EMERYVILLE BERKELEY OAKLAND TRANSIT STUDY

FINAL REPORT

Appendices

Appendix A

Transit Context – Additional Information

EBOTS

Transit Context - Existing Transit Conditions

BART (Bay Area Rapid Transit)

Bay Area Rapid Transit (BART) is the a rapid transit, heavy-rail system that covers 104 miles and serves 44 stations throughout the San Francisco Bay Area. Within the project area, BART serves West Oakland station, connecting this station to the larger heavy-rail network as well as serving as a connection point for many AC Transit bus routes. The West Oakland station sits at the eastern-end of the "Transbay Tube"—connecting Oakland to San Francisco. It is located within a residential and industrial area that saw increased development in recent years; further development of a "Transit Village" surrounding this station is currently in planning.

Users were surveyed to determine the travel mode distribution for accessing the West Oakland BART Station. Zero taxi and motorcycle modes were recorded, out of 178 respondents. The distribution of modes for the 100 West Oakland respondents, as well as for nearby stations, is represented below.[1] Compared to the comparative mode shares of nearby stations (19th Street Oakland, 12th Street Oakland, MacArthur, and Lake Merritt stations), West Oakland has a relatively low walk- and transit-share and high personal automobile mode shares.

Table: Transit mode to BART

HOME ORIGIN STATIONS	Walked	Bicycle	Transit	Car	Drove Alone	Car-pooled	Dropped Off
12th St. / Oakland City Center	45%	3%	31%	21%	7%	3%	11%
19th St. / Oakland	70%	6%	11%	13%	2%	2%	9%
Lake Merritt	45%	8%	5%	42%	23%	4%	15%
MacArthur	35%	8%	15%	40%	27%	5%	8%
West Oakland	16%	5%	1%	78%	51%	9%	18%

AC Transit

The Alameda-Contra Costa Transit District provides bus service to in the Easy Bay within Alameda and Contra Costa counties as well as to San Francisco's Transbay Terminal. In addition to providing local bus-line connections, many of the routes served by AC Transit serve routes that connect to alternative transit modes, including BART, the Capital Corridor, the Alameda-Oakland Ferry, and the Emery Go-Round.

[1] Corey, Canapary & Galanis, BART Marketing and Research Development. How did you get to this BART station for this trip? West Oakland.

Several Transbay lines have stops within the project area. Transbay lines are typically represented by letters instead of numbers. Bus lines 800-899 are all-nighter lines, operating from 1AM-5AM. Altogether, 25 routes run through the project area, with 10 of those connecting to the Transbay Terminal in San Francisco. The table below shows the number of stops in the project area that each bus line offers.

TRANSBAY		EAST BAY ONLY	
Route	**Number of Stops in Project Area**	**Route**	**Number of Stops Within Project Area**
F	7	25	4
C	4	26	13
H	4	31	10
Z	8	314	6
J	6	62	5
G	4	88	2
FS	2	49	3
NL	2	51B	4
SB	1	802	5
800	9	72	9
		72M	9
		72R	4
		57	1
		62	5
		72M	9

Shuttles

Emery Go-Round

Emery Go-Round is a free shuttle system funded by the City of Emeryville's Business Improvement District. The shuttle system has three routes that provide service seven days per week (weekend service is limited). Emery Go-Round serves as a transit connection to MacArthur BART station, the Emeryville Amtrak station, and the West Berkeley shuttle system. These routes also service to the large Powell Street Plaza Shopping Center in addition to many schools, grocery stores, and other businesses.

Annual ridership for the Emery Go-Round exceeds 1.5 million trips.[2] Approximate number of boardings and alightings for each route are listed below:

- Hollis shuttle line: 527,000 trips per year
- Shellmound/Powell line: 867,000 trips per year
- Watergate Express (commute hours only): 153,000 trips per year

[2] Ridership data calculated with trip data from March 2013 – June 2013. Data provided by the Emeryville Transportation Management Association, personal communication July 19, 2013.

West Berkeley Shuttle

The West Berkeley Shuttle provides weekday commuter service from Ashby BART station to the area West of Ashby BART station—extending nearly to Berkeley's Aquatic Park on the San Francisco Bay. During the morning commute period, the shuttle runs from 5:40AM-9:11AM; during the evening commute period, the shuttle runs from 3PM-6:17PM. Each of the two lines, serving similar routes, travel east-west on Ashby Avenue and Dwight Way and north-south on San Pablo Avenue and 7th St. The shuttle service is operated by the Emeryville Transportation Management Association.

As of December 2007, the West Berkeley Shuttle had an average of 100 boardings per weekday in the study area alone (Existing Conditions Report, Wilbur Smith Associates).

Free Broadway Shuttle (not in study area)

Downtown Oakland's Free Broadway Shuttle, or the "Free B", connects 12th Street and 19th Street Oakland BART stations, the Oakland-Jack London Square Ferry Terminal, and the Jack London Square Amtrak station. The Free B offers weekday service from 7AM-7PM and weekend night service from 7PM-1AM on Fridays and 6PM-1AM on Saturdays.

Amtrak (Capitol Corridor)

Amtrak's "Capitol Corridor" passenger-train route runs from Auburn to San Jose and passes through Sacramento, as well as Berkeley, Emeryville, and Oakland. The majority of the line runs parallel to Interstate-80, traveling along the Western-edge of the study area. The service runs approximately once per hour, seven days per week. All trains allow bicycles and in 2012, the Capital Corridor began offering free Wi-Fi to all passengers. The average number of boardings and alightings per day for each station within the project area are shown below.

Averaged for months of March 2012 - March 2013			
Station	Boardings/day	Alightings/day	Total/day
BKY	209	207	416
EMY	493	496	989
OKJ	412	427	839
OAC	34	38	71

The system also offers the San Francisco Motorcoach connections to the Transbay Terminal from the Emeryville station. The Motorcoach connection, called Route 99, carries approximately 20-25,000 passengers per month in both directions.

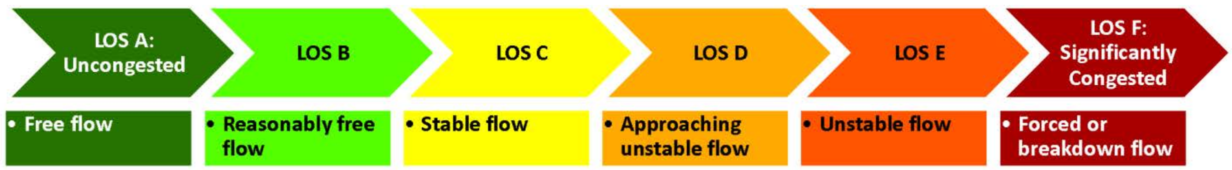
Route 99 Motorcoach Connection – Ridership numbers for April 2012 – March 2013			
	Eastbound (SF to EMY)	Westbound (EMY to SF)	Total
Yearly Total	143,939	147,446	291,385
Daily Average	394	404	798

San Francisco Bay Ferry

The San Francisco Bay Ferry (SFBF) provides passenger ferry service from Oakland and Alameda to five points in San Francisco, Oyster Point in South San Francisco, including special event service to San Francisco's AT&T Park for baseball games. Year-round weekday service, as well as seasonal weekend service is provided nearly once per hour from about 6AM to 9PM. The service is owned by the San Francisco Bay Area Water Emergency Transportation authority.

Roadway System and Traffic Conditions

The roadway network within the EBOTS study area includes a hierarchical system of freeways, arterial and collector streets, and residential streets. Level of Service (LOS), as defined by the Highway Capacity Manual 2000, is defined for many intersections throughout the study area. LOS is used as a measure to represent the overall performance of a roadway and based on the number of seconds of delay within an intersection. LOS can range from LOS A (excellent conditions and short delays) to LOS F (congested conditions and long delays).



Hierarchical Street Network

Freeways

Interstate 80/580 borders the Western edge of Berkeley and Emeryville, and also defines the border between Emeryville and Oakland. This freeway provides connection to San Francisco via the San Francisco-Oakland Bay Bridge and connects the study area to Sacramento and Marin County. Interstate 880 borders the Oakland-region of the study area on the Western and Southern side.

Arterial and Collector Streets

Arterial Streets are urban roads, but have higher capacity and speeds than local streets. They serve to collect traffic onto freeways and between urban centers. These streets also carry the majority of the bus routes. Major arterial and collector streets within the study area include:

- San Pablo Avenue (North-South)
- Peralta Street (North-South)
- Mandela Parkway (North-South)
- Adeline Street (North-South)
- Market Street (East-West)
- Gilman Street (East-West)
- University Avenue (East-West)
- Dwight Way (East-West)
- Ashby Avenue (East-West)
- 40th Street (East-West)
- West Grand Avenue (East-West)
- 14th Street (East-West)
- 7th Street (East-West)

The majority of signalized intersections exist within arterial and collector streets. Many of the signalized intersections within the study area are actuated, responding to approaches from the minor-roadway approach within the intersection.[3] San Pablo Avenue's signals operate with transit signal priority, allowing buses and emergency vehicles to extend green phases and trigger early green phases when approaching; this system uses cameras mounted above each traffic signal (West Berkeley Circulation Master Plan 2009, page 10).

Local Streets

A network of local streets exists within the project area, most often serving single- and multi-family communities and some industrial areas. Speed limits within residential areas are typically 25mph and traffic calming measures are frequently taken to discourage through-traffic within neighborhoods. Traffic calming measures are used throughout the study area within residential streets to encourage vehicles to use arterials and collector streets rather than cutting through residential neighborhoods. Traffic calming measures implemented in the area include diverters preventing traffic from continuing through a street, speed bumps, and traffic circles.

West Berkeley

Street Network

The major arterial and collector streets within West Berkeley include San Pablo Avenue, 6th Street, and 7th Street running North-South as well as Gilman Avenue, University Avenue, Dwight Way, and Ashby Avenue running East-West. Interstate 80/580 runs North-South on the Western side of the project area. Ashby Avenue, University Avenue, and Gilman Street all provide access to the interstate.

Level of Service Analysis

The 2009 West Berkeley Circulation Master Plan found low LOS along several arterial and collector streets in West Berkeley, including single-direction flows on Gilman Street, University Avenue, Ashby Avenue, Dwight Way, and San Pablo Avenue. Several intersections were also found to have very low LOS in the 2009 West Berkeley Circulation Master Plan, particularly at major intersections long Gilman Street and University Avenue.

Emeryville

Street Network

The City of Emeryville Alternative Transportation Plan (Nelson Nygaard, 2009) notes that the roadway network within Emeryville is designed to provide service to motor vehicles, but does not provide good service to non-automobile modes. Primary North-South corridors within Emeryville include San Pablo Avenue, Hollis Street, Horton Street, Shellmound Street and Interstate-80/580. Primary East-West corridors include 40th Street, Powell Street, and 65th Street. Within Emeryville, the railroad tracks that carry the Capital Corridor passenger train limit travel to areas west of these tracks. Powell Street is the only direct access to the freeway within Emeryville (City of Emeryville, Alternative Transportation Plan 2009).

Level of Service Analysis

Much of the traffic within Emeryville is generated due to trips that are generated by surrounding cities as well as those generated by nonresidents for employment and shopping destinations (Emeryville General Plan Draft EIR, 2009).[4] Data collected in 2007 (PM peak hour only) shows that LOS is lower along Powell Street and 40th Street, especially within the intersection of the I-80 Eastbound Ramps and Powell Street.

[3] West Berkeley Circulation Master Plan (2009). Available at: http://www.ci.berkeley.ca.us/uploadedFiles/Planning_and_Development/Level_3_-_Redevelopment_Agency/Chapter%203%20Traffic%20Conditions.pdf Last accessed August 2013.
[4] Emeryville General Plan Draft Environmental Impact Report, 2009. Available at: http://www.ci.emeryville.ca.us/DocumentCenter/Home/View/665 Last accessed August 2013.

West Oakland

Street Network

Major arterial and collector streets within the project area include Market Street, Mandela Parkway, Adeline Street, Peralta Avenue, and Wood Street traveling North-South and West Grand Avenue, 14th Street, and 7th Street traveling East-West. These collector Streets are surrounded by Interstate 880 to the South and West, Interstate 80/580 to the North, and Interstate-980 located just east of the project boundary.

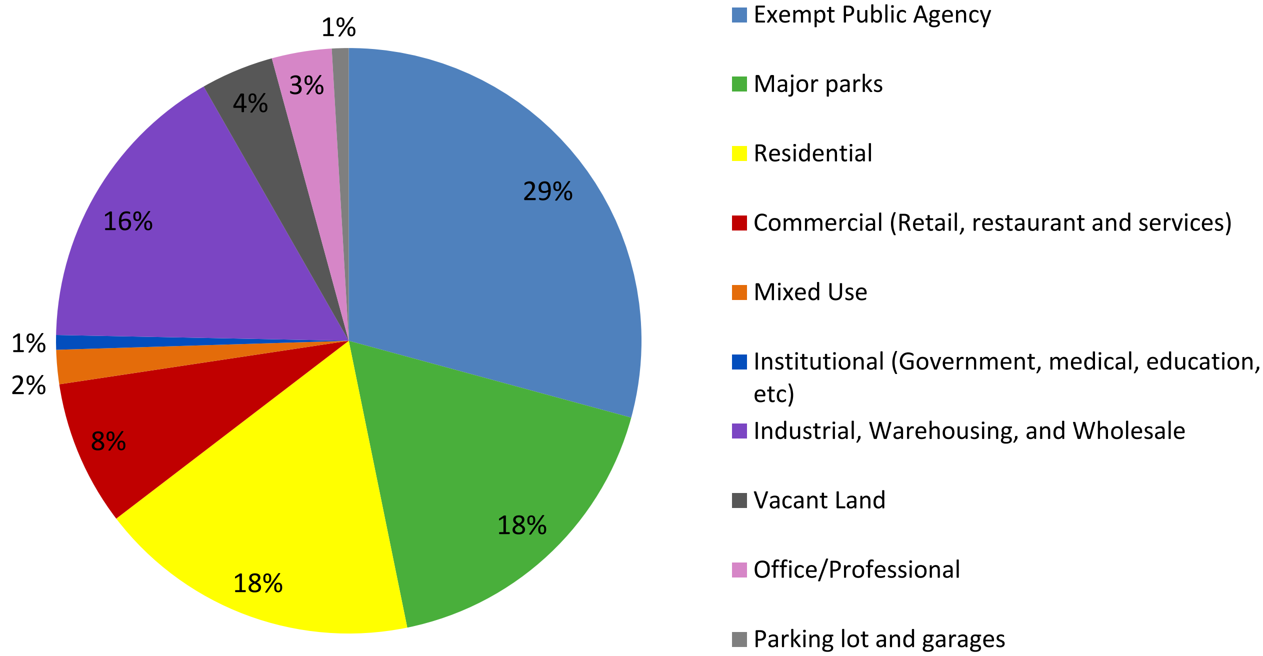
West Grand Avenue is the primary arterial carrying heavy commercial traffic to and from the Downtown area, the Port of Oakland and the San Francisco bay Bridge. Wood Street, Peralta Street and Mandela Parkway serve as the major collector streets connecting Emeryville to Oakland, via Hollis Street. Mandela Parkway bisects 7th Street, connecting West Oakland on the south and continuing to Emeryville's major shopping district (City of Oakland, Infrastructure Report, 2011).[5]

Level of Service Analysis

Despite the large amount of heavy truck use, West Oakland's traffic network operates at a higher LOS compared to Emeryville and West Berkeley's. According to the West Oakland Specific Plan EIR, Level of Service along West Grand Avenue is high, with the exception of LOS C for both AM and PM peak hours within the intersection of West Grand Avenue and Interstate-880. Similarly, Adeline and Market operate mostly at LOS A and LOS B. Overall 7th Street, 5th Street, and Interstate connections appear to operate at the lowest LOS. However, arterial and connector streets connecting West Oakland to Emeryville appear to be operating at a higher LOS. Additionally the Emeryville General Plan EIR (2009) shows LOS E at the intersection of Mandela Parkway and Horton Street located along Oakland's northern border.

[5] City of Oakland Industrial district Strategy support Public Infrastructure Report. March 1, 2011. Available at: http://www2.oaklandnet.com/oakca1/groups/ceda/documents/report/oak030539.pdf Last accessed August 2013.

Land Use Profile - EBOTS Study Area



Land Use Type	Acres
Exempt Public Agency & Public Utilities	994.55
Major Parks	597.82
Residential	606.09
Commercial	272.77
Mixed Use	64.14
Institutional (Government, medical, education, etc)	27.43
Industrial, Warehousing, and Wholesale	559.12
Vacant Land	136.82
Office/Professional	112.51
Parking lot and garages	31.52
Total	**3402.77**

Detailed Land Use Profile – EBOTS Study Area

Public Agency & Utility	
Exempt Public Agency	1483.23
Major Parks	597.82
Property leased to or owned by a public utility	109.14
Subtotal	***1592.37***
Residential	
Single Family Residential	257.41
Multi-Family Residential	158.79
Condominiums, 5 or more unit residential & cooperatives	189.89
Subtotal	***606.09***
Commercial	
Shopping Center, Restaurants, and Supermarkets	200.58
Car wash, repair garage & service stations	17.72
Automobile dealership	4.78
Hotel/Motel	18.76
Other recreational activity, e.g. rinks, stadiums	30.93
Subtotal	***272.77***
Industrial, Warehousing, and Wholesale	
Warehouse	215.30
Terminals, trucking and distribution	9.71
Other Industrial	334.11
Subtotal	***559.12***
Vacant Land	
Vacant residential land	34.27
Vacant commercial land	34.82
Vacant industrial land	67.60
Vacant government owned property	0.13
Subtotal	***136.82***
Mixed Use	
Condominium or townhouse with mixed use	44.21
Store on 1st floor, with offices, apts/lofts 2nd/3	19.62
Subtotal	***64.14***
Institutional (Government, medical, education, etc)	
School	7.69
Church	15.45
Other institutional property	4.29
Subtotal	***27.43***
Office/Professional	
Bank	2.34
Medical - Dental building	4.35
Office building	105.82
Subtotal	***112.51***
Parking lot and garages	
Parking lot	26.47
Parking garage	5.05
Subtotal	***31.52***

EBOTS – Transit Context – Additional Information

Destinations, Routes and Connections

The first stage in devising new transit services for the area was to identify those streets with active land uses that would generate transit trips. These land uses include multifamily residential buildings, business offices, medical complexes and retail commercial facilities. The streets serving these land uses should be suitable in terms of width and traffic characteristics to be able to accommodate transit vehicles. This first round of service development concentrated on bus and small shuttle vehicles, but the possible implementation of streetcars was also considered. Where possible, a series of streets was sought that would form a continuous corridor of travel. Such straight corridors are easier for patrons to understand and allow for more efficient transit operation by reducing the number of turns required.

Several north-south streets were examined as candidates for service. San Pablo Avenue is among the area's busiest thoroughfares, but it lies at the east margin of the study area and has already been the subject of transit service proposals in the COA. Other streets allowing for north-south continuity in the three cities are:

- Adeline Street (southern portion), Mandela Parkway, and Peralta Street in Oakland;
- Hollis Street, Shellmound Street, and West Frontage Road in Emeryville; and
- 6th and 7th Streets in Berkeley.

East-west streets in the study area (and areas further east) include:

- 2nd/3rd Street couplet, 7th/8th Street couplet, West Grand Avenue and MacArthur Boulevard in Oakland;
- 40th Street, Powell Street/Stanford Avenue, 65th Street in Emeryville and parts of Oakland; and
- Ashby Avenue, Dwight Way and University Avenue in Berkeley.

Connections further north of the study area's border with the City of Albany were examined as well but discontinuities in the street system made transit routings too circuitous. Moreover, possible termini north of this border, such as the BART stations at El Cerrito Plaza or El Cerrito Del Norte, stretch what can be served by the local transit concepts under consideration in this study. These northern points might, however, be tied to Transbay routes serving the study area. Street connections further west and south of the study area are not possible because the existing street network ends at the freeways and San Francisco Bay shoreline.

Possible terminals and destinations to be served were examined both inside and outside the study area. It is generally desirable to terminate a transit line at a point where significant trips will be generated. Given the emphasis of EBOTS routes as transit collectors and distributors, as well as short-distance connectors, a terminal or way station at a transfer point with other modes or transit lines is especially important. The key transfer points in or close to this study area include:

- Amtrak/Capital Corridor stations at Oakland Jack London Square, Emeryville, and Berkeley;
- BART station at West Oakland, with possible connections to stations outside the study area at 19th Street, MacArthur, Ashby, Downtown Berkeley, and North Berkeley;

- AC Transit Uptown Transit Center at 20th & Broadway; and
- Ferry terminal at Jack London Square (with a possible future terminal in Berkeley).

In addition to these transfer points, transit should serve important destinations in the area. Many of these have been discussed in other study memoranda. They include numerous employment centers, like Pixar and Bayer, and retail centers like the Bay Street, Powell Street and East Bay Bridge shopping centers. Major medical facilities are located mostly outside the study area and need to be tied to it, a function now handled largely through independent shuttles; these include the Kaiser, Alta Bates Summit, and Children's Hospital complexes in Oakland.

EBOTS

Transit Technology Options

A wide range of technology options were initially considered based on community input and compatibility with the study area.

The Transit Technology Matrix in the figure below outlines the potential transit technologies that were considered for this evaluation.

Transit Technology Matrix

TECHNOLOGY	DESCRIPTION	CAPITAL COST (Per mile)	OPERATIONS AND MAINTENANCE COST (Per year)	CAPACITY (Passengers per vehicle hour)	SPEED and RELIABILITY	RIGHT OF WAY REQUIREMENTS	TRANSIT SUPPORTIVE DENSITY (Dwelling units per Acre)	SQ FT OF NON-RESIDENTIAL FLOOR SPACE (millions)
Demand Response Shuttle (Dial-a-Ride)	Shuttles serve specific locations and typically operate in mixed traffic 	--	--	Very low capacity	Low to moderate speed and reliability	Mixed flow, no dedicated ROW requirements	--	--
Shuttle Bus	Shuttles serve specific locations and typically operate in mixed traffic 	$50,000 to $100,000	$0.5 to $1.5 million	Low capacity 300 to 1,000	Low to moderate speed and reliability	Mixed flow, no dedicated ROW requirements	--	--
Conventional Bus	Typical single unit and articulated transit buses, operate in mixed traffic 	$1 to $2 million	$1 to $2 million	Low to moderate capacity 300 to 1,200	Low to moderate speed and reliability	Mixed flow, no dedicated ROW requirements	4 to 15	2.5
BRT / BRT Lite	BRT - Typical single unit and articulated transit buses, with exclusive lanes, signal priority, and station improvements BRT Lite - May include signal priority or exclusive lanes with fewer station features 	BRT $7 to $20 million BRT Lite $2 to $4 million	$1 to $2 million	BRT - Moderate to High capacity 500 to 2,500 BRT lite - Low to moderate capacity 500 to 1,500	Moderate speed and reliability. Improved speed and reliability with exclusive lanes and signal priority	BRT - 22 to 40 feet BRT lite - 0 to 22 feet	4 to 15	7
Streetcar	Steel rail-based vehicles that can operate in mixed traffic or in exclusive ROW 	$15 to $30 million	$1.5 to $2.5 million	Moderate to high line capacity 500 to 4,000	Moderate speed and reliability Improved speed and reliability with exclusive lanes	Mixed flow - no ROW requirements Dedicated ROW - 25 to 40 feet	9	21
Light Rail (LRT)	Steel rail-based vehicles that typically operate in exclusive ROW 	$30 to $70 million	$1.5 to $2.5 million	High capacity 1,000 to 9,000	Moderate to high speed and reliability	25 to 40 feet	9	21
Automated Guideway Transit (AGT)	Automated vehicles that operate on an exclusive guideway 	--	--	Moderate to high capacity 500 to 4,000	Moderate to high speed and reliability	Elevated, minimal ROW needed	--	--
Personal Rapid Transit (PRT)	A technology that uses small, automated vehicles on exclusive guideways that provide direct service between a passenger's origin and destination 	Estimates vary widely. No modern constructed systems.	--	Moderate to high capacity	Moderate to high speed and reliability	Elevated, minimal ROW needed	--	--

Sources: Transit-Supportive Density Levels adapted from Pushkarev and Zupan (1977); TCRP Predicting Fixed Guideway Transit Success (2013)

These transit technologies were initially screened to narrow the consideration to the best technologies given community input, right-of-way and environmental constraints, and political realities in terms of project funding. The following transit technologies, shown in the table below, were screened for further evaluation.

Transit Technologies under Further Evaluation

Technology	Description
Shuttle Bus	Shuttles are an efficient method and proven transit technology for meeting the needs of transit riders, particularly commuters and shoppers in the study area, connecting high-demand land uses with transit stations and transfer points. They currently provide service to certain parts of the study area.
Conventional Bus	Conventional buses provide traditional route-based service, giving mobility and access to residents, visitors, and commuters throughout all parts of the study area. Buses are able to provide moderate-capacity/moderate-frequency access and can be rerouted as needed. They currently provide service to most of the study area.
Streetcar	Streetcars operate in either mixed-flow or exclusive right-of-way, yet they provide substantial infrastructure improvements that help spur economic development.

The table below shows the transit technologies that were removed from consideration based on the initial screening.

Transit Technologies Not Evaluated

Technology	Description
Demand Response Shuttle	On-demand shuttles, also known as "Dial-a-Ride" vehicles, have very low capacity (five passengers per vehicle hour); their application would be cost prohibitive, based on the number of vehicles and drivers needed to meet peak-hour demand.
Bus Rapid Transit (BRT)	Bus Rapid Transit has moderate potential in the study area, but requires dedicated right-of-way, which has limited application on the constrained roadways in the study area. BRT may be considered in the future but is not evaluated in this report.
Light Rail	Light Rail typically has moderate potential in the study area, but requires dedicated right-of-way, which has limited application on the constrained roadways in the study area. It may be considered in the future but is not evaluated in this report.
Automated Guideway Transit	An Automated Guideway Transit network is one of the more expensive transit technologies in use today. It requires exclusive right-of-way and is typically elevated. This transit technology was screened from consideration due to cost, visual impacts and right-of-way constraints
Personal Rapid Transit	Personal Rapid Transit offers an innovative, yet largely untested, method of public transit. While it has the potential to serve as a connector system to BART, the technology is unproven, and a modern system has yet to be constructed. It also requires elevated structures, which are controversial and would require a separate planning study to consider appropriate applications in the EBOTS study area.

Phasing

The technology screening evaluation summarized above indicates that several transit technologies are currently more appropriate for providing mobility options to the EBOTS study area. Depending upon how land uses and travel patterns change in the long term, it is important to consider technologies that are adaptable to the area from a feasibility, cost effectiveness, and reliability standpoint. Moreover, transit technologies must be flexible enough to absorb emerging travel demand to reduce the dependence of travel by motor vehicle when such demand comes. As a result, phasing of transit technologies needs to be considered through this evaluation. For instance, current demand may indicate that only a shuttle-based transit service is feasible in the area, but projections show that a streetcar or BRT option may be more feasible in the future. In this case, routing and amenities should be carefully selected to allow these technologies to be phased in later. The EBOTS Consultant Team focused on determining transit technologies that could both modestly enhance existing transit service in the short term and lay the groundwork for future infrastructure-based transit options.