted through policy guidance, route design, or operational practices. These include policies to address transit lane use and enforcement; all-door boarding; proof of payment and fare enforcement; Rapid Bus-Replace Local operations; zero-emission vehicles; and placement of operator restrooms.

11.1 Policies

11.1.1 Regional Policy Recommendations

Regional transportation planning agencies and local jurisdictions can adopt policies that improve transit operations and facilitate better multi-modal projects. Two possible policies are listed below.

- *Establish requirements for cities that receive funding for traffic signal upgrades on major transit corridors.* For example, a regional policy could require that funding for all new traffic signals include elements that support transit operations as a condition of funding. This could include inter-connected signals, adaptive control and transit signal priority. Access to data should be web-based with access for all stakeholders.
- *Establish transit-supportive requirements for funding complete streets projects on major transit corridors.* This policy would require that pedestrian and bicycle projects include transit performance elements that are designed to “not preclude” high-level transit investments in the future. Complete streets projects should not result in a deterioration of bus operations or potential loss in ridership.

11.1.2 Fleet Speed and Regional Partnerships

Declining average fleet speed, estimated at five percent in three years, could have dire consequences for the District, including: loss of passengers, declining fare revenue, expanded fleet needs and escalating operating and maintenance costs. The pace of implementing Major Corridors projects may not be fast enough to prevent the continued downward spiral caused by slower bus service. Regional partnerships should be developed to upgrade signals to adaptive control, improve signal timing and add TSP to all streets with transit service as soon as possible. Regional or countywide standards should be established and met by all cities as a condition of any transportation funding.

11.1.3 Surface Rail

The study is not recommending surface rail (Light Rail or streetcar) for any corridor in the AC Transit system due to the prohibitive cost of rail infrastructure. For even the highest ridership corridors, BRT seems capable of meeting the future demand. However, there remains a possibility that surface rail projects may still be proposed by cities in the future and that the District needs to respond with viable alternatives.

Cities across the country have been planning and developing short streetcar lines. These new systems generally operate in mixed flow traffic and are promoted as economic development projects more often than transportation projects. In many cases, these projects fall short of their ridership claims (e.g.

Atlanta) and their economic benefits have been questioned. Locally there have been two recent transportation studies that examined urban streetcars. When a city-sponsored streetcar proposal arises, it would be critical for the District to provide guidance to determine whether the project is primarily oriented toward economic development, in which case it should be evaluated and operated on that basis, or whether it is primarily a transportation project, in which case there must be assurance that the project fills a legitimate transportation need and is coordinated with the transit network.

Only one corridor, Telegraph Avenue, was found to meet MTC's residential density threshold for rail and have sufficient roadway width to accommodate surface rail. Rather than oppose streetcar projects outright, the District could encourage other potential rail projects to focus on if primary motivation is to provide a transportation service. Rail operations, assuming that they are primarily intending to meet a transportation purpose rather than an economic development purpose, should operate on exclusive right-of-way to justify high expense. Without the dedicated rights-of-way, surface rail would be more expensive to build and operate worse than any bus alternative.

11.2 Infrastructure

11.2.1 Transit Lanes

There are many types of transit lanes, including lanes used exclusively by transit and others that allow for limited use by other vehicles and lane restrictions that are applied only during peak periods. AC Transit's East Bay BRT corridor, currently in development, would utilize exclusive transit lanes in the median of the street that would be enforced during all hours of operation. While that is the most efficient and easily enforced configuration, transit lanes in other corridors may consider other configurations due to the unique circumstances and constraints of the corridor. Internal District design and policy guidelines may need to be developed for the following types of transit lanes:

- **Transit Priority Zones:** AC Transit is considering possible transit zones in downtown Oakland and Berkeley, as discussed in Section 6. These are short (two to four blocks) sections of a street that have intense transit use and would be designed to provide preferential treatment for transit. An example of a transit zone is 5th and 6th Avenues in downtown Portland. Design considerations for Transit Priority Zones include lane configuration, bus station assignments,



Figure 21: Transit Priority Zone, Portland, Oregon



Figure 22: Curbside Bus Transit Lane, Eugene, Oregon

supporting multi-modal improvements, and separation of transit from other vehicles. Policy considerations include the extent of transit priority and preference in the Transit Priority Zones.

- **Curbside Transit Lanes:** Many BRT systems use curbside transit lanes that are shared with right-turning vehicles (as shown in photo). These lanes, often referred to as Business Access Transit (BAT) lanes, typically require non-transit vehicles to turn right at every intersection, with only the bus allowed to use the lane for through travel. Design considerations for this type of bus lane include signage and lane striping. Policy considerations include lane enforcement and penalties for violators.
- **Peak-Hour Transit Lanes:** Some transit systems have exclusive or semi-exclusive use of curbside transit lanes during peak hours, with the lane available for on-street parking during off-peak times. The Metro Rapid in Los Angeles is one of several systems that use peak-hour transit lanes.



Figure 23: Curbside Bus Transit Lane

Design considerations for this approach include lane markings and signage. Policy considerations center on enforcement, including possible towing of cars that are parked in the lane during restricted hours. A peak-hour transit lane may have limited benefit for transit, as many of the corridors have high midday traffic congestion and transit ridership. In addition, violations and enforcement are often a constant challenge with part-time transit lanes.

Bi-Directional Transit Lanes: Some systems use a single lane, generally in the street median, for two-way bus travel. This lane configuration can result in delays for transit, especially if service frequencies are high. Lane Transit District in

Eugene, Oregon uses bi-directional lanes.

Design configurations for this type of transit lane include providing passing opportunities for buses, signal controls, signage, and lane marking. Policy considerations include enforcement of the lane and possible use by emergency vehicles.

- **Targeted Center-Running Transit Lanes:** San Francisco implemented a pilot project of center-running, transit- and taxi-only lanes were implemented on three blocks of the busy mixed-used



Figure 24: Bi-Directional Transit Lane (Eugene, Oregon)

corridor of Church Street. These lanes were established to improve service reliability for a local bus line and a Light-Rail line in a short segment that experienced significant transit delays. Results showed average travel time savings of up to 14 percent (or one minute) and average reductions in travel time variability of up to 27 percent. Design considerations for this approach include signage and lane striping.

11.2.2 Multi-Agency Bus Facilities

Several streets, such as West Grand Avenue in Oakland and University Avenue in Berkeley, could serve as multi-agency bus facilities. The West Grand Avenue segment could accommodate BRT-level improvements. Because of the role of Transbay service, the potential design could be distinct from that of the East Bay BRT project on International Boulevard/East 14th Street in the following ways: 1) The design needs to accommodate any bus vehicle model so the platform can be no higher than 10.5 inches; 2) Because it could be used by a mix of BRT, Transbay, and regional express buses, the design would need to enable two buses to pass each other. The roadway near the stations would have three transit lanes including a reversible passing lane that is open in the peak direction and could allow express buses to continue to San Francisco without stopping.

11.2.3 Zero-Emission Vehicles

Climate change and particulate pollution are concerns worldwide. There is growing recognition of the need to operate cleaner and greener vehicles. The Major Corridors Study recommends that the District adopt the most advanced low carbon, low emission vehicle propulsion technology available at the time of BRT project implementation. This could include battery electric, hydrogen fuel cell or advanced hybrid technology. This forward-looking approach should be incorporated into the definition of projects and feature prominently in the branding of the service. For Enhanced Bus and Rapid Bus projects, it is recommended that the District commit to giving these corridors priority for deployment of zero or low emission vehicles, such as diesel hybrids and transition to cleaner vehicles at a pace faster than the District as a whole.

California's Air Resources Board has a goal for transit agencies to operate **all zero-emission vehicles** (ZEVs) by 2040. AC Transit has maintained a hydrogen fuel cell demonstration program since 2000, and 13 hybrid-electric fuel cell buses currently run on several District lines. All-electric (battery-powered) bus technology is improving, with buses now having a range of up to 200 miles before requiring recharging. The performance of fuel cell and battery electric vehicles will only improve over time.

The fleet for the major corridors should be given priority in the District's transition away from conventional diesel propulsion. As the agency moves toward growing its fleet of ZEVs, especially to meet the capital investment strategies outlined for the major corridors, there would be numerous implications for staffing and facilities for the District as well as for local regulations. Employees would need to be trained on how to operate and/or maintain ZEVs. Upgrades or retrofits of existing maintenance/operating divisions would need to be constructed so that they can accommodate the equipment and materials needed to maintain and repair the buses, e.g., compressors to fuel the hydrogen vehicles. Stations may need to be able to accommodate rapid-charge mechanisms for electric buses. Procurement would also need to shift to new materials and products. Local permits restrict

fueling to a maximum of 20 buses per day, which would need to be reviewed to accommodate a larger fleet.⁵

11.2.4 Operator Restrooms

- Operator restrooms are an important consideration for drivers' comfort and well-being. While there are existing operator restrooms at the end of some bus lines (e.g., Contra Costa College in the San Pablo Avenue/Macdonald Avenue corridor), this is not always the case. Service planners would need to factor in restroom locations when designing and scheduling service on the routes, including those with new extensions. Options for facilities would include: existing private facilities (with permission), existing public facilities, and new dedicated facilities. This study's capital cost estimates include two operator restrooms per corridor. San Francisco Municipal Transportation Agency (SFMTA) faces the similar challenges in locating operator restrooms, and SFMTA is installing Operator Convenience Stations (See Figure 25) where they face challenges in finding restrooms at route terminus.



Figure 25: SFMTA Operator Convenience Station at 25th & Potrero

11.3 Route Design

11.3.1 Revising the Definition of Rapid Bus

The Rapid Bus definition used by the District has not been refreshed since before implementation of the 1-Rapid Line in 2007. There is a need to update the definition to take advantage of new technology and other opportunities to speed operations. This section reviews potential updates to the Rapid Bus definition to include two types of service: Rapid Overlay and Rapid Replace Local; and explore new technology and a revised fare collection policy.

AC Transit's Board Policy 550 – Service Standards and Design Policy defines Rapid Bus as follows:

Provides limited stop service along a Trunk Route or Major Corridor featuring wide stop spacing, headway based schedules, transit signal priority and passenger amenities. Underlying local service contributes to aggregate service frequency.

Included in the definition is the notion that the “underlying local service” contributes to the frequency of service in the corridor. Although not mentioned in the policy, the purpose of the local service is actually to provide better access to the system. The opposite interpretation could be reached that the

⁵ AC Transit, “Taking the HyRoad,” March 2012. Available: http://www.actransit.org/wp-content/uploads/010912B_HyRoad_web2.pdf

“wide stop spacing” is the key feature of Rapid, but the language does not explicitly state that the local bus service is for access.

According to the AC Transit’s Board Policy 508 – Bus Stop Policy, Local bus stops should be spaced between 800-1,300 feet apart and Rapid Bus stops should be spaced between 1,700-5,000 feet apart. The minimum for Rapid spacing is 1,700 feet or 0.322 miles, which is approximately the same distance as between BRT stations. This is 30 percent further apart than the maximum recommended spacing for local bus stops. Many other BRT systems, including Cleveland, Eugene, Seattle, and Fresno have replaced Local service with a stand-alone BRT service. This will also be the service design for the East Bay BRT project.

Policy and design considerations for the Rapid Bus-Replace Local service include operational coordination with local routes that may operate on a portion of the corridor and the extent of required relocation of local routes on the corridor. Central to the design of a Rapid Bus-Replace Local service would be to ensure good passenger access and optimal bus stop locations. This concept is ideal for Line 51 where there are portions of the route that could not accommodate a Rapid Overlay due to limited roadway width.

11.3.2 Transbay Overlay on Local Streets

The Major Corridors Study did not consider Transbay bus service with the exception of Line NL on the Grand Avenue/MacArthur Boulevard corridors and Line F on the Adeline Street corridor. One concept that could strengthen bus service in some corridors is a continuous overlay of a Transbay route or routes onto a major corridor where population density and demand for travel to San Francisco is naturally higher. This would enable “one-stop shopping” for customers’ travel needs – local and Transbay buses serving one street. This service design was raised in the AC Transit’s original Inner East Bay Comprehensive Operations Analysis conducted in 2013 and has been discussed as part of MTC’s Core Capacity Transit Study.

11.4 Fares

11.4.1 All-Door Boarding/Proof of Payment

While all-door boarding and proof of payment (POP) will be implemented on the East Bay BRT project, it is currently not offered on any of the other District bus lines. Allowing all-door boarding and POP on Rapid Bus corridors would reduce dwell times and speed up bus operations. San Francisco, the only U.S. operator to provide all-door boarding throughout its entire system, found that after POP implementation average dwell time decreased 38 percent, average bus speeds improved two percent, half of all passengers used the rear



Figure 26: All-Door Boarding, San Francisco

door to enter, and fare payments at the front door declined 4 percent.⁶ In addition, the presence of licensed, uniformed fare inspectors on buses can improve the perception of safety and security.⁷

Policy questions for the major corridors related to all-door boarding and proof of payment include:

- Will corridors that have a combination of off-board fare collection and on-board fare collection be considered, or must corridors use the same manner of fare collection for their entire length?
- What is the frequency of fare checking and how will violations be handled?
- What infrastructure is required to make fare purchase convenient for riders?

11.4.2 Fare Payment

Technology for fare payment will continue to evolve over time. As a growing number of people have access to smart phones connected to their credit cards or bank cards, a mobile phone application could replace the existing fare medium or complement other fare medium. If implemented correctly, use of mobile phones and devices for transit fares can eliminate the need to issue separate fare media. Locally San Francisco Municipal Transportation Agency and Sacramento Regional Transit District provides mobile fare payment as one of the payment options.



Figure 27: SFMTA Mobile Ticket Example

⁶ SFMTA, "All-Door Boarding Evaluation: Final Report." December 2014, <https://www.sfmta.com/sites/default/files/agendaitems/2014/12-2-14%20Item%20All%20Door%20Boarding%20Report.pdf>

⁷ TCRP Synthesis 96, 2012, "Off-Board Fare Payment Using Proof-of-Payment Verification."

12 Funding Strategy

The following section describes current funding sources that would be applicable for the Enhanced Bus, Rapid Bus, and BRT strategies contemplated, with the exception of a possible Regional Measure 3, which would be a voter-approved increase in Bay Area bridge tolls. Funding sources for rail strategies were not included in this discussion, given the unlikelihood of its implementation.

12.1 Local Sources

Alameda County **Measure BB**, approved by Alameda County voters in 2014, funds the 2014 Transportation Expenditure Plan. Bus transit capital projects included in the 2014 Plan are BRT projects and projects that improve transit operations and access. The Alameda CTC will lead multimodal corridor planning for several corridors, which will include the concepts evaluated in this study.

The CCTA is seeking to place a half-cent increase in the county sales tax rate on the Contra Costa County ballot in November 2016. The measure must first be approved by Contra Costa cities and the Board of Supervisors to be placed on the November ballot, where a 2/3 yes votes would be required to pass. The tax would augment the existing half-cent transportation sales tax authorized by Measure J from 2004 and would be charged for 30 years to raise an estimated \$2.9 billion countywide over that time period. In West Contra Costa County—the location of AC Transit’s service within the County—there would be \$110.6 million for “bus and other non-rail transit.” This would average \$3.7 million per year. Bus operating expenses, bus capital expenses, and expenses for other forms of road-based transportation would be eligible for these funds. The potential Measure also includes \$55 million for “high capacity transit” along the I-80 corridor in Contra Costa County. San Pablo Avenue north to Hercules and 23rd St in Richmond/San Pablo are being reviewed for upgraded bus service under the West Contra Costa County’s High-Capacity Transit Study.

12.2 Regional Sources

The regional **Transportation for Clean Air Program** (TFCA) is administered by the Bay Area Air Quality Management District and is intended for projects that reduce transportation-related greenhouse gas emissions. The amount of funding through this program is small (typically less than \$1 million per project) and generally acts as a match to larger funding allocations from other programs. Traffic signal and transit signal priority improvements score well in this program and AC Transit has received funding from it for the Broadway/College Avenue/University Avenue corridor, Hesperian Boulevard corridor, East 14th Street/Mission Boulevard corridor, and the East Bay BRT project.

MTC’s **OneBayArea Grant** (OBAG) comprises several sub-programs. The second OBAG cycle continues the Transit Performance Initiative (TPI) Incentive and Investment programs that align particularly well with corridor projects. AC Transit has funded the Line 51 Corridor and South County Corridors projects with TPI Investment grant awards. The third round call for the TPI program is expected in 2016.

With MTC’s **Regional Measure 2** (RM2) nearly fully expended, it is likely that a successive program would be developed in the near future. RM2 is funded through bridge toll revenue and prioritized transit, bicycle and pedestrian projects that reduce traffic congestion on bridges operated by MTC and the Bay Area Toll Authority. Although information on a potential **Regional Measure 3** has not been

made available, it could be an important funding source for the investment strategies evaluated in this study.

12.3 State Sources

The state's **Cap and Trade** funding program is the most significant new source of funding for transit improvements and includes the following formula and discretionary funding programs: Affordable Housing and Sustainable Communities Program; Low-Carbon Transit Operations Program; and Transit and Intercity Rail Capital Program. Because these funds are relatively new, guidance and funding levels and long-term strategies are still in development. These funds are appropriated auction proceeds from the Greenhouse Gas Reduction Fund. To qualify for funding, projects must reduce greenhouse gases by promoting mode-shift, reducing vehicle miles traveled, and using clean fuels. These funds also have requirements for benefitting disadvantaged communities. Corridor projects are particularly well-suited for this type of funding through the increased ridership and expanded service that they enable.

Caltrans' **Sustainable Communities Grant** is a discretionary program that funds studies of multimodal transportation issues having statewide, interregional, regional or local significance. Examples listed by Caltrans include: studies that advance efforts to reduce greenhouse gases, create sustainable communities, or evaluate the accessibility and connectivity of multimodal transportation networks. Specifically, these include corridor enhancement studies and the identification of policies, strategies, and programs to preserve transit facilities and optimize transit infrastructure. Studies are eligible to receive between \$50,000 and \$500,000.

12.4 Federal Sources

The FTA **New Starts** program is exclusively for new fixed guideway projects or extensions to existing fixed guideway systems with a total estimated capital cost of \$300 million or more, or that are seeking \$100 million or more in Fixed Guideway Capital Investment Grants funds. New Starts projects require a minimum of 40 percent local (non-federal) matching funds. In the San Francisco Bay Area, MTC restricts New Starts exclusively to rail projects per a locally devised agreement.

The FTA **Small Starts** program is for new fixed guideway projects, extensions to existing fixed guideway systems, or corridor-based BRT projects with a total estimated capital cost of less than \$300 million and that are seeking less than \$100 million in Fixed Guideway Capital Investment Grants funds. Small Starts projects require a minimum of 20 percent local (non-federal) matching funds. FTA defines fixed-guideway BRT as having at least 50 percent fixed guideway, and all the corridors evaluated for a BRT strategy meets the FTA's BRT definition. The Small Starts program also includes corridor-based BRT, which does not have a minimum fixed-guideway requirement. Rapid Bus corridors could qualify for Small Starts funding as corridor-based BRT projects.

The FTA **Core Capacity** program funds substantial corridor-based capital investments in existing fixed guideway systems that increase capacity by not less than 10 percent in corridors that are at capacity today or will be in five years.

Transportation Investment Generating Economic Recovery (TIGER) discretionary grants administered by the U.S. Department of Transportation will fund capital investments in surface transportation infrastructure and will be awarded on a competitive basis for projects.

FTA 5339 – Grants for Bus and Bus Facilities has both formula and discretionary components and prioritizes capital projects to replace, rehabilitate and purchase buses, vans, and related equipment, and to construct bus-related facilities. A sub-program provides competitive grants for including technological innovations to support low or zero-emission vehicles or facilities. Zero-emission vehicles purchased for a specific corridor project would qualify under this program.

FTA 5307 – Urbanized Formula Funds are formula funds programmed by MTC. Although these funds would be applicable for the investment alternatives evaluated in this study, the regional priority for the use of these funds has been the replacement of vehicles and fixed guideway equipment, making it unlikely that they will be available in any significant amount for these projects.

Table 19 lists the phases and projects eligible under the above-referenced funding sources, as they are currently understood. While the table lists funding sources that AC Transit could apply, funding agencies may change eligible agencies, eligible projects and/or funding priorities.

Table 19: Eligible Phase and Project Type by Funding Source

Funding Type	Funding Source	Phases Eligible			Projects Eligible		
		Planning	Design	Constr ¹	Enhanced	Rapid	BRT
Local	Alameda County Measure BB	X	X	X	X	X	X
Regional	Transportation for Clean Air Program		X	X	X	X	X
	One Bay Area Grants	X	X	X	X	X	X
	Potential Regional Measure 3		X	X	X	X	X
State	Cap & Trade: AHSC			X	X	X	X
	Cap & Trade: LCTOP			X	X	X	X
	Cap & Trade: TIRCP			X	X	X	X
	Caltrans Sustainable Transportation Grant	X			X	X	X
Federal	New Starts ²						
	Small Starts		X	X	³	X	X
	Core Capacity		X	X	X	X	X
	TIGER			X			X
	5339 – Grants for Bus and Bus Facilities			X	X	X	X
	5307 – Urbanized Formula Funds	X	X	X	X	X	X

¹ Constr = Construction

² A regional agreement devised by MTC restricts New Starts exclusively to rail projects

³ Small Starts may not be available for Enhanced Bus projects, as Small Starts projects are required to: 1) have defined stations with shelters and passenger information; 2) provide faster travel time using TSP, queue-jump lanes, or separated guideway; 3) headways of 10-minute peak/20-minute off-peak or 15-minute all day for 14 hours per day; and 4) branding stations and vehicles.

While there are a good number of possible funding sources for the corridor improvements contemplated by this study, one challenge would be finding funding for planning and environmental phases and assembling funding to accomplish larger improvements. The East Bay BRT project, for example, has over 10 funding sources. Additionally, over 30 percent of the project was funded through RM2, which, as discussed, has nearly been exhausted.

13 Implementation Plan

Transit corridor projects, particularly the more extensive ones such as BRT, require considerable time and resources to implement. As a result, it is important to plan for an orderly sequencing of the projects that considers the allocation of resources. The order in which these projects would be implemented will be determined by a number of factors, including:

- **Need:** Corridors in which the improvements are most needed to address capacity and transit operational issues could be pursued earlier;
 - **Ridership:** Improvements to corridors with higher ridership will provide greater performance and benefit to users and may be pursued earlier;
 - **Complexity:** The most difficult or complex corridors can take advantage from experiences and lessons learned from the less complex corridors, and so may be pursued later; and
- Political/jurisdictional support:** Support from the jurisdiction in which the corridor is located is critical to allowing a transit project to move forward. Similarly, if regional funding agencies view corridor specific improvements as a way to serve larger goals, such as property development, a corridor may gain enough institutional momentum to begin the project development process.

While the first three bulleted items, which are issues related to the characteristics of a corridor, are important, the last item - political/jurisdictional support, is ultimately the key requirement for a project to advance. Because that factor is difficult to predict, this implementation plan does not specify a priority order for corridor development. Instead, generic corridor development timelines are proposed, and they account for how many project can be advanced in given periods.

13.1 Short-Term Implementation Plan

By 2020, eight Enhanced Bus Corridors could be developed, with one corridor, the Broadway/College Avenue/University Avenue corridor, complete and another, the Hesperian Boulevard corridor, underway. In addition, the San Pablo Avenue/Macdonald Avenue and Telegraph Avenue corridors, which now have Rapid Bus, could be improved with Rapid Bus upgrades. The Adeline Street corridor would only need operational improvements in the near term. The International Boulevard/East 14th Street corridor is already under development as a BRT line and has a set implementation schedule and is not addressed as part of this short-term plan. Completing the remaining nine projects by 2020 would require working on multiple corridors concurrently.

Enhanced Bus projects can be completed in three years, with one year each for planning, design/engineering, and construction. Rapid Bus upgrades on the San Pablo Avenue/Macdonald Avenue and Telegraph Avenue corridors include enhancements to existing Rapid Bus improvements on those corridors, and would have the same three-year implementation schedule as the development of Enhanced Bus corridors. Operational improvements on the Adeline Street corridor would be limited to AC Transit service changes, and can be planned and implemented as part of an upcoming Transbay Comprehensive Operations Analysis.

Table 20 shows a possible short-term implementation schedule for the 10 corridors. This schedule staggers the corridor development to minimize AC Transit staffing requirements of the projects. With

the exception of one year, no more than three corridors would be in planning, design, or construction at any one time. For example, a planning/project team can work on three corridors for a year, then move to three new corridors the following year, and three others in the third year. Similarly, design and construction management could pursue a maximum of three design and three construction contracts in any single year. AC Transit would need to assess its current staffing levels in Planning and Capital Projects departments to determine the additional staffing needed to meet this schedule. All additional staffing would be folded into the individual project budgets.

Table 20: Implementation Schedule – Short-Term

Corridor	2016	2017	2018	2019	2020
Enhanced Bus Corridor #1	Planning	Design	Construction		
Enhanced Bus Corridor #2	Planning	Design	Construction		
Enhanced Bus Corridor #3		Planning	Design	Construction	
Enhanced Bus Corridor #4		Planning	Design	Construction	
Enhanced Bus Corridor #5		Planning	Design	Construction	
Enhanced Bus Corridor #6			Planning	Design	Construction
Enhanced Bus Corridor #7			Planning	Design	Construction
Rapid Bus Upgrade Corridor #1	Planning	Design	Construction		
Rapid Bus Upgrade Corridor #2		Planning	Design	Construction	
Adeline Operations Improvements		Planning & Implementation			
BRT #1		Planning	Design	Construction	

Table 20 does not include vehicle acquisition, which can be a long lead-time (e.g., 18 to 24 months) item for procurement. Unlike BRT vehicles, it is assumed that the vehicles used for Enhanced Bus and Rapid Bus would be common 40-foot diesel-hybrid coaches and that they would be procured as part of ongoing bus purchases. Because this element of the project is independent from the design and construction, the vehicle delivery process can be scheduled to coordinate with the project development schedule. The Enhanced Bus and Rapid Bus branding would need to be incorporated into the vehicle procurement, either as a factory-installed feature or applied by AC Transit after vehicle delivery.

13.2 Long-Term Implementation Plan

By 2040, it is anticipated that:

- One corridor would be an upgraded Enhanced Bus corridor,
- Five corridors would be developed for Rapid Bus,
- Four corridors would be developed for BRT, and
- Extensions would be added to the East Bay BRT corridor.

As with the initial Enhanced Bus implementation, Enhanced Bus upgrades (e.g., to keep signaling and other hardware and software current and in a state of good repair) can be completed in three years, with one year each for planning, design/engineering, and construction.

A new Rapid Bus corridor is more complex than an Enhanced Bus corridor having higher service levels and a higher level of capital improvements, including a potentially higher investment at stations, branding and, possibly, segments of exclusive bus lanes or queue jump lanes. As a result, a Rapid Bus project would require more time for planning, which would include determining a service plan,

identifying the most appropriate capital improvements to improve operations, and achieving consensus on the design. The construction period would also be longer. It is estimated a total of four years would be required: 1.5 years for planning, one year for design, and 1.5 years for construction.

Development of a BRT corridor would be a complex project that, with political consensus, typically takes seven to eight years from the start of planning to the revenue service date. Exclusive transit lanes, which are the key feature of BRT corridors, can be very controversial and require considerable thought and discussion to arrive at a mutually agreeable approach to implementation and resolving traffic and parking issues. In addition, during project development, funding would likely need to be secured from several federal, state and local sources. If FTA funds are used, the schedule would need extra time for the FTA funding and monitoring process as well as possible delays due to the federal funding cycles. For purposes of this plan, it is assumed that BRT corridor implementation, including the relatively simple extensions on the East Bay BRT corridor, would take eight years, with three years for planning (including funding identification), two years for design, and three years for construction.

A schedule for long-term corridor development is shown in Table 21. The general approach to the long-term implementation plan is to minimize overlapping planning work on the various corridors, because the planning phase requires intensive AC Transit staff time as well as the greatest amount of coordination with partner agencies. The proposed schedule would necessitate the establishment of an AC Transit Project Planning Team for corridor development that would focus on a single BRT corridor project and complete the planning work on that corridor before starting work on the next BRT corridor. This approach reduces planning staff requirements, directs the agency's attention on a single BRT corridor during the critical planning and decision-making phase, and allows for lessons learned by the planning team on one project to be applied to subsequent corridor planning. Design and construction phases would certainly require AC Transit staff involvement, but would be more reliant on consultant/contractor labor than the planning phase.

The Rapid Bus corridors are shown with staggered starting dates, and overlapping the BRT corridor projects. This cannot be avoided given the project durations and the intention to complete all the corridors by 2040.

The Enhanced Bus Upgrade corridor for 2040 is shown at the end of the planning period. In reality, timing depends on when the original enhancements would be installed. In general, technology needs to be updated every 10 to 15 years.

As with the short-term implementation plan, the long-term implementation schedule does not include vehicle acquisition, which can be a long lead-time item for procurement. Vehicles used for Enhanced Bus and Rapid Bus can be procured as part of ongoing bus purchases. However, the acquisition of vehicles for the BRT corridors would be more complicated. For example, BRT would strive to use zero-emission vehicles in all corridors. In addition, some BRT corridors may impose additional vehicle requirements such as right- and left-side doors. Given these variables, overall procurement time for BRT coaches could be longer than the time to acquire diesel-hybrid coaches. At some point, the California Air Resources Board may accelerate the transition to ultra-low or zero emission vehicles. Project development should take additional vehicle acquisition time into consideration and also allow for substantial contingency

time in the vehicle schedule due to potential complications during procurement. Because this element of the project is independent from the design and construction, the vehicle delivery process can be scheduled to coordinate with the project development schedule.

There are several factors that will influence both the priority order in which the corridors would be developed, as well as the schedule for project development. This implementation plan lays out one scenario for corridor development and provides a target for planning and capital budgeting. However, it would need to remain flexible to account for both internal and external factors that would affect project delivery and adjusted as necessary.

Table 21: Implementation Schedule – Long-Term

Corridor	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
Adeline Corridor	TBD																						
Enhanced Bus Upgrade Corridor #1											Pln.	Des.	Const.	Timing Pending the initial installation									
Rapid Bus Corridor #1			Planning	Design	Constr																		
Rapid Bus Corridor #2						Planning	Design	Constr.															
Rapid Bus Corridor #3											Planning	Design	Constr.										
Rapid Bus Corridor #4															Planning	Design	Constr.						
Rapid Bus Corridor #5																			Planning	Design	Constr.		
BRT Corridor #1	Planning			Design		Construction																	
BRT Corridor #2				Planning		Design		Construction															
BRT Corridor #3							Planning		Design		Construction												
BRT Corridor #4										Planning		Design		Construction									
BRT Corridor #5													Planning		Design		Construction						

14 Next Steps

Upon Board approval of this Major Corridors study, the next step would be the selection of corridor or corridors for further study and planning. The first steps in the project development process would be coordination with partner agencies including frank discussions with local jurisdictions. A general agreement on approach and level investment in each corridor is needed before commencing the next round of studies. Implementation of the proposed Enhanced Bus, Rapid Bus and BRT service will require new ways to forge partnerships with local jurisdictions and regional transportation agencies.

Project development would ideally combine conceptual design, preliminary engineering, and environmental analysis into a single study effort. Future studies will certainly require a high level of public engagement given the large number of stakeholders in impacted neighborhoods.

Plan Bay Area has major implications for the District and other transit agencies in the region. Increased density in the core has placed greater stress on the freeway and surface streets in Berkeley, Emeryville, Oakland and into San Francisco. There is increased interest in a cooperative approach to solving these problems. For improving the Major Corridors, project development could be initiated by other agencies with a high level of District involvement. For example, the Alameda CTC will begin a study of several major multimodal corridors this fall. Similarly, MTC's Bay Bridge Forward project may begin studying ways to improve Bay Bridge access for buses, including improvements to West Grand Avenue and portions of other major corridors. The scope of these efforts could be the development of multimodal capital and non-capital improvements as well as CEQA/NEPA documentation.

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