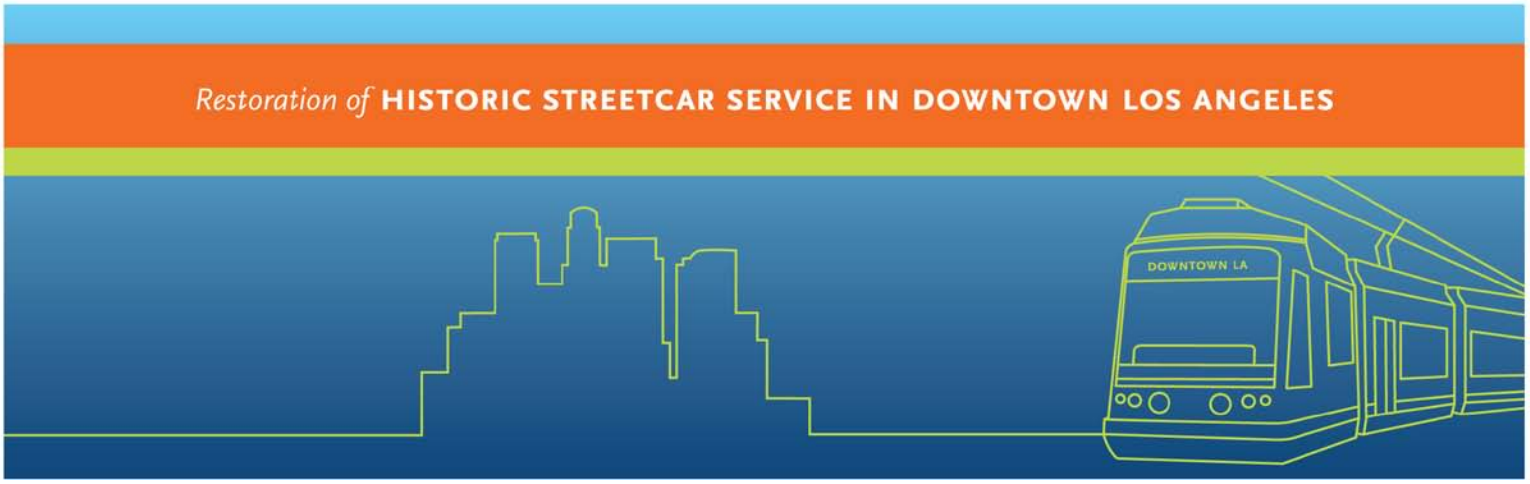

Restoration of Historic Streetcar Service in Downtown Los Angeles

Alternatives Analysis (AA)
FINAL

January 13, 2012

Metro

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Appendices

Tables

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ACRONYMS

AA	Alternatives Analysis
ACE	Advanced Conceptual Engineering
ADA	American with Disabilities Act
AVTA	Antelope Valley Transit Authority
BID	Downtown Center Business Improvement District
CEQA	California Environmental Quality Act
CRA/LA	Community Redevelopment Agency of the City of Los Angeles
DASH	Downtown Area Short Hop
FAR	Floor Area Ratio
FTA	Federal Transit Administration
GHG	Greenhouse Gas
HRT	Heavy Rail Transit
LASED	Los Angeles Sports and Entertainment District
LPA	Locally Preferred Alternative
LA	Los Angeles
LADOT	Los Angeles Department of Transportation
LASI	Los Angeles Streetcar, Inc.
LRT	Light Rail Transit
Metro	Los Angeles County Metropolitan Transportation Authority
MSF	Maintenance and Storage Facility
MOCA	Museum of Contemporary Art
NEPA	National Environmental Protection Act
OCTA	Orange County Transportation Authority
O&M	Operations and Maintenance
Project	Restoration of Historic Streetcar Service Project
PSA	Project Study Area
SCAG	Southern California Association of Governments
SCC	Standard Cost Category
TIGER	Transportation Investment Generating Economic Recovery
TOD	Transit-Oriented Development

1.0 PURPOSE AND NEED

1.1 Introduction

This Alternatives Analysis (AA) presents the development and evaluation of alternatives under consideration for the Restoration of Historic Streetcar Service Project (project). The alternatives were screened based on defined criteria to identify a Locally Preferred Alternative (LPA). This AA provides decision-makers the information needed to approve further investigation, including environmental documentation that would be in compliance with the National Environmental Policy Act (NEPA) and California Environmental Quality Act (CEQA).

This section describes the Purpose and Need for the project in Downtown Los Angeles. The project was originated by the Community Redevelopment Agency of the City of Los Angeles (CRA/LA) and is being planned in partnership with the Los Angeles County Metropolitan Transportation Authority (Metro), Los Angeles Streetcar, Inc. (LASI), and the Federal Transit Administration (FTA). The project would reintroduce streetcar service to Downtown Los Angeles and would connect downtown neighborhoods and activity centers while tying together the regional transit network and aiding revitalization efforts.

The project aims to address the challenges of navigating a disconnected downtown by providing a transportation link between various districts (Bunker Hill, Financial Core, Historic Core, Broadway, Jewelry District, South Park, Los Angeles Sports and Entertainment District, Civic Center, Chinatown, El Pueblo, and Union Station). By connecting residential and employment hubs, shopping districts, civic resources, cultural institutions, historic landmarks, and entertainment venues in Downtown Los Angeles, the project would increase mobility and accessibility for the people who live, work, and visit downtown. The project would provide better linkages to the regional transit network and connect with the Metro Red, Purple, Blue, Gold, and future Expo rail lines, Metro Rapid and Local bus service, as well as Amtrak, Metrolink, and other regional and intercity transit services. The project would promote transit use and walking within downtown while reducing the need to travel by automobile, decreasing greenhouse gas (GHG) emissions and oil consumption.

In concert with local efforts, the project would play a pivotal role in the revitalization of many downtown districts, including the Historic Core. Local initiatives such as Bringing Back Broadway (an effort to restore Broadway, which contains the highest concentration of historic theaters in the western United States), redevelopment plans, street improvements, and proposed design guidelines would contribute to restoring the area's historic significance and stimulate economic development opportunities. Reintroducing streetcar service would facilitate the renewal of the Historic Core and Historic Broadway Theatre District.

1.1.1 Previous Planning Efforts

The streetcar was formally reintroduced in planning efforts by the Community Redevelopment Agency of the City of Los Angeles (CRA/LA) in its study of the South Park district in 1995. Since then, there have been several studies and public workshops led by CRA/LA, the Bringing Back Broadway Initiative, and the non-profit Los Angeles Streetcar, Inc. (LASI) that have resulted in a number of proposed streetcar alternatives.

The following provides a summary of past studies related to the restoration of streetcar service in Downtown Los Angeles. They range in relevance from the feasibility of restoring streetcar services, to design guidelines incorporating a streetcar into proposed street configuration, and traffic studies that analyze proposed street improvements.

Feasibility Study for the Resurrection of the Red Car Trolley Services, 2006

This feasibility study explored the restoration of streetcar services using modern or heritage streetcars as part of an overall redevelopment strategy for the downtown area. It analyzed various alignment concepts and estimated travel times, ridership, and costs for each. The alignment concepts incorporated the best alternatives for providing urban circulator services for residents and tourists in Downtown Los Angeles.

Broadway Streetcar Design Resource Book, 2008

The Design Resource Book provided a summary of streetscape design concepts developed from a public workshop in Downtown Los Angeles. It provided design guidance in written and graphic form for private and public projects undertaken around Broadway within the Historic Core. It aimed to promote an enhanced environment by improving pedestrian realms as well as the aesthetic and functional quality of Broadway.

The Next Downtown Project Transportation Analysis, 2008

This traffic analysis studied the impact of the new Downtown Street Standards as it aims to provide for improved vehicular circulation and foster a pedestrian-friendly environment in the downtown area. The updated Central City Community Plan proposed street designations based on more comprehensive street hierarchy which balances traffic flow, pedestrian needs, transit routes and stops, bicycle routes, historic structures and other functions and elements of the street. The study year scenarios included existing (2008) conditions, 2030 with or without new street standards, 2030 with additional transit expansion, and 2030 with additional rail transit expansion and travel demand management scenarios.

Broadway Streetscape Plan Preliminary Traffic Study, 2010

This traffic study provided an initial assessment of the Broadway Streetscape Master Plan that examined the feasibility of implementing streetscape improvements along Broadway between 2nd Street and Olympic Boulevard in Downtown Los Angeles. The Master Plan and this preliminary traffic study also identified Broadway as an alignment option for the proposed streetcar. This preliminary study outlined the existing and forecast traffic conditions in the designated project area with and without the proposed project for years 2009 and 2013.

Table 1 provides a summary of the planning efforts that have developed specific streetcar alternatives.

Table 1: Previous Planning Efforts

Planning Effort	Recommendations
2006, Feasibility Study for the Resurrection of the Red Car Trolley Services	5 streetcar concepts
2008, Broadway Streetcar Workshop	6 streetcar alternatives (specific to Broadway)
2009, 7 Stakeholder Meetings	3 streetcar options
2010, Los Angeles Streetcar, Inc. Options	2 streetcar options

Source: Metro, 2011

1.2 Project Study Area Description

1.2.1 Project Study Area Overview

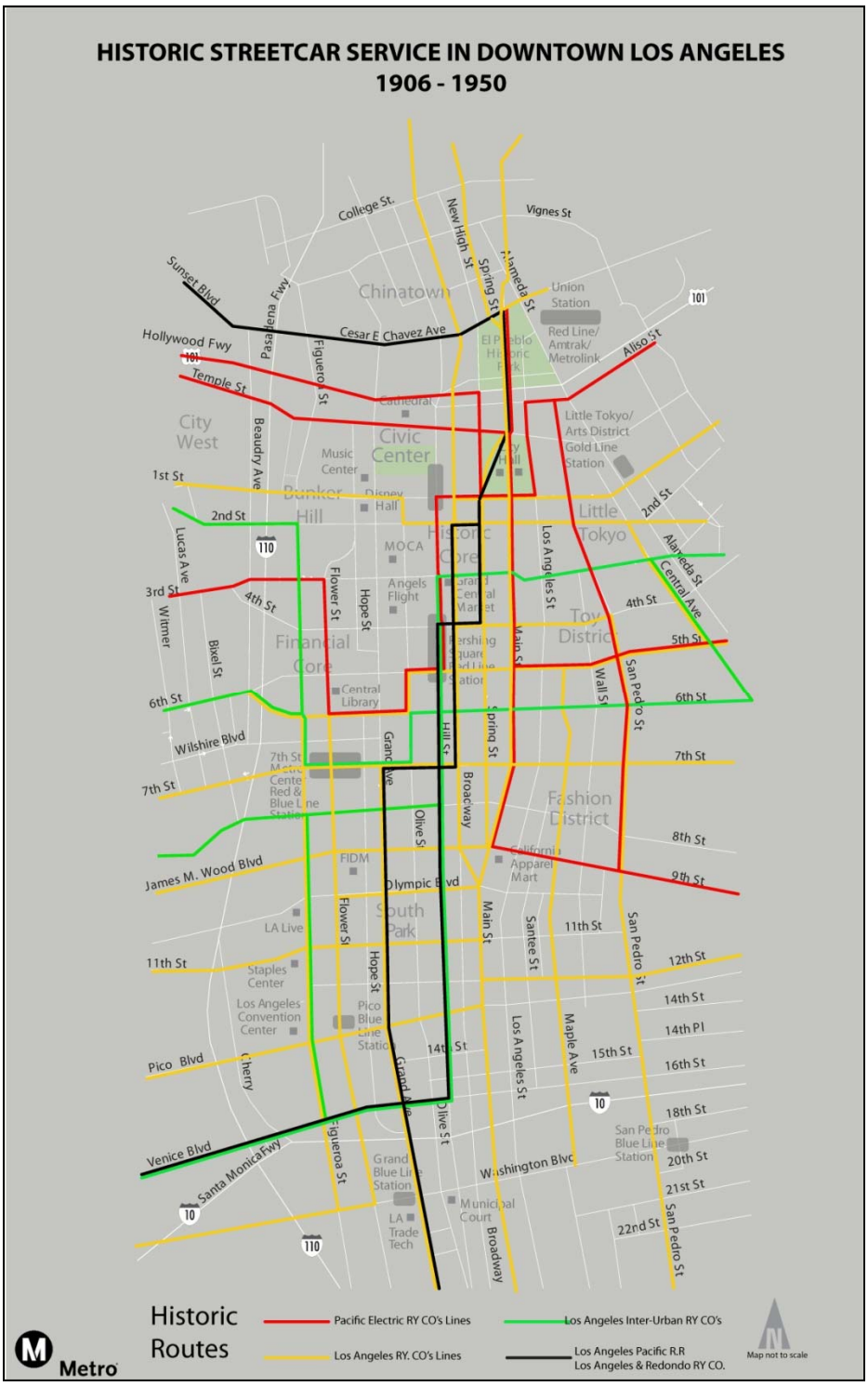
The project study area (PSA) is located within Downtown Los Angeles (Figure 1) and is bounded by the Harbor Freeway (SR-110) on the west, Washington Boulevard on the south, Alameda and Los Angeles Streets on the east, Cesar E. Chavez Boulevard on the north with a narrow extension into Chinatown stretching along New High and Alameda Streets just north of College Avenue. The PSA encompasses the following neighborhoods/districts: Bunker Hill, Financial Core, Historic Core, Broadway, Jewelry District, South Park, Los Angeles Sports and Entertainment District (LASED), Civic Center, Chinatown, El Pueblo, and Union Station.

The PSA was historically the core of Los Angeles' streetcar network that spanned 600 miles during the first half of the 1900s. Despite its expansive coverage, streetcar service was discontinued in 1963. Most of the tracks from this extensive streetcar system are still embedded in downtown streets and many of the overhead span wire connections are still found on historic buildings. These historic streetcar alignments within the PSA are being analyzed for the restoration of the proposed streetcar routes. Figure 2 shows a map of historic streetcar service in the PSA.

Figure 1: Project Study Area

Source: Metro, 2011.

Figure 2: Historic Streetcar Service in PSA



Source: Metro, 2011.

1.2.2 Characteristics of PSA

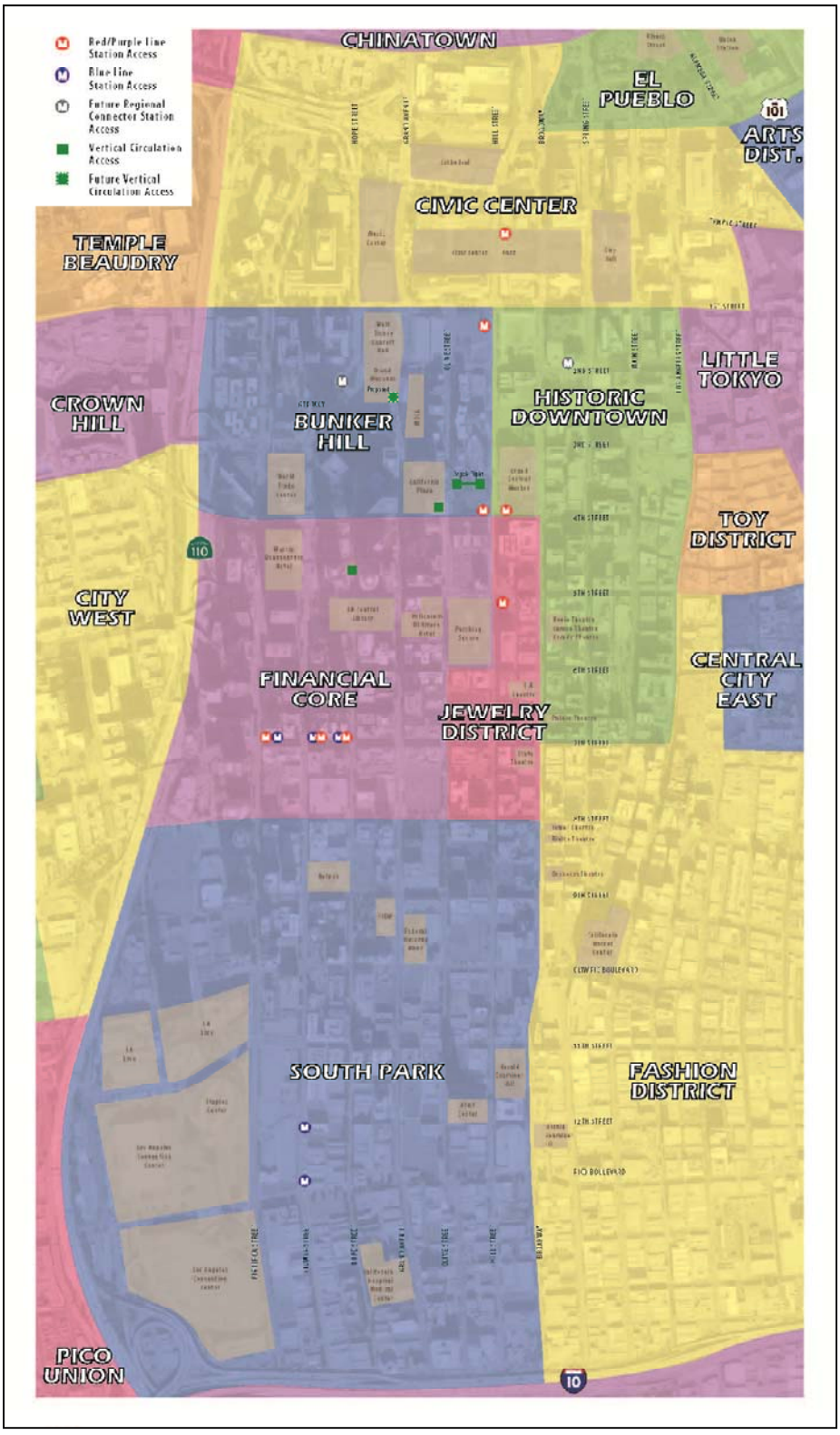
The PSA is a dense urban core covering 2.05 square miles that is home to the region's fastest growing residential area of over 45,000 residents[1], the region's largest employment center of over 500,000 employees[2], and one of the region's largest tourist destinations with over 10 million annual visitors[3]. The PSA is also home to many of the region's historic and cultural attractions, such as Bunker Hill (Disney Concert Hall, Museum of Contemporary Art, and future Broad Museum), Broadway (historic theaters and architecture), and Los Angeles Sports and Entertainment District (Staples Center, Nokia Theater, Convention Center, LA Live, Grammy Museum, and potential football stadium). The PSA is a regional hub for transit service, with the highest volumes of boardings/alightings in the Metro rail and bus system as well as connections to Metrolink, Amtrak, and other regional and intercity transportation. Table 2 describes the general characteristics of the districts within the PSA, while Figure 3 shows the activity centers and districts within the PSA.

[1] 2011 Downtown Los Angeles Demographic Study, Downtown Center Business Improvement District (BID)
[2] 2011 Downtown Los Angeles Demographic Study, Downtown Center BID
[3] 2011 Downtown Los Angeles Demographic Study, Downtown Center BID

Table 2: Districts in PSA

District	Description
Bunker Hill	The Bunker Hill District is located generally between 1st St on the north, Hill St on the east, 4th St on the south, and Figueroa St on the west. Major downtown destinations located within Bunker Hill include the Walt Disney Concert Hall, Museum of Contemporary Art, the future Broad Museum, and several high-rise office towers, senior and market-rate housing, hotels and commercial/retail centers.
Civic Center	Bordering Bunker Hill to the northeast is the Civic Center, which serves as a hub for City, County, State, and Federal government with the second-largest concentration of civic buildings in the country. The Cathedral of Our Lady of the Angels, the Ahmanson Theater, Mark Taper Forum, and the Dorothy Chandler Pavilion are also destinations in this district.
Financial Core	The Financial Core District is located south of Bunker Hill and is dominated by high-rise office buildings. Other landmarks in this district include the Central Library, the Millennium Biltmore Hotel, and Pershing Square.
Historic Core	To the east of the Financial Core is the Historic Core District, which contains a large concentration of historic buildings. The Grand Central Market and the Broadway Historic Theater District (with theaters dating back to the early 1900s) are destinations in this district. The retail district is reliant on public transit because parking is in short supply.
Jewelry District	The Jewelry District, located to the southwest of the Historic Core, is the largest jewelry district in the country and second largest in the world according to the Los Angeles Convention and Visitor Bureau. Like the Historic Core, the district attracts a high volume of retail sales and parking is in short supply.
Fashion District	The Fashion District lies to the south of 7th St and to the east of Broadway and is a popular retail destination. The core shopping district is bounded by 9th St, Los Angeles St, Pico Blvd, and Stanford Ave.
South Park	South Park is located south of the Financial Core and includes the Los Angeles Convention Center, Staples Center, LA Live, and a variety of warehouses, office space, and residences. It also includes a growing number of neighborhood supporting commercial and retail uses such as a supermarket, restaurants, and coffee shops.
Los Angeles Sports and Entertainment District (LASED)	Located within South Park, the LASED is a district with its own specific plan by the same name under the City of Los Angeles' General Plan. The district consists of Staples Center (capacity 19,000, home to two NBA teams, one WNBA team, and one NHL team), Nokia Theater (capacity 7,100), Los Angeles Convention Center (720,000 sq. ft.), LA Live, Club Nokia, Grammy Museum, and a potential football stadium (proposed capacity 72,000). Currently, the Staples Center hosts over 250 events per year, while Nokia Theater hosts over 120 events per year.

Figure 3: Activity Centers and Districts in PSA

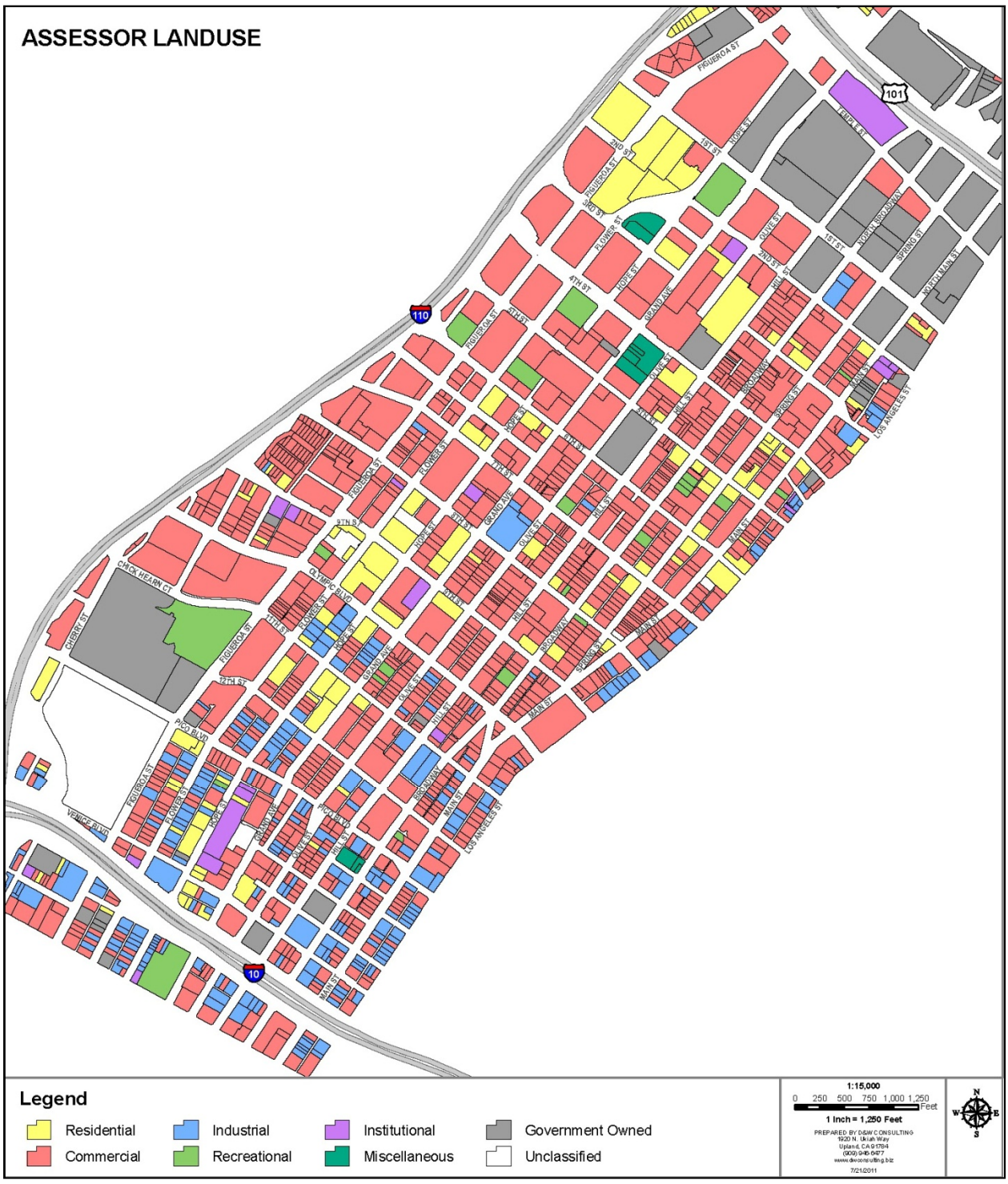


1.2.2 Land Use in PSA

As the largest employment center in Los Angeles County, the PSA is comprised primarily of commercial land uses, with numerous office buildings and retail shops. In recent years there has been an increasing amount of residential and mixed uses over the past decade (especially in South Park and the Historic Core), with 9,391 units of housing having been built within downtown since 2000 (an increase of 89 percent), and an additional 11,831 units are in planning (permitted, undergoing the approval process, or under consideration)[4]. The PSA also has a substantial number of historic buildings. Some of these buildings have been restored; however, many remain vacant or abandoned totaling over one million square feet of unused commercial and residential space[5]. Surface parking lots are also prevalent in the PSA, though these lots are often in poor condition and contribute to blight. Figures 4 through 8 show land use, historically significant buildings, surface parking, development since 2000, and planned development in the PSA, respectively.

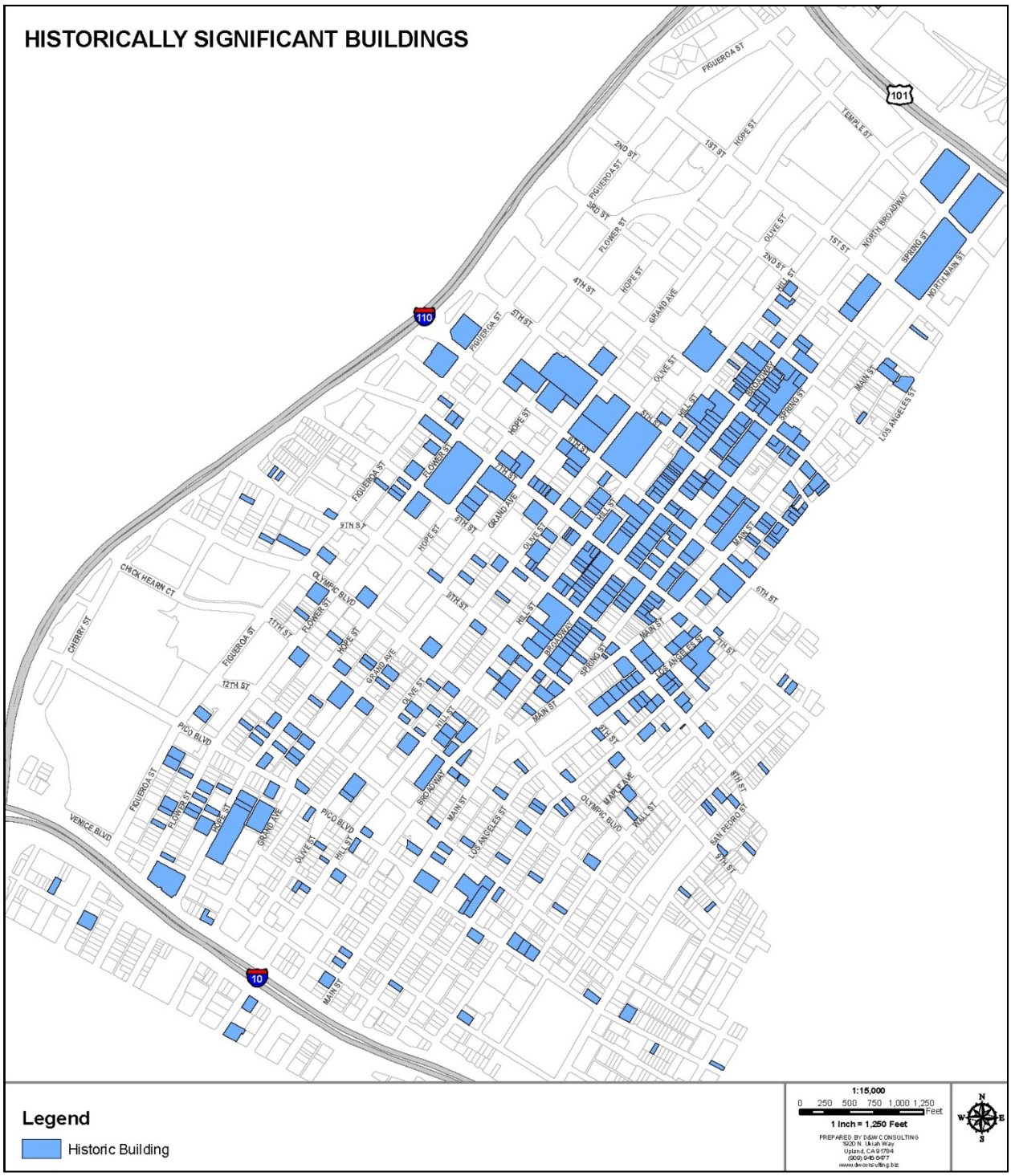
[4] Downtown Center Business Improvement District
[5] Bringing Back Broadway

Figure 4: Land Use in PSA



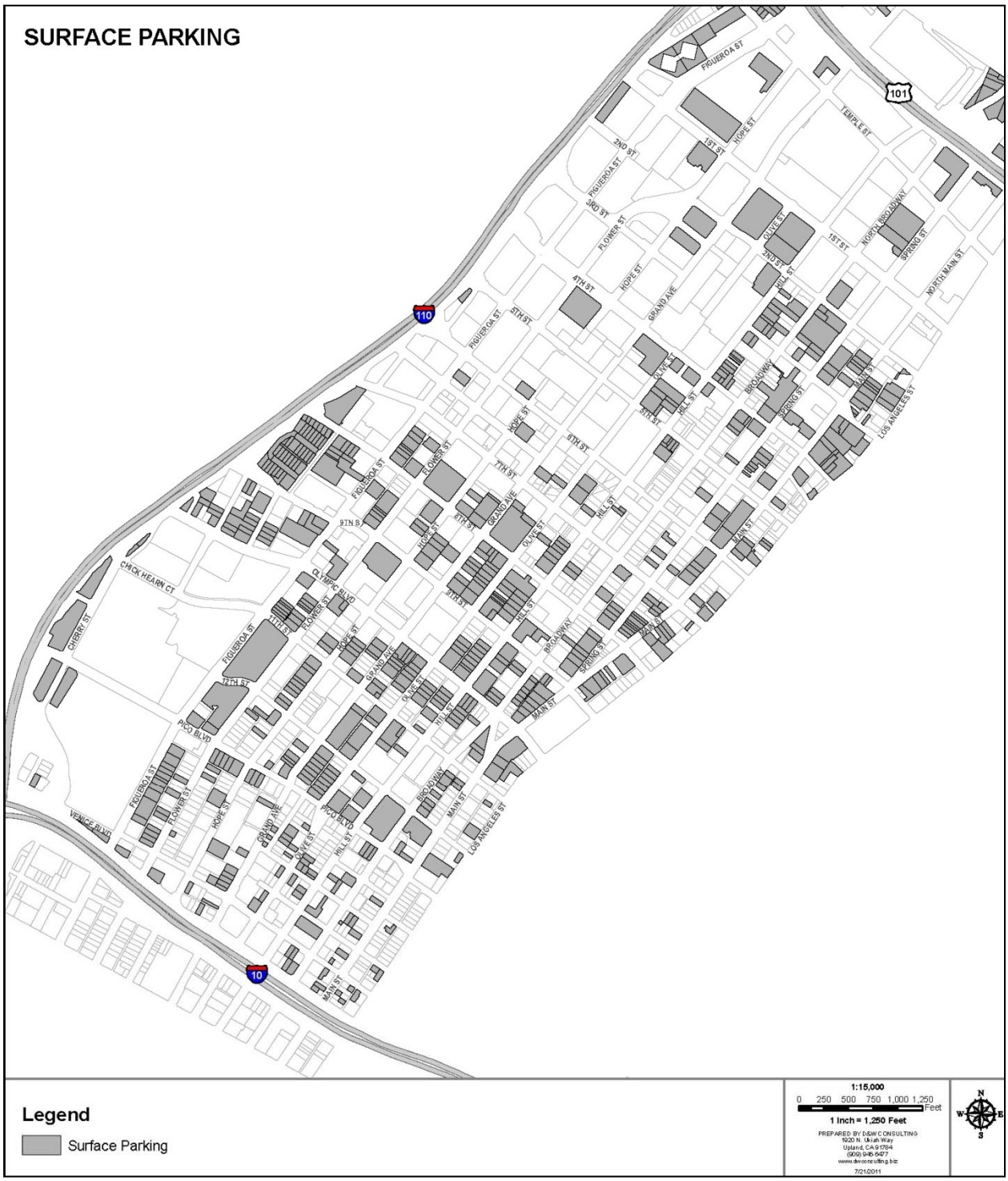
Source: Los Angeles County Assessor, 2011.

Figure 5: Historically Significant Buildings in PSA



Source: Los Angeles County Assessor, 2011.

Figure 6: Surface Parking in PSA



Source: Los Angeles County Assessor, 2011.

Figure 7: Development Since 2000 in PSA

Source: Downtown Center Business Improvement District, 2011.

Figure 8: Planned Development in PSA

Source: Downtown Center Business Improvement District, 2011.

1.2.3 Demographics in PSA

According to the 2010 Census data, the total population of the PSA is 25,269, an increase of 3,890 (18 percent) since the 2000 Census. According to the Southern California of Governments (SCAG) 2010 forecast, the total population of the PSA is 20,981, a total that is significantly lower than both 2000 and 2010 Census data. However, the SCAG 2010 forecast is the basis for population and employment projections in the region and so it is used as a conservative estimate to be consistent with regional estimates and forecast data. The SCAG 2010 estimate for total employment in the PSA is 183,488, which is approximately 4 percent of Los Angeles County's employment. It is worth noting that these employment estimates are likely low as well, given that the PSA encompasses most of Downtown Los Angeles, which has 500,000 workers according to the Downtown Center Business Improvement District (BID). However, it should be noted that the Downtown Center BID employment estimate includes the area between Los Angeles Street and the Los Angeles River, which is outside of the PSA. Table 3 summarizes the PSA and Los Angeles County population and employment information for 2010 according to SCAG. Figures 9 and 10 illustrate the PSA's existing population and employment distribution.

Table 3: Population and Employment in PSA and Los Angeles County

Demographics	PSA	Los Angeles County	PSA Percent of County
Population	20,981	10,610,647	0.20%
Employment	183,488	4,549,528	4.03%

Source: SCAG 2010 Projections.

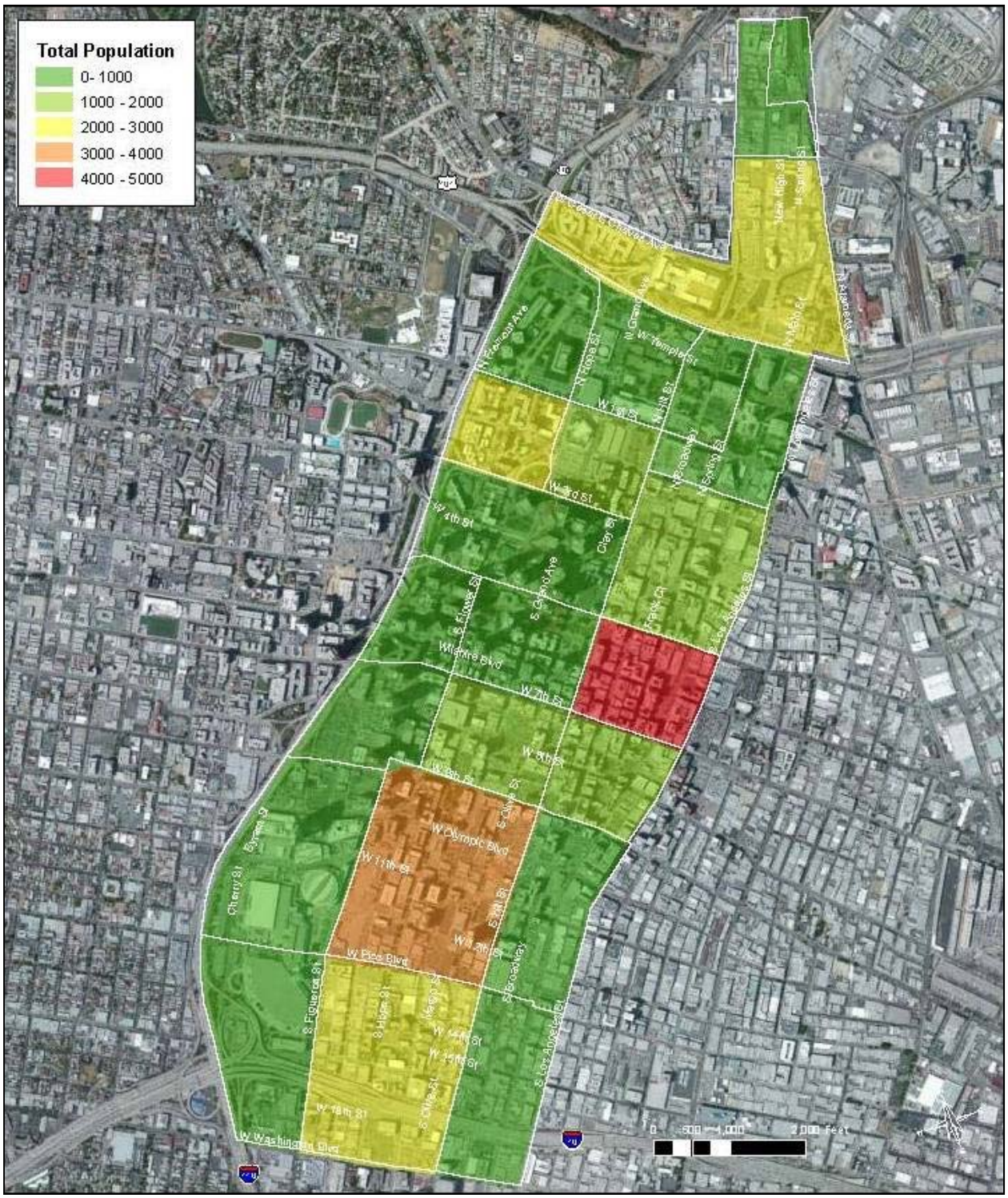
The PSA is a very diverse community, as shown by the existing race and ethnicity distribution in Table 4. According to 2010 Census data, Asian (30 percent), White (28 percent), and Hispanic (24 percent) make up the largest percentage of the population in the PSA. Figure 11 illustrates the population's race and ethnicity distribution in the PSA.

Table 4: Race and Ethnicity in PSA

Race/Ethnicity	PSA	Percent
Total Population	25,269	100.00%
Asian	7,604	30.09%
White	7,235	28.63%
Hispanic	6,189	24.49%
Black	3,252	12.87%
Native American	117	0.46%
Hawaiian or Pacific Islander	30	0.12%
Other	62	0.25%
Two or more races	780	3.09%

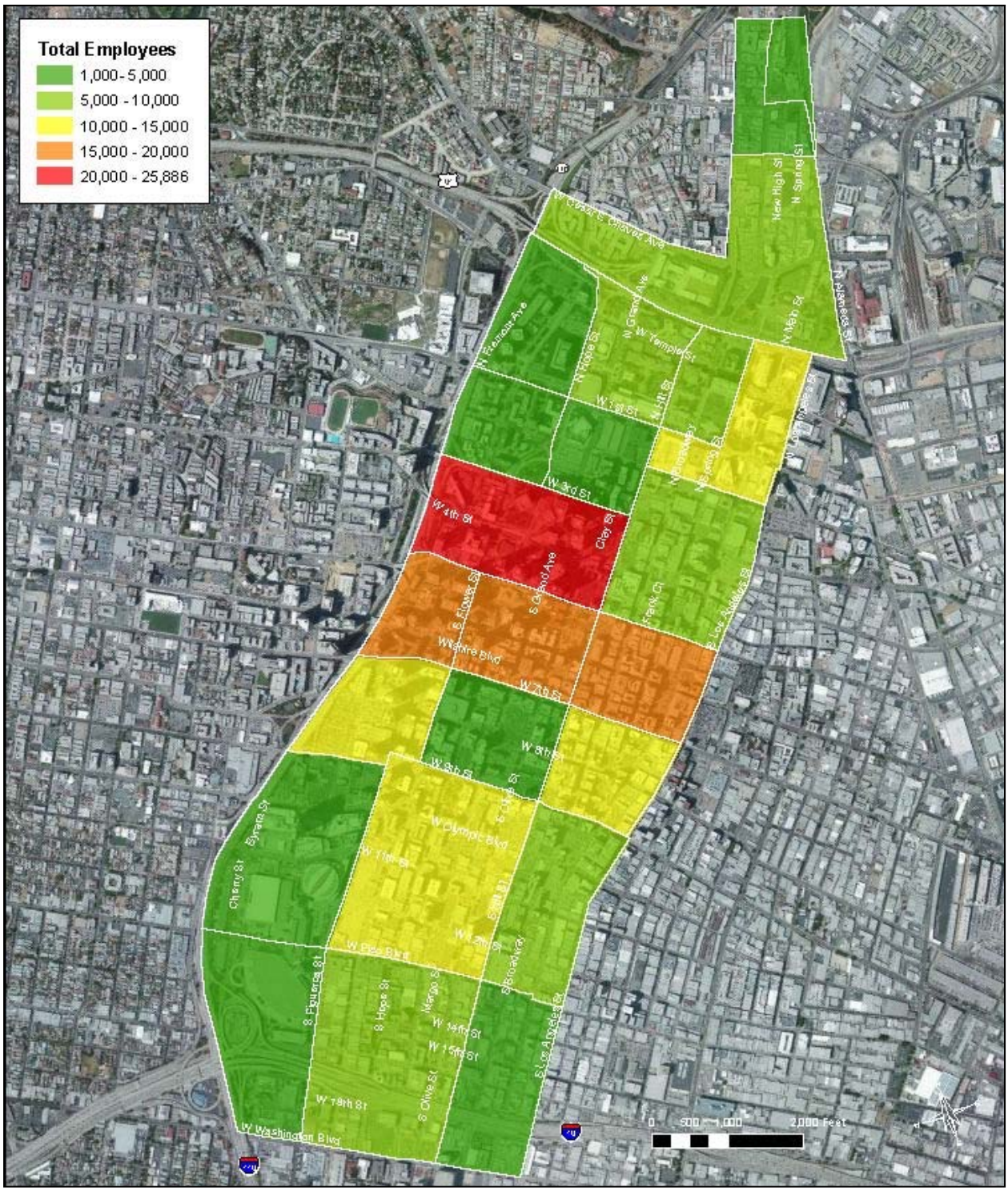
Source: 2010 Census.

Figure 9: Population in PSA (2010)



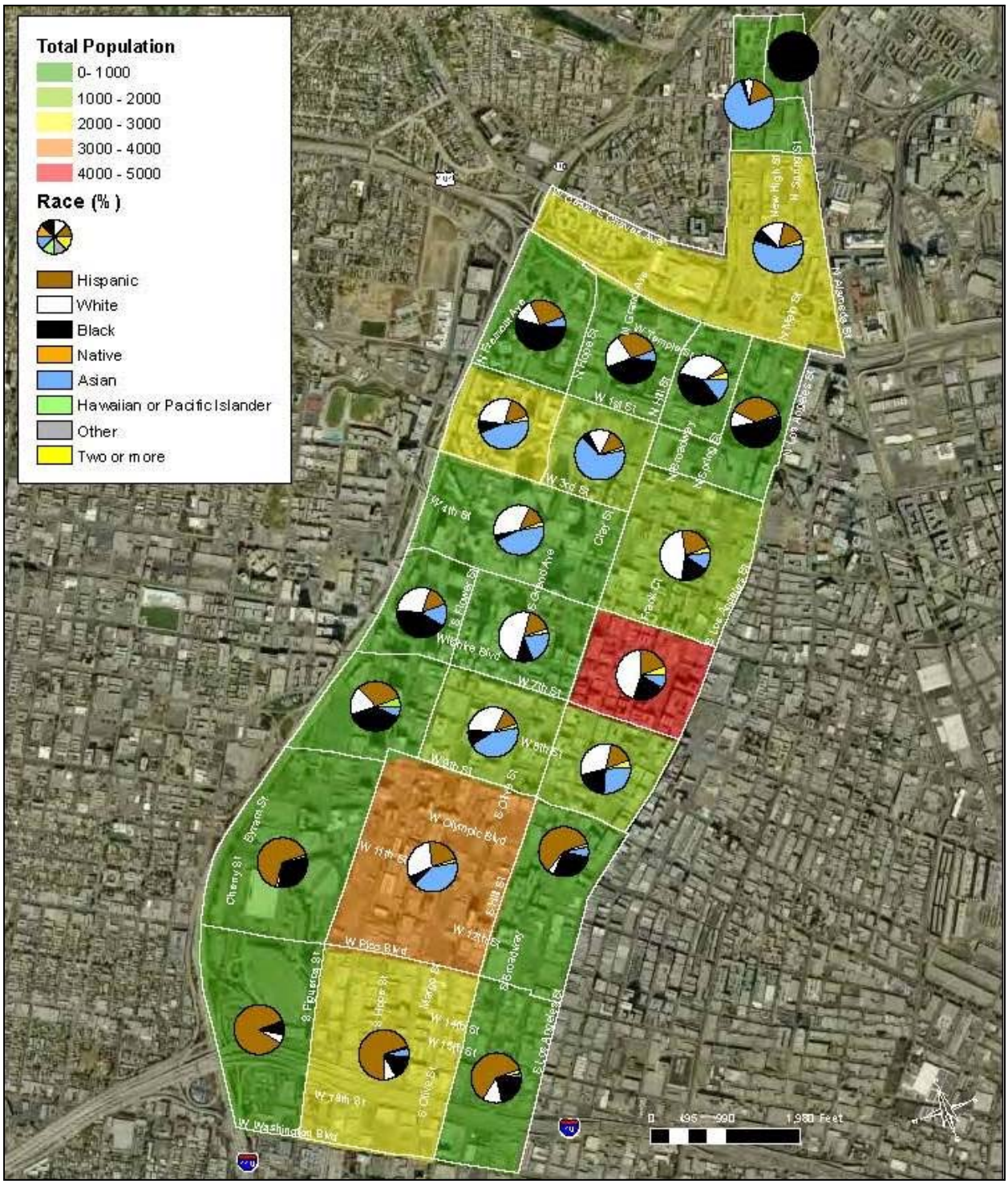
Source: 2010 Census.

Figure 10: Employment in PSA (2010)



Source: SCAG 2010 Projections.

Figure 11: Race and Ethnicity in PSA (2010)



Source: 2010 Census.

The PSA includes a large transit-dependent population of low income households, zero car households, and population over 65 years. According to SCAG, there are 7,278 low income households in the PSA, while the 2008 Downtown Demographic Study by the Downtown Center Business Improvement District (BID) estimates that downtown is home to over 10,000 units of below market rate affordable housing. Many of the PSA's residents are youth or elderly, with 1,762 age 18 years and younger and 4,111 age 65 years and over. These statistics are indicative of an increased dependence on public transit, since low income households, youth, and elderly populations are less likely to be able to own and operate one or multiple automobiles due to physical, financial, or legal limitations. The American Community Survey indicates that approximately 2,075 households in the PSA have no car and rely exclusively on public transit.

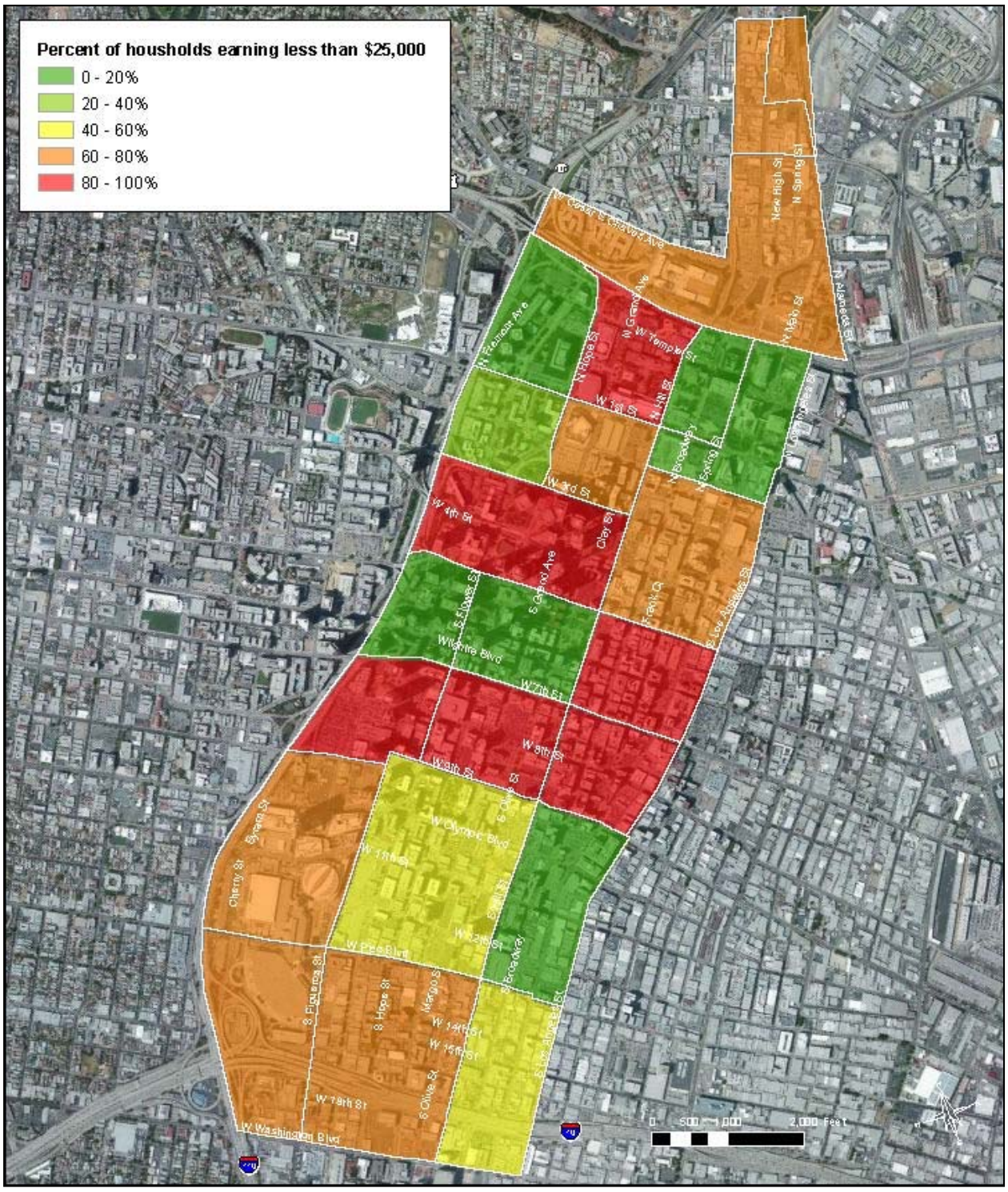
Table 5 shows the demographics of potential transit users in the PSA. Figures 12 through 15 show low income households, zero car households, population under 18 years, and population over 65 years in the PSA, respectively.

Table 5: Demographics of Potential Transit Users in PSA

Demographic	Total	Percent
Population	20,981	100.00%
Low income households	7,278	34.69%
Zero car households[1]	2,075	9.89%
Under 18 years	1,762	8.40%
Over 65 years	4,111	19.59%

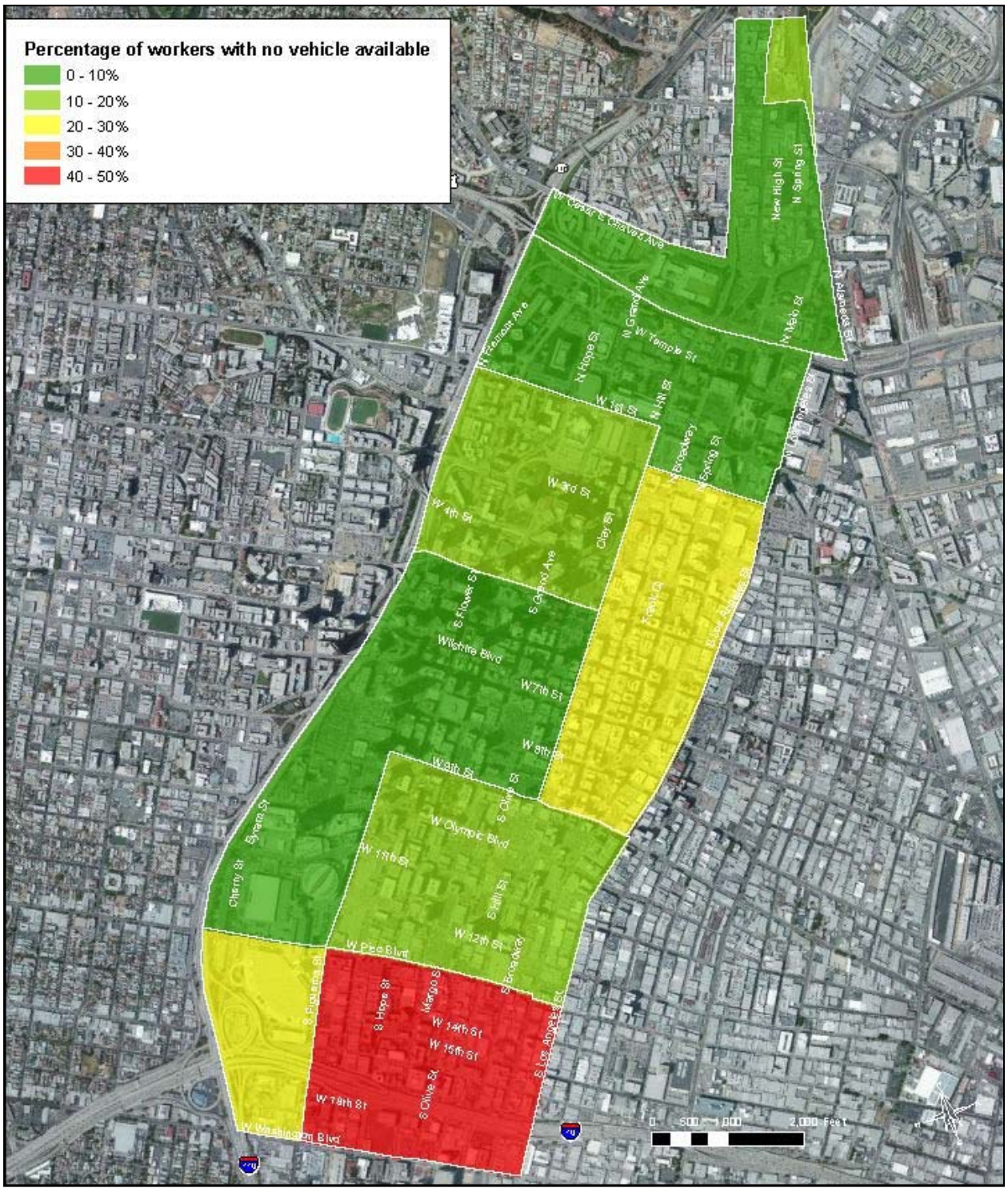
Source: SCAG 2010 Projections, except [1]American Community Survey (2005-2009).

Figure 12: Low Income Households in PSA (2010)



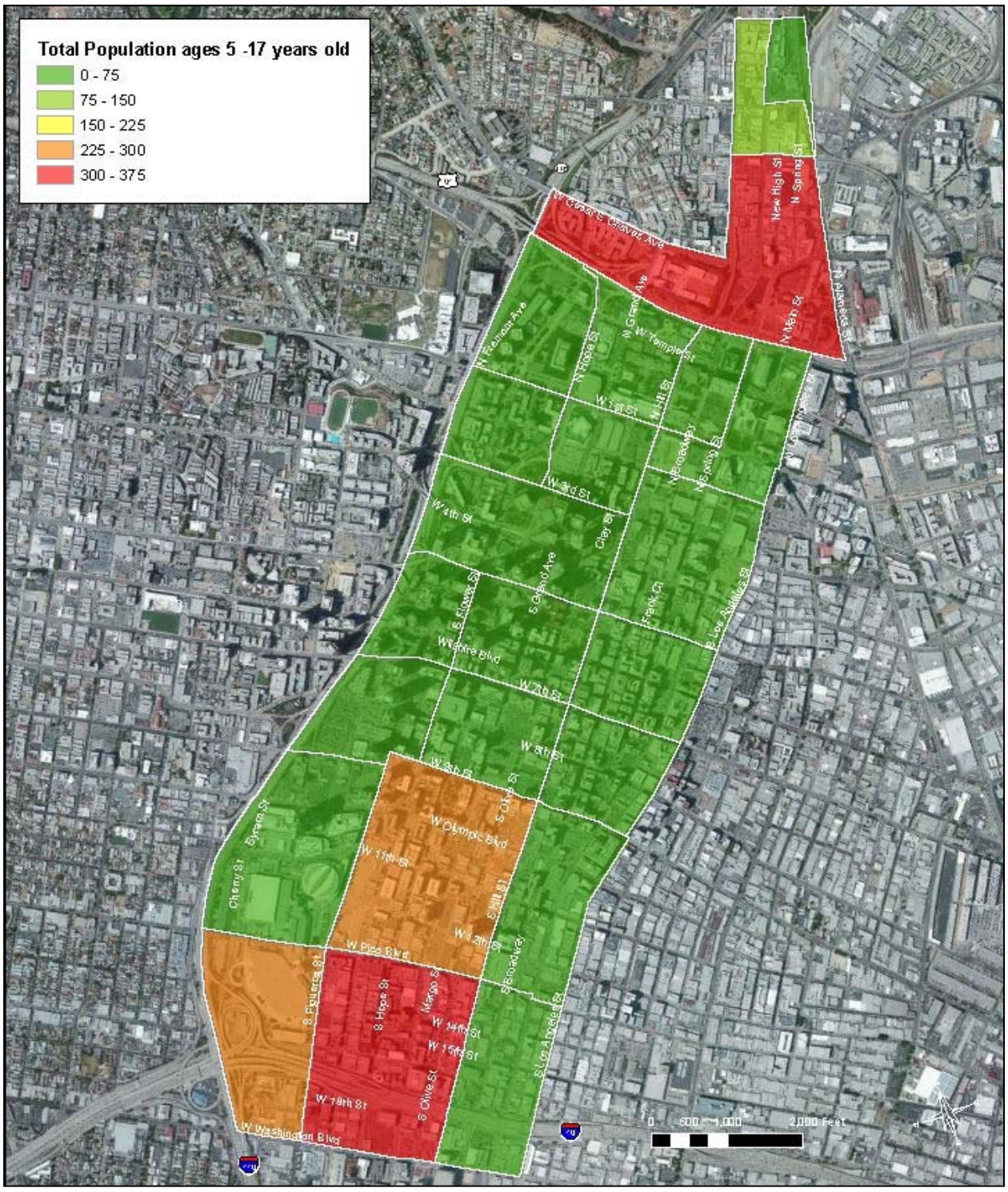
Source: SCAG 2010 Projections.

Figure 13: Zero Car Households in PSA (2010)



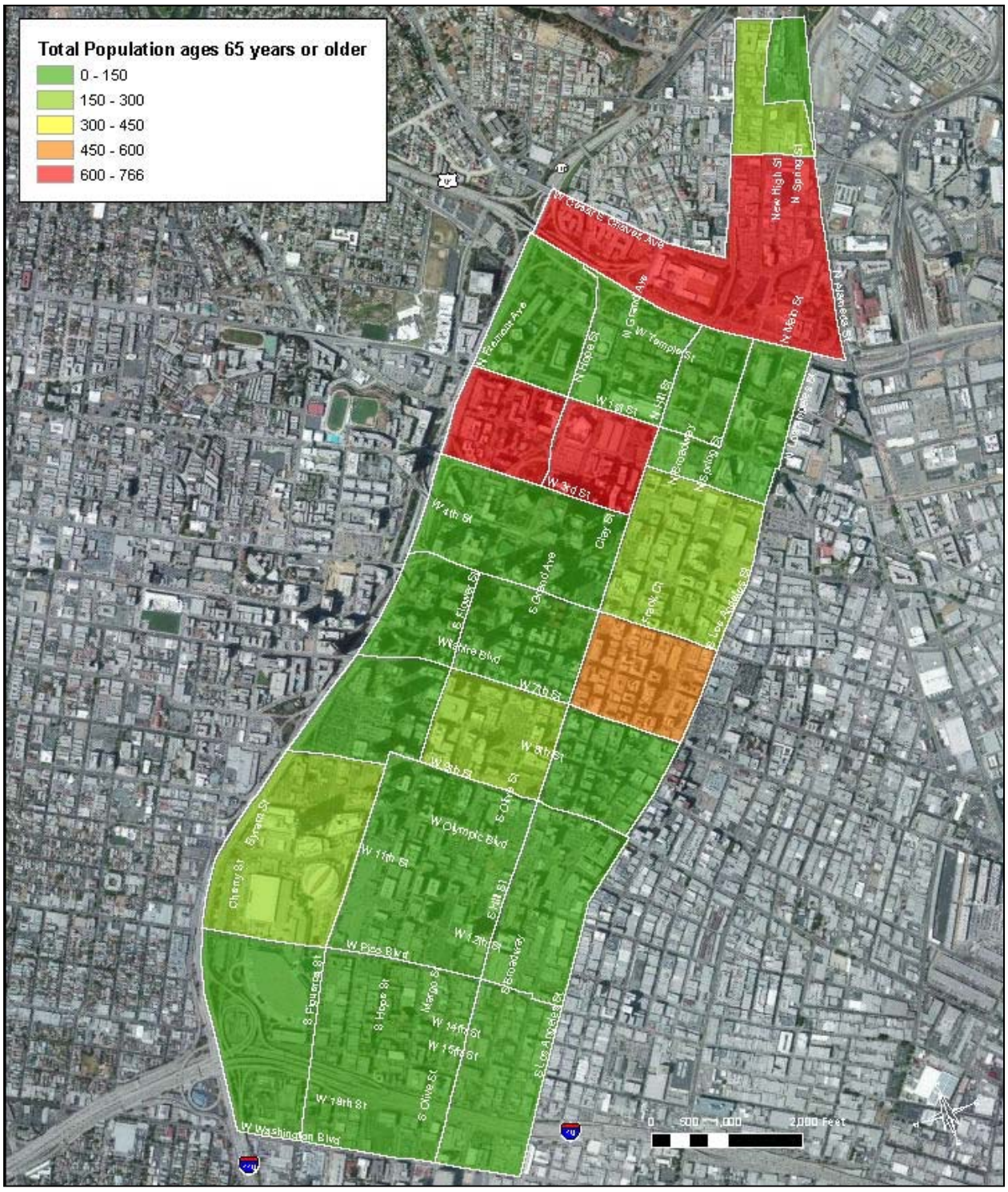
Source: American Community Survey (2005-2009).

Figure 14: Population Under 18 Years in PSA (2010)



Source: SCAG 2010 Projections.

Figure 15: Population Over 65 Years in PSA (2010)



Source: SCAG 2010 Projections.

1.2.4 Transit Service and Facilities in the PSA

The PSA has the highest concentration of transit service of any area in Los Angeles County. At present, ten transit operators provide service within the PSA with the bulk of service provided by Metro. These operators are:

- Antelope Valley Transit Authority (AVTA)
- City of Gardena (Gardena Municipal Bus Lines)
- City of Santa Clarita Transit
- City of Santa Monica (Big Blue Bus)
- Foothill Transit
- City of Los Angeles Department of Transportation (LADOT)
- Los Angeles County Metropolitan Transportation Authority (Metro)
- City of Montebello (Montebello Bus Lines)
- Orange County Transportation Authority (OCTA)
- City of Torrance (Torrance Transit)

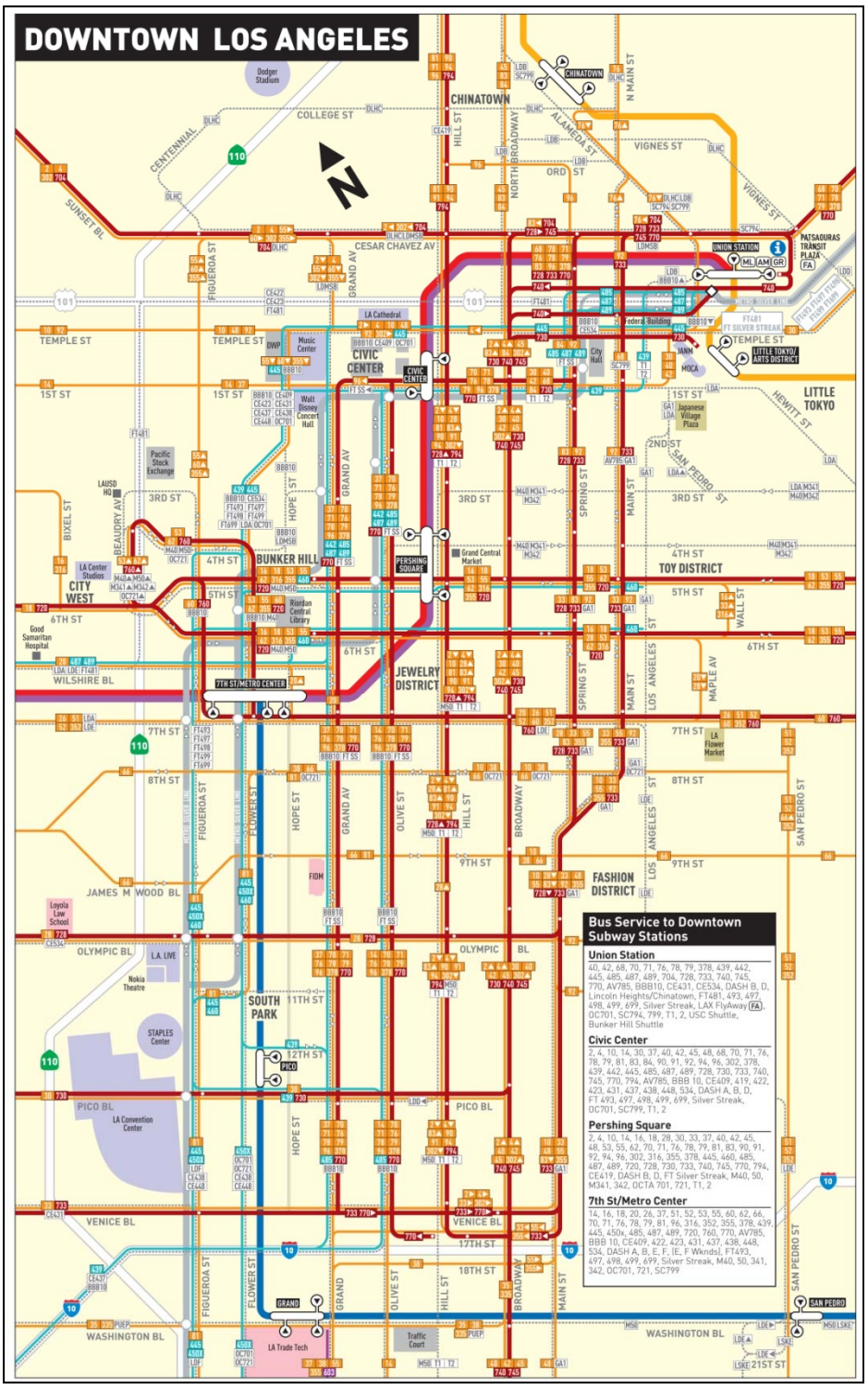
With the exception of Metro, LADOT, Montebello Bus Lines, and Gardena Municipal Bus Lines, these transit operators run mostly peak commute hour, peak-direction commuter bus service in and out of the PSA. LADOT provides frequent Downtown Area Short Hop (DASH) service along short, mostly circular shuttle routes within the downtown area. In addition to public transit services, several high-rise office tenants within the PSA offer private shuttle bus service for their employees.

Metro

This section describes Metro rail and bus service in Downtown Los Angeles, as shown in Figure 16. Metro provides rail service with the Red Line from Union Station to North Hollywood, the Purple Line from Union Station to Wilshire Center, the Blue Line from the 7th Street/Metro Center to Long Beach, and the Gold Line from Union Station to Pasadena and East Los Angeles.

There are seven Metro rail stations located within the PSA. The Red and Purple Line stations are Union Station, Civic Center (Hill Street between Temple Street and 1st Street), Pershing Square (Hill Street between 4th Street and 5th Street), and 7th Street/Metro Center (7th Street between Figueroa Street and Hope Street). The 7th Street/Metro Center Station serves as a transfer point to the Blue Line, which includes stations at Pico (Flower Street between Pico Boulevard and 12th Street) and Grand (Washington Boulevard between Flower Street and Grand Avenue). Union Station and Chinatown are served by the Gold Line.

Figure 16: Metro Rail and Bus Service in Downtown Los Angeles



Source: Metro, 2011.

By 2012, the Metro Expo Line will provide service from 7th Street/Metro Center Station to Culver City. By 2019, the Regional Connector will provide a new seamless connection between 7th Street/Metro Center Station and Union Station. The Regional Connector will add three new stations, two of which are in the PSA at 2nd Street/Hope Street and 2nd Street/Broadway. The Regional Connector will enable the Blue/Expo Lines to be interlined with the Gold Line and therefore eliminate the need for Gold, Blue, and Expo Line passengers to transfer to the Red and Purple Line at 7th Street/Metro Center and Union Station to reach their final destination within the downtown area. Further expansions of Metro rail, such as the Westside extension, can be expected in the coming years as a part of the Measure R 30/10 Plan improvements, so transit ridership in Downtown Los Angeles will continue to increase.

All Metro rail stations provide connections to additional public transportation options, including bus service provided by Metro and other transit operators as well as Metrolink and Amtrak rail services at Union Station. Table 6 summarizes existing and future Metro rail service in the PSA.

Table 6: Metro Rail in PSA

Existing Metro Rail Lines					
Line	**Mode**	**Route**	**Length**	**Weekday Boardings**	**Year**
Red/ Purple	HRT	Union Station to North Hollywood, Wilshire/Western	17.4 miles	155,686	1993-2000
Blue	LRT	7th St/Metro Center to Long Beach	22 miles	79,142	1990-1991
Gold	LRT	East Los Angeles to Sierra Madre Villa	13.6 miles	34,055	2003
Future Metro Rail Lines					
Line	**Mode**	**Route**	**Length**	**2020 Weekday Boardings**	**Year**
Expo (Phase I)	LRT	7th St/Metro Center to Culver City	8.5 miles	43,600	2012
Regional Connector	LRT	7th St/Metro Center to Little Tokyo and Arts District	1.9 miles	42,750	2019

Source: Metro, 2011.

Existing Metro rail boardings/alightings by station in Downtown Los Angeles show that there are many short rail trips within the PSA. For example, the westbound Red/Purple Line has 20,851 daily boardings at Union Station. Of this amount, 1,443 alight at Civic Center, 3,022 alight at Pershing Square, and 9,491 alight at 7th Street/Metro Center. This means that over half the passengers boarding at Union Station are either circulating within Downtown Los Angeles or connecting to other transit services, such as the Blue Line. Table 7 summarizes weekday ridership for Metro Rail stations in the PSA.

Table 7: Metro Rail Weekday Boardings/Alightings by Station in PSA

	Weekday (FY 2010)	
Station	**Boardings**	**Alightings**
Red/Purple		
Eastbound		
7th/Metro Center	9,185	15,470
Pershing Square	3,439	7,434
Civic Center	1,657	4,749
Union Station	0	20,346
Westbound		
Union Station	20,851	0
Civic Center	4,565	1,443
Pershing Square	7,671	3,022
7th/Metro Center	14,577	9,491
Subtotal	*61,945*	*61,955*
Blue		
Northbound		
Grand	1,685	3,501
Pico	849	1,730
7th/Metro Center	0	15,016
Southbound		
7th/Metro Center	15,227	0
Pico	1,729	799
Grand	3,115	1,495
Subtotal	*22,605*	*22,541*
Gold		
Northbound		
Union Station	7,035	1,723
Chinatown	705	516
Southbound		
Chinatown	517	602
Union Station	1,917	7,156
Subtotal	*10,174*	*9,997*
Total	**94,724**	**94,493**

Source: Metro, 2011.

The majority of bus transit service in the PSA, as well as the Los Angeles region, is provided by Metro, which operates a number of short and long-distance radial lines, as well as cross-town service, express service, and even 24-hour "Owl" service on many routes. Metro's bus services vary considerably in speed and capacity. The most basic routes provide line-haul service to and from downtown along arterial streets. Heavily-traveled routes often have overlaid limited-stop or Metro Rapid bus service. Table 8 provides total weekday boardings/alightings at bus stops in the PSA as well as the total bus route ridership.

Table 8: Metro Bus Weekday Boardings/Alightings at Bus Stops in PSA

		Bus Stops in PSA		Route
Route	Description	Boardings	Alightings	Ridership
2	Downtown LA - Pacific Palisades via Sunset Blvd	3,704	3,319	19,827
4	Downtown LA - West LA - Santa Monica via Santa Monica Blvd	2,624	2,811	19,029
10	Downtown LA - West LA via Temple St & Melrose Ave	2,601	2,660	12,458
14	Downtown LA - Beverly Hills via Beverly Blvd	3,073	3,041	19,747
16	Downtown LA - Century City via 3rd St	3,575	3,927	25,363
18	Wilshire Center - Montebello via 6th St & Whittier Blvd	4,121	4,548	24,684
20	Downtown LA - Santa Monica via Wilshire Blvd	1,653	1,433	16,224
26	Hollywood - Downtown LA - Compton - Artesia Transit Center via Avalon Blvd	4,222	4,634	28,274
28	Downtown LA - Century City via West Olympic Blvd	1,330	1,480	8,461
30	Pico/Rimpau - Downtown LA - Indiana Station via Pico Blvd & East 1st St	4,148	3,868	12,527
33	Downtown LA - Santa Monica via Venice Blvd	1,480	1,351	11,653
35	Downtown LA - Fairfax/Washington via Washington Blvd	1,540	1,636	7,961
38	17th/Broadway - Washington/Fairfax via W Jefferson Blvd	628	677	5,549
40	Downtown LA - LAX -South Bay Galleria via King - La Tijera - Hawthorne	4,977	4,843	23,229
45	Lincoln Heights - Rosewood via Broadway	8,514	8,142	21,855
53	CSU Dominguez Hills via Central	2,017	1,838	13,264
55	Downtown LA - Imperial/Wilmington Station via Compton Ave	2,025	2,026	9,863
60	Downtown LA - Artesia Station via Long Beach Blvd	4,256	3,726	16,984
62	Downtown LA - Hawaiian Gardens via Telegraph Rd	808	848	4,545
66	Wilshire Center - Downtown LA - Montebello via 8th & Olympic Blvd	3,375	3,467	19,344
70	Downtown LA - El Monte via Garvey Ave	2,654	2,449	12,193
71	Downtown LA – Cal State LA via Wabash Av & City Terrace Dr	423	505	1,597
76	El Monte - Downtown LA via Valley Blvd	2,312	2,379	11,095

Source: Metro, 2011.

Table 8 (Continued): Metro Bus Weekday Boardings/Alightings at Bus Stops in PSA

Route	Description	Bus Stops in PSA		Route Ridership
		Boardings	Alightings	
78	Downtown LA - Arcadia via Las Tunas Dr & Huntington Dr	2,732	2,514	11,457
81	Eagle Rock - Downtown LA - Harbor Freeway Station via Figueroa	3,586	3,801	16,426
83	Downtown LA - Eagle Rock via York Blvd - Pasadena Ave	1,612	1,351	4,433
84	Eagle Rock - Downtown LA – Montebello via Eagle Rock Blvd & Cesar E Chavez Ave	1,510	1,684	9,494
90	Downtown LA - Sunland via Glendale Ave, Foothill Blvd	1,258	1,185	5,657
92	Downtown LA to Burbank Station via Glenoaks Blvd, Brand Blvd, Glendale Blvd	903	1,001	5,453
94	Downtown LA - Sun Valley via San Fernando Rd	1,448	1,203	6,299
96	Downtown LA - Sherman Oaks via Riverside Dr, LA Zoo	455	513	2,712
439	Downtown LA - Culver City Transit Center via I-10 Freeway	110	134	458
442	Downtown LA - Hawthorne Station via Manchester B	69	76	226
445	San Pedro - Union Station via Pacific Ave, 1st St, Harbor Beacon Park Ride Lot & Harbor Transitway	289	326	1,180
450	Artesia Transit Center - Downtown LA via Harbor Transitway	284	307	754
460	Downtown LA - Disneyland via Harbor Transitway & I-105 Freeway	586	694	4,187
485	Altadena - Downtown LA via Lake Av & El Monte Busway	362	444	2,533
487	Downtown LA - Sierra Madre Villa Station - El Monte Station	642	719	3,931
603	Glendale Galleria - Grand Station via Hoover St, Rampart Blvd & San Fernando Rd	215	171	7,724
704	Downtown LA - Santa Monica via Santa Monica Blvd	722	770	11,214
720	Santa Monica - Commerce via Wilshire Blvd & Whittier Blvd	3,861	4,171	39,542
728	Downtown LA - Century City via Olympic Blvd	1,335	1,597	7,154
730	Downtown LA - Pico Rimpau via Pico Blvd	1,176	1,271	4,646
733	Downtown LA - Santa Monica via Venice Blvd	1,563	1,764	12,318
740	South Bay Galleria - Downtown LA via Hawthorne Blvd, Crenshaw Blvd & M.L. King Blvd	1,626	1,799	8,306
745	Downtown LA - Harbor Freeway Station via Broadway	2,593	3,152	7,402
760	Downtown LA - Artesia Station via Long Beach Blvd	1,463	1,541	8,576
770	Downtown LA - El Monte via Cesar E. Chavez Ave & Garvey Ave	1,495	1,448	8,637
794	Downtown LA - Sylmar Station via San Fernando Rd, Brand Blvd	975	897	4,985
910	Silver Line	2,570	2,838	8,049
Total		**101,500**	**102,979**	**549,479**

Source: Metro, 2011.

LADOT

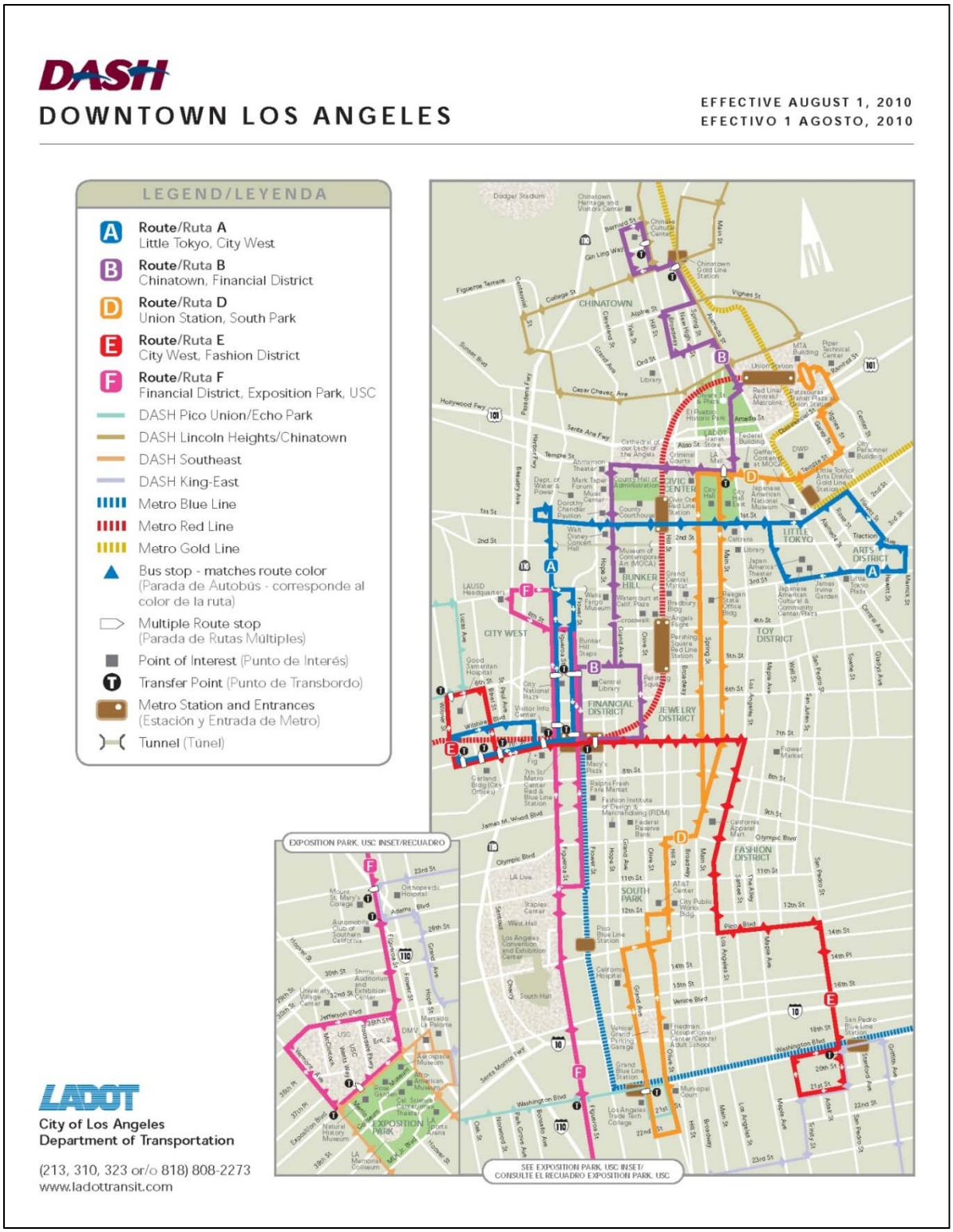
The Los Angeles Department of Transportation (LADOT) provides Downtown Area Short Hop (DASH) bus service. Downtown DASH includes five local circulation routes connecting the PSA with Little Tokyo, Chinatown, the Fashion District, and the University of Southern California (Figure 17). Fares are lower than Metro ($0.50 for DASH vs. $1.50 for Metro) and frequencies are high (approximately every 5-10 minutes). Service hours are 6a.m. to 7p.m., Monday through Friday, and some limited service on weekends. Table 9 provides a summary of DASH ridership in Downtown Los Angeles, which attracted over 22,000 daily boardings in 2011.

Table 9: Downtown DASH Weekday Boardings

DASH Route	Weekday Boardings (2011)
A	3,886
B	3,525
D	4,081
E	7,352
F	3,306
Total	**22,150**

Source: LADOT, 2011.

Figure 17: DASH Service in Downtown Los Angeles



Source: LADOT, 2011.

Intercity and Commuter Rail

Intercity and commuter rail service to Downtown Los Angeles are provided by Metrolink and Amtrak, with connections to Metro rail service at Union Station. Most passengers arriving at Union Station on Metrolink are bound for downtown and presently use the Metro Red and Purple Lines, Metro buses, DASH buses, or employer-provided shuttles to complete their trips.

Metrolink serves the counties of Los Angeles, Orange, Riverside, San Bernardino, San Diego, and Ventura and six lines serve Union Station. Average weekday ridership on Metrolink trains through the third quarter of FY 2011 was 41,739 with 13,796 boardings at Union Station (the most systemwide)[6].

Amtrak serves Union Station with its regional Pacific Surfliner train and long distance Coast Starlight, Texas Eagle, Sunset Limited, and Southwest Chief trains, as well as its intercity buses. The Pacific Surfliner was Amtrak's second-busiest line in 2010 with an average daily ridership of approximately 7,200, connecting Los Angeles with major destinations in Southern and Central California such as San Diego, Santa Barbara, and San Luis Obispo with 11 daily trains in each direction[7]. Average daily Amtrak boardings in Union Station were approximately 4,200 in 2010 for all Amtrak routes serving Union Station, the most of any station in California and the fifth largest nationwide[8].

Union Station will grow as an intercity rail hub as a result of the California High Speed Rail project. The first phase to link San Francisco and Los Angeles is projected to open by 2020, while extensions to Sacramento, San Diego, and Las Vegas could follow. High speed rail ridership at Union Station is expected to exceed 14,000 daily boardings by 2035[9].

Transit Mode Share

The transit mode share for commute trips in downtown is available from the 2011 Downtown Los Angeles Demographic Study by the Downtown Center Business Improvement District (BID). According to the study, which is a survey of downtown residents, employees, and visitors, approximately 20 percent of employees commuted by Metro rail, 15 percent commuted by Metro bus or other public bus, 7 percent commuted by DASH, and 6.5 percent commuted by Metrolink and Amtrak[10]. Table 9 provides the survey results of the mode share for commute trips.

[6] Metrolink May 2011 Ridership Report
[7] Pacific Surfliner 2010 Ridership Report
[8] Amtrak California Fact Sheet 2010
[9] California High Speed Rail 2010 Business Plan
[10] 2011 Downtown Los Angeles Demographic Study, Downtown Center Business Improvement District (BID)

Table 9: Mode Share for Commute Trips

		Residence		Live and Work Downtown
	Total	Downtown LA	LA County	
Resident	10,742	4,464	6,278	2,439
Metro rail	19.7%	15.6%	22.6%	14.0%
Metro bus/other bus	15.3%	11.7%	17.9%	10.8%
DASH	7.1%	10.5%	4.6%	14.2%
Metrolink/Amtrak	6.5%	3.6%	8.6%	3.4%
Alone by car	60.4%	54.5%	64.6%	41.0%
Carpool	8.5%	6.0%	10.4%	4.9%
Shuttle/vanpool	1.2%	0.9%	1.3%	1.2%
Walk	15.4%	31.4%	4.1%	49.3%
Bicycle	5.1%	8.3%	2.8%	10.3%
Other	2.4%	2.6%	2.2%	2.4%
Do not commute/work	7.9%	14.0%	3.5%	15.5%

Source: 2011 Downtown Los Angeles Demographic Study, Downtown Center Business Improvement District (BID)

The forecast transit mode share in downtown was obtained from the Metro Regional Connector New Starts submittal[11]. By 2035, there are projected to be approximately 278,500 auto vehicle trips and 71,100 transit trips in downtown, which equals an auto/transit mode split of 80/20 percent. However, this mode share changes when considering home-based work peak (trips from home to work during peak hours). By 2035, there are projected to be approximately 36,000 auto vehicle trips and 32,500 transit trips in downtown, which equals an auto/transit mode split of 53/47 percent.

[11] Metro, 2011

1.2.5 Traffic Conditions in PSA

This section summarizes traffic conditions within the PSA. The PSA is surrounded by freeways, including SR-110 on the west, US-101 on the north, and I-10 on the south. Key freeway access points are provided by 3rd Street, 4th Street, 5th Street, 6th Street, 8th Street, Hope Street, Main Street, and Los Angeles Street. These freeway access points are supplemented by other roadways streets in the downtown street network, including Figueroa Street, Flower Street, Grand Avenue, Olive Street, Hill Street, Broadway, Spring Street, Temple Street, 1st Street, 7th Street, 9th Street, Olympic Boulevard, and Pico Boulevard. The PSA also includes a bus and right turn only lane on Figueroa Street and a shared peak hour travel lane/off peak parking lane on Hill Street.

LADOT does not have current traffic data for intersections within the PSA. Therefore, existing traffic conditions were obtained from the Metro Regional Connector Draft Environmental Impact Statement/Environmental Impact Report (EIS/EIR)[12]. However, the Regional Connector PSA does not include traffic conditions south of 8th Street so two other sources were included for these locations; the Broadway Streetscape Plan Traffic Study[13] and the 1340 S. Figueroa Traffic Impact Study[14]. Together, these three studies include AM peak and PM peak traffic conditions at key intersections within the PSA.

For intersections, the AM and PM peak hour volumes were analyzed using Level of Service (LOS). LOS is a qualitative measure used to describe traffic flow conditions, ranging from excellent flow (LOS A) to overloaded, stop-and-go conditions (LOS F).

Table 10 summarizes the existing operating conditions for the key intersections in the PSA.

[12] Metro, 2010
[13] IBI, 2010
[14] Crain and Associates, 2008

Table 10: Traffic Conditions at Intersections in PSA

	AM Peak		PM Peak	
Intersection	**LOS**	**Delay**	**LOS**	**Delay**
2010[1]				
Grand Ave / 1st St	C	24.9	C	27.6
Hill St / 1st St	B	16.6	C	27.8
Broadway / 1st St	B	15.3	B	16.1
Spring St / 1st St	B	14.2	B	11.5
Main St / 1st St	B	11.7	C	21.4
Los Angeles St / 1st St	B	11.7	B	17.6
Judge John Aliso St / 1st St	A	8.8	B	13.6
Central Ave / 1st St	A	5.5	A	8.8
Alameda St / 1st St	B	17.1	C	28.8
Figueroa St / 2nd St	B	19.8	C	30.4
Grand Ave / 2nd St	B	10.3	B	13.1
Hill St / 2nd St	B	13.5	B	11.8
Broadway / 2nd St	B	14.5	B	15.5
Spring St / 2nd St	B	15.3	B	12
Main St / 2nd St	B	10.4	B	16.8
Los Angeles St / 2nd St	B	11.4	B	18.5
San Pedro St / 2nd St	B	11.3	B	13.6
Central Ave / 2nd St	A	7.4	A	8.3
Alameda St /2nd St	B	10.2	B	13.8
Figueroa St / 3rd St	C	27.9	D	45
Flower St / 3rd St	B	19.3	B	10.4
Grand Ave / 3rd St	A	6.7	A	9.8
Hill St / 3rd St	B	18.3	B	18.7
Broadway / 3rd St	C	23.9	B	18.1
Spring St / 3rd St	C	22.3	B	13.7
Main St / 3rd St	B	13.6	B	15.7
Los Angeles St / 3rd St	B	14.2	B	15.1
San Pedro St / 3rd St	A	10	A	9
Central Ave / 3rd St	B	12.1	B	11.5
Alameda St / 3rd St	C	21.6	B	12.9
Figueroa St / 4th St	B	13.2	B	13.3
Flower St / 4th St	C	20.3	D	44.6
Grand Ave / 4th St	A	2.7	A	4.4
Figueroa St / 5th St	B	12.8	C	25.4
Flower St / 5th St	B	13.9	B	16.6
Grand Ave / 5th St	B	14.7	C	24.3
Olive St / 5th St	B	15.4	B	17.7
Figueroa St / 6th St	C	30.8	D	43.6
Flower St / 6th St	B	14.8	B	19

Source: [1]Regional Connector Draft EIS/EIR, Metro, 2010; [2]Broadway Streetscape Plan Traffic Study, IBI, 2010; [3]1340 S. Figueroa Traffic Impact Study, Crain and Associates, 2008.

Table 10 (Continued): Traffic Conditions at Intersections in PSA

	AM Peak		PM Peak	
Intersection	**LOS**	**Delay**	**LOS**	**Delay**
Hope St / 6th St	A	6	B	10.7
Grand Ave / 6th St	B	13	B	15.2
Olive St / 6th St	B	12.6	C	20
Figueroa St / Wilshire Blvd	C	21.3	F	117.1
Flower St / Wilshire Blvd	B	14.5	C	22.4
Figueroa St / 7th St	B	19.3	C	27.4
Flower St / 7th St	A	8.9	B	19.8
Hope St / 7th St	A	7.7	B	10.5
Grand Ave / 7th St	B	12.9	B	17.9
Olive St / 7th St	B	12	B	16.1
Figueroa St / 8th St	B	13.5	C	20.5
Flower St / 8th St	A	9.4	B	18.8
Hope St / Temple St	C	23.6	C	30.6
Grand Ave / Temple St	C	29.8	D	38.4
Hill St / Temple St	B	17.6	C	33.1
Broadway / Temple St	C	20.3	C	21.8
Spring St / Temple St	B	14.5	B	12.8
Main St / Temple St	A	8.8	B	19.5
Los Angeles St / Temple St	B	12.5	B	14.7
Judge John Aiso St / Temple St	A	7.5	A	9.7
Alameda St / Temple St	C	22.8	C	34.4
Los Angeles St / Aliso St	B	11.1	B	15.8
Alameda St / Aliso St	C	20.1	C	24
Los Angeles St / Arcadia St	B	11.7	B	12.3
Alameda St / Arcadia St	C	22.9	B	15.8
Alameda St / N Los Angeles St	B	13.3	B	10.5
Alameda St / S Los Angeles St	A	4.4	B	10.6
Dewap Rd. / 1st St	A	2.7	B	12.1
Olive St / 1st St	B	11.7	B	17.8
Hope St / 1st St	D	35.8	C	25.6
S. Hope St / 2nd St	A	7	B	12.2
S. Hope St / General Thaddeus Kosciuszko Way	B	15.1	B	17.7
Broadway / Arcadia St	A	9.7	B	12.6
Spring St / Arcadia St	B	12.5	A	9
Main St / Arcadia St	A	8.1	B	11.3
Broadway / Aliso St	B	12.8	B	11.5
Spring St / Aliso St	A	9.1	A	9.7
Main St / Aliso St	A	5.9	B	11.6
Hill St / 4th St	B	11.5	B	17

Source: [1]Regional Connector Draft EIS/EIR, Metro, 2010; [2]Broadway Streetscape Plan Traffic Study, IBI, 2010; [3]1340 S. Figueroa Traffic Impact Study, Crain and Associates, 2008.

Table 10 (Continued): Traffic Conditions at Intersections in PSA

	AM Peak		PM Peak	
Intersection	**LOS**	**Delay**	**LOS**	**Delay**
Olive St / 4th St	B	14.2	C	24.2
Broadway / 4th St	A	9.1	B	15
Spring St / 4th St	A	9.9	B	14.9
Main St / 4th St	A	7.2	C	20.3
Los Angeles St / 4th St	A	7.9	B	19.2
San Pedro St / 4th St	A	6.3	B	11.4
Central Ave / 4th St	A	7.3	B	14.3
Alameda St / 4th St	A	8.3	C	32.2
2010[2]				
Hill St / 9th St	A	n/a	A	n/a
Hill St / Olympic	A	n/a	A	n/a
Hill St / 11th St	A	n/a	A	n/a
Broadway / 9th St	A	n/a	A	n/a
Broadway / Olympic	A	n/a	A	n/a
Broadway / 11th St	A	n/a	A	n/a
Spring St and Main St / 9th St	A	n/a	A	n/a
Main St / Olympic	A	n/a	A	n/a
Main St / 11th St	A	n/a	A	n/a
2008[3]				
Figueroa St / Olympic Blvd	A	n/a	A	n/a
Figueroa St / Pico Blvd	B	n/a	A	n/a
Figueroa St / Venice Blvd	B	n/a	A	n/a
Figueroa St / 18th St	A	n/a	A	n/a
Figueroa St / Washington Blvd	C	n/a	B	n/a
Flower St / Olympic Blvd	A	n/a	A	n/a
Flower St / Pico Blvd	A	n/a	B	n/a
Flower St / Venice Blvd	A	n/a	A	n/a
Grand Ave / Venice Blvd	A	n/a	A	n/a

Source: [1]Regional Connector Draft EIS/EIR, Metro, 2010; [2]Broadway Streetscape Plan Traffic Study, IBI, 2010; [3]1340 S. Figueroa Traffic Impact Study, Crain and Associates, 2008.

1.3 Statement of Need

This section describes the existing problems/deficiencies within the PSA to demonstrate the need for the project. In evaluating the activity centers, districts, characteristics, demographics, and travel conditions within the PSA, several themes emerge which reinforce the need for the project. The following themes describe the need for the project in Downtown Los Angeles:

- Geographically disconnected pedestrian network
- Lack of local short-trip transit service
- Increased transit demand from development, population, household, and employment growth
- Traffic congestion and parking demand
- Underutilized land and historic buildings

1.3.1 Geographically Disconnected Pedestrian Network

There is a geographic disconnect between many of the activity centers and districts within Downtown Los Angeles due to its size, topography, and street grid, inhibiting pedestrian circulation. The PSA is very large and extends approximately three miles from the Los Angeles Convention Center on the southwestern end to Union Station and Chinatown on the northeastern end, with various commercial, residential, and entertainment nodes in between. Topography also poses a challenge: Bunker Hill, which is the commercial core of Downtown, rises 90-120 feet above the surrounding areas, creating steep grades (15-30 percent) for pedestrian navigation. The street grid similarly impedes pedestrian circulation; blocks are fairly large (600 by 350 feet, on average, compared to 300 by 300 feet in Downtown San Francisco and 225 by 225 feet in Downtown Portland), interruptions in the grid network are commonplace, and sidewalk quality is often poor. Furthermore, temperatures typically exceed 75 degrees for eight months of the year, and shade can be difficult to find in some locations. The combination of these geographic factors means that many internal downtown trips exceed a comfortable walking distance of a quarter/half mile, inhibiting pedestrian circulation from South Park to Grand Central Market (1.2 miles), Bunker Hill to the Jewelry District (0.6 miles, 14 percent grade), or the Metro Pershing Square Station to the Orpheum Theater (0.6 miles), and thereby creating voids of investment and activity.

1.3.2 Lack of Local Short-Trip Transit Service

While there is an abundance of transit service in Downtown Los Angeles, it serves travel markets with generally longer commute-based trips with varying service hours and frequency. There is no surface transit option that is geared towards short trips with a high quality service

that includes a full span of service, high frequency, large passenger capacity, simple route structure, and level boarding.

Metro provides transit service downtown, but this service is a complex network of dozens of regional lines that make local circulation difficult to navigate. No single line ties together downtown's major activity centers; so taking Metro can be more difficult than walking. For example, to travel from Bunker Hill to the historic downtown core around 6th Street and Broadway is approximately three quarters of a mile, yet taking the bus takes the same amount of time as walking due to lack of direct service. Moreover, at $1.50 per trip, Metro rail and bus fares are high enough that they discourage short trips. As a result, the use of the Metro rail and local bus system is challenging for downtown circulation, especially for novice transit users.

DASH is better utilized for local downtown trips, yet it still provides an incomplete transit circulation service to the PSA. DASH is not an optimal downtown circulator due to its complicated network of meandering routes, low stop visibility, non-level boarding, poor service of South Park and Broadway, and truncated service hours (6a.m.-7p.m., limited weekend service). Furthermore, no single DASH line connects South Park and Bunker Hill. Like Metro, DASH has a broader service focus of providing connections between the PSA and surrounding districts, rather than circulation within the PSA. A more developed local transit circulation network is needed to complement DASH and provide an intuitive, user-friendly, "one seat" ride between major downtown destinations.

1.3.3 Increased Transit Demand from Development, Population, Household, and Employment Growth

Over the past decade Downtown Los Angeles has experienced significant new development and population growth, placing an increased strain on its transportation system. Since 2000, 9,391 housing units have been constructed in the PSA (89 percent increase), as well as other major nonresidential projects such as LA Live. There are presently 11,831 additional housing units[15] in planning along with numerous retail and commercial developments, suggesting considerable future growth and development.

In addition, the population of the PSA is projected to grow over 10 percent and employment is projected to grow over 6 percent by 2035 based on estimates by SCAG. Transit dependent populations, such as elderly and low income populations, are also expected to increase by 34 percent and 18 percent, respectively, by 2035. This growth in development, population, and employment will increase trips within Downtown Los Angeles and place an increasing strain on the local transportation system, requiring expanded transit service.

[15] Downtown Center Business Improvement District

1.3.4 Traffic Patterns and Parking Demand

Due to the aforementioned problems with local pedestrian and transit circulation, many short trips in downtown are made by automobile. The high demand for parking compounds the mobility issues in parts of the PSA as on-street parking is difficult to find. This parking demand needs to be redistributed so that some users can "park once" and circulate throughout downtown using transit instead of making multiple short trips by automobile and parking in multiple on-street parking spaces. This approach compliments LADOT's parking strategy which is to better utilize existing on-street parking spaces in areas with less parking demand.

Downtown parking is primarily concentrated in Bunker Hill and the Financial District and is not evenly distributed. Parking problems are especially prevalent in older districts such as the Jewelry District and the Historic Core, which also have a shortage of off-street parking. Depending on the time of day and whether a special event is occurring, a lack of parking capacity exists on a larger scale around the Staples Center, Nokia Theater, and the Convention Center (where major events occur almost every day). The proposed football stadium and convention center expansion could further compound these issues. As a result, automobile traffic circulating throughout downtown in search of parking contributes to unnecessary vehicular trips.

The lack of on-street parking in downtown has led to the prevalence of surface parking lots throughout downtown; a short term solution that comes at the expense of the overall vitality of the surrounding neighborhood and often contributes to blight. With substantial development in planning in geographically isolated districts such as South Park, traffic congestion and parking scarcity would likely increase without transit improvements to improve mobility and better utilization of downtown's parking resources.

1.3.5 Underutilized Land and Historic Buildings

Despite considerable development and investment over the past decade, significant underutilized land and commercial space remains in the PSA, particularly along Broadway and in South Park. These areas are particularly geographically isolated from the primary employment centers of Bunker Hill and the Financial District, and have poor local transit circulation and connections to Metro rail. Over a million square feet of potential commercial and residential space is presently unused in historic buildings primarily on and around Broadway, while vacant lots are commonplace, especially in South Park. It is necessary to strengthen the connection between Broadway, South Park, and the major activity centers in downtown to better utilize transportation resources and revitalize neighborhoods, especially given local, regional, and state goals to reduce greenhouse gas (GHG) emissions through infill development and smart growth.

1.4 Statement of Purpose

The purpose of the project is to connect residents, employees, and visitors to various services, employment centers, points of interest, and the regional transit network while serving as a catalyst for the revitalization of Downtown Los Angeles. This urban circulator service would link otherwise disconnected districts and increase opportunities for mobility within the downtown area as a convenience for residents, employees, and visitors.

The project has two overarching goals which were generated during public workshops, meetings, and open houses and reflect input from public agencies, community groups, and stakeholders:

1. Enhance mobility and surface transit circulation in Downtown Los Angeles

2. Support the growth and revitalization of Downtown Los Angeles, including its historic districts

Within these overarching goals are numerous objectives, as outlined below.

1.4.1 Enhance Mobility and Transit Circulation in Downtown Los Angeles

- Connect major districts, destinations, and activity centers
- Improve transit coverage and circulation
- Provide simple, localized, high frequency service
- Alleviate traffic and reduce parking demand
- Serve transit-dependent populations
- Improve transit accessibility

Connect major districts, destinations, and activity centers

The project would strengthen the connection between major districts, destinations, and activity centers within the PSA, fostering a more unified and cohesive downtown area. The project would enable easy, frequent, and convenient travel throughout the downtown area for residents, employees, and visitors.

Improve transit coverage and circulation

The project would improve transit coverage and circulation within the PSA, helping to complete the first/last mile of many trips and providing stronger intermodal connections to bus and rail, as well as to the pedestrian and bicycle network. In particular, the project would

help fill gaps in transit coverage in parts of South Park, the Jewelry District, the Historic Core, and Bunker Hill. By improving transit coverage, the project would enhance mobility, acting as a "pedestrian accelerator" to shorten long walking distances and reduce travel times within the PSA. The project would also serve cyclists by "bridging gaps" in the bicycle network since bicycles could be accommodated on board the vehicles.

Provide simple, localized, high frequency service

The project would provide a higher quality transit circulation service than what is currently available for travel within the PSA. As discussed earlier, transit service in downtown is primarily geared towards regional travel corridors or peak commuter service rather than local trips within downtown. The project would differ from current transit service by providing the following:

- Simple route structure: Project would provide a simple, user-friendly, intuitive route to provide a direct "one seat" connection between major downtown activity nodes.
- All-day high frequency service: Project would run approximately 18-20 hours a day, 7 days a week at headways of 10 minutes or less, and requiring no schedule for travel.
- Intermodal connections: Project would maximize connections to Metro rail and bus service and complement existing DASH service.
- Higher vehicle capacity: Project would provide a larger passenger capacity than existing bus service, creating a more comfortable ride and accommodating higher load factors from special events.
- Low-floor vehicles: Project would have low floor vehicles compliant with the Americans with Disabilities Act (ADA) to facilitate rapid and accessible boardings and alightings.
- Proof of Payment and All-Door Boarding: Project would employ a proof of payment ticket system and all-door boarding to minimize stop dwell times and ensure easy use.

Alleviate traffic and reduce parking demand

By connecting activity centers, districts, and destinations in downtown, the project would reduce the need to travel by car for trips within the PSA. The project would help promote a "park once" strategy which would better utilize existing parking resources so people would no longer need to drive within the PSA for short trips. Expanding transit coverage and circulation within the PSA encourages people to take transit into the PSA, further reducing traffic and parking demand. Additionally, the project would help relieve parking pressures in parking deficient areas like the Historic Core, and for major events at the convention center, Staples Center, Nokia Theater, and potential football stadium by linking these activity centers with downtown parking garages to better utilize existing parking capacity.

Serve transit-dependent populations

The project's expansion of transit service and coverage in downtown would improve mobility for transit-dependent populations. The PSA can be characterized as more transit dependent than Los Angeles County as a whole because of its dense population, proportionately low income levels, number of households with zero vehicles, and public transportation users. The project would enhance transit service downtown and therefore provide greater mobility to transit-dependent populations.

Improve transit accessibility

The project would use low floor and American with Disabilities Act (ADA) compliant vehicles with level boarding to improve service and mobility for seniors, disabled, families with children and strollers, and shoppers with heavy bags. The project could also accommodate bicycles on board the vehicles.

1.4.2 Support the Growth and Revitalization of Downtown Los Angeles, including its Historic Districts

- Restore historic streetcar service
- Revitalize geographically isolated, economically depressed areas
- Support smart, sustainable growth
- Foster a more livable downtown
- Encourage historic restoration and transit-oriented development
- Strengthen downtown's economic competitiveness

Restore historic streetcar service

The project would restore historic streetcar service to Downtown Los Angeles, reinstating a valuable cultural resource and attraction as well providing a new transit connection.

Revitalize geographically isolated, economically depressed areas

The project would help revitalize struggling neighborhoods by connecting them with a frequent, efficient, high quality transit service. By forging stronger physical connections between employment hubs, residential neighborhoods, arts and entertainment destinations, retail centers, and tourist attractions, the project would unify downtown into a unified destination rather than a series of fragmented areas. This connectivity would strengthen downtown's economic competitiveness and help reactivate economically depressed, geographically isolated neighborhoods.

Support smart, sustainable growth

The project would support smart and sustainable growth in population and employment which meets local, regional, and state goals to reduce greenhouse gas (GHG) emissions and oil consumption. Currently there are 11,831 housing units in planning in downtown. The project would help ensure this growth is backed by an expansion in transit services to help reduce the GHG emissions and oil consumption which would otherwise occur from increased automobile use in the area.

Foster a more livable downtown

The project would help make downtown a more livable, attractive environment by increasing the frequency, reliability, connectivity, and accessibility of transit and providing a wider variety of transportation choices. The project would foster a more vibrant pedestrian environment and improve access to currently isolated neighborhoods.

Encourage historic restoration and transit-oriented development

The project would help foster a more attractive investment environment in Downtown Los Angeles to support transit oriented development (TOD) and the restoration of historic buildings. TOD is development characterized by a mixed-use, high density, and pedestrian friendly environment along the streetcar line. Presently there is over a million square feet of abandoned commercial and residential space in historic buildings in the PSA with no development or restoration plans in place, as well as significant underused land in the form of vacant lots and surface parking lots. The *Los Angeles Streetcar Economic Impact Analysis (2010)* prepared by AECOM for CRA/LA and LASI demonstrated that the permanence of a streetcar line and the enhanced mobility and connectivity it would bring would create a more attractive investment environment and lead to more TOD and building restoration over a no-streetcar scenario. The economic assessment found that a streetcar would "support and induce:

- Development of nearly 675,000 square feet of new and rehabilitated office space, with construction costs valued at $210 million
- Development of 2,600 new housing units, with construction costs valued at $730 million, providing housing for 3,600 new residents
- 7,200 new construction jobs over the development period, with employee compensation of approximately $500 million
- 2,100 new permanent office, retail, entertainment, and hotel jobs with employee compensation of approximately $120 million annually by the end of the study period
- 5,800 new hotel room nights from new convention and business visitors

- New retail, restaurant, hotel, and entertainment spending reaching up to $24.5 million annually over the course of the development period
- $47 million in cumulative City of Los Angeles tax revenues during the 25-year development period"

Strengthen downtown's economic competitiveness

The project would strengthen downtown's economic competitiveness as a place to live and work. Economic competitiveness was evaluated in the economic impact analysis of the project relative to employment, labor, income, and value added. An economic impact analysis was completed as part of the project's TIGER (Transportation Investment Generating Economic Recovery) III application16. The Minnesota IMPLAN (IMpact analysis for PLANning) Group's input-output model was used to estimate the direct, indirect, and induced effects of the Los Angeles Streetcar, in terms of employment, labor income, and value added.

The estimated spending on project engineering, construction, and vehicle procurement (capital expenditures) between 2012 and 2015 was used to compute short-term economic impacts, which are described below:

- The project is expected to generate 1,719 job-years during the project development phase
- The project is expected to create $143.5 million in value added, including $92.6 million in labor income
- The project is expected to create 718 cumulative job-years (42 percent of total job-years) in key industries employing low-income people by the end of 2015, bringing in an estimate of $39.3 million in labor income (the majority in the construction sector)

In addition to short-term job creation, the project is expected to generate long-term employment opportunities. Unlike those resulting from capital expenditures, these jobs are expected to exist through the useful life of the project. The annual long-term employment impacts resulting from the operation and maintenance of the project were estimated and resulted in the following:

- The project is expected to create $5.3 million in net incremental spending annually
- The project is expected to create 79 total job-years annually
- The project is expected to create 19 job-years annually in industries employing low-income workers

[16] Los Angeles Streetcar, Inc. TIGER III application; HDR Decision Economics Benefit Cost and Economic Impact Analysis

2.0 EVALUATION METHODOLOGY

This section describes the evaluation methodology for the project.

2.1 Evaluation Process

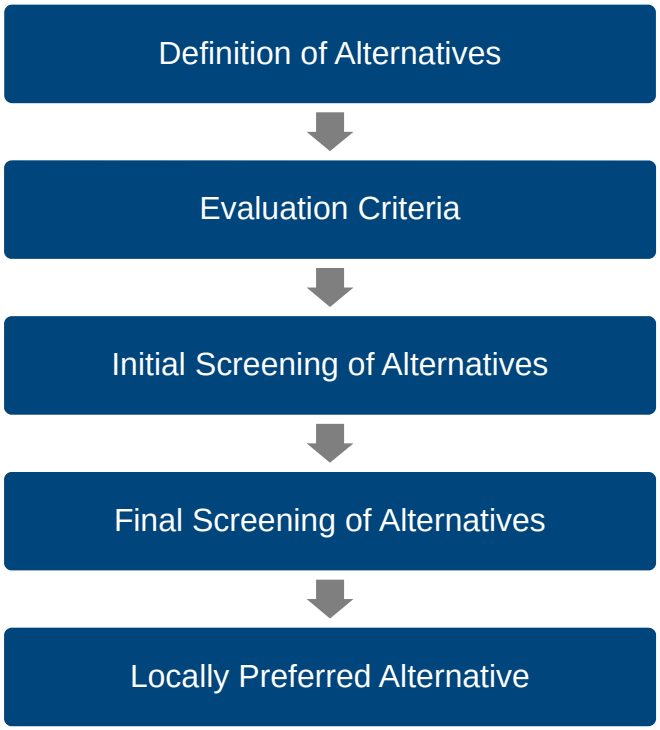
The Alternatives Analysis (AA) presents an evaluation of alternatives under consideration for the project. The alternatives were screened based on criteria developed by Metro to identify a Locally Preferred Alternative (LPA). The AA provides decision-makers the information needed to advance the project into the next phases, including environmental documentation in compliance with the National Environmental Policy Act (NEPA) and California Environmental Quality Act (CEQA), design, and construction. The evaluation process (Figure 18) included two phases: Initial Screening and Final Screening.

Initial screening included a conceptual level evaluation that analyzed the advantages and disadvantages of the alternatives considered. The initial screening included an analysis of reasonable alternatives, which were developed cooperatively by Metro, the Community Redevelopment Agency of the City of Los Angeles (CRA/LA), and Los Angeles Streetcar, Inc. (LASI). The purpose of the initial screening was to determine which of the alternatives would be the most feasible, and thereby narrow the range of alternatives considered for more detailed analysis in the final screening phase. The initial screening evaluation criteria were qualitative in nature and sought to eliminate alternatives that have fatal flaws, do not meet project goals, or do not have public support.

The final screening analyzed the list of alternatives that advanced from the initial screening. The final screening evaluation criteria were more quantitative than the criteria used for initial screening and address ridership potential, operational characteristics, cost, system configuration, design issues, environmental issues, land use and economic development opportunities, and community support. The results of the final screening culminate in the identification of a LPA.

The evaluation process does not include the analysis of maintenance and storage facility (MSF) site locations, as these will be identified separately from the preliminary identification of the LPA. This approach was taken so that the development and evaluation of alternatives was not constrained by a speculative MSF location. In order to advance the development and evaluation of streetcar alignment alternatives, potential MSF sites will be considered following preliminary identification of the LPA in this AA. LPA adoption by the Metro Board of Directors will occur prior to the start of environmental documentation. The MSF sites will be refined during the subsequent advanced conceptual engineering and environmental documentation phases.

Figure 18: Evaluation Process



2.2 Initial Screening Evaluation Criteria

The initial screening evaluation analyzed the list of reasonable alternatives considered (which were developed cooperatively by Metro, CRA/LA, and LASI) using a set of qualitative evaluation criteria. Its purpose was to eliminate alternatives that have fatal flaws, do not meet project goals, or do not have public support.

These evaluation criteria correlated to the project's two overarching goals which were generated during pubic workshops, meetings, and open houses and reflect input from public agencies, community groups, and stakeholders:

1. Enhance mobility and surface transit circulation in Downtown Los Angeles
    - Connect major districts, destinations, and activity centers
    - Improve transit coverage and circulation
    - Provide simple, localized, high frequency service
    - Alleviate traffic and reduce parking demand
    - Serve transit-dependent populations
    - Improve transit accessibility

2. Support the growth and revitalization of Downtown Los Angeles, including its historic districts
    - Restore historic streetcar service
    - Revitalize geographically isolated, economically depressed areas
    - Support smart, sustainable growth
    - Foster a more livable downtown
    - Encourage historic restoration and transit-oriented development
    - Strengthen downtown's economic competitiveness

Table 11 describes the criteria used in the initial screening analysis to evaluate potential alternatives. The alternatives were rated High, Medium, or Low for each criteria, with High meaning optimal performance and Low indicating sub-standard performance. All of the criteria were weighted equally for the initial screening.

Table 11: Initial Screening Evaluation Criteria

Criteria	Project Goal	Measurement
Length	Goal #1	What is the relative length of the alternative (the shorter alternatives receive higher scores because they have a lower capital cost)?
Connectivity	Goal #1 and #2	Does the alternative connect to the following: Union Station, Bunker Hill, Civic Center, Financial Core, Historic Core, South Park, and LASED?
Missed destinations	Goal #1 and #2	Does the alternative miss any major destinations, namely Union Station and Bunker Hill?
Required connections	Goal #1	Does the alternative require transfers, walking, or vertical circulation (stairs, escalators, etc.) to reach major destinations?
Street grade	Goal #1	Does the alternative use streets with a grade over 9 percent?
Out-of-direction travel	Goal #1	Does the alternative travel out-of-direction, which may increase passenger travel time?
Ridership potential	Goal #1	What is the relative potential of the alternative to attract riders?
Capital costs	Goal #1	What is the relative capital cost of the alternative?
Operation and maintenance cost	Goal #1	What is the relative operating and maintenance cost of the alternative?
Transit system integration	Goal #1	Does the alternative improve linkages to the regional transit network?
Expandability	Goal #1	Does the alternative include flexibility for future service expansion?
Historic integrity	Goal #2	Does the alternative use streets that had streetcar service?
Traffic delay	Goal #1	Does the alternative use intersections/streets that experience traffic delay?
Traffic and parking	Goal #1	Does the alternative require the elimination of a travel lane and/or parking?
Risks	Goal #1 Goal #2	Are there major risks (schedule, design, and construction) associated with the alternative that jeopardize the ability to implement the alternative?
Economic development	Goal #2	Does the alternative serve areas with substantial potential for future economic development (both new and revitalization of historic buildings)?
Local funding	Goal #1 and #2	What is the potential of the alternative to generate local funding since it is anticipated that a property assessment will be use for local funding?
Consistency with plans and guidelines	Goal #2	Is the alternative consistent with adopted local/regional plans and Federal guidelines (FTA project development guidelines)?
Community support	Goal #1 and #2	Is there community support for the alternative?
Fatal flaw	Goal #1	Does the alternative have a fatal flaw, such as a planning, design, environmental, or community issue that prevents implementation of the alternative?

Goal #1: Enhance mobility and surface transit circulation in Downtown Los Angeles.
Goal #2: Support the growth and revitalization of Downtown Los Angeles, including its historic districts.

2.3 Final Screening Evaluation Criteria

The alternatives that advanced from initial screening were evaluated in more detail in final screening. The final screening evaluation criteria were more quantitative than the initial screening evaluation criteria and were intended to identify a Locally Preferred Alternative (LPA). The final screening evaluation criteria were based on the following categories:

- Ridership
- Capital Costs
- Operation and Maintenance (O&M) Costs
- Cost/Benefit
- Destinations
- Circulation
- Design
- Environmental
- Economic Development

The final screening criteria evolved from the initial screening criteria. For example, while the initial screening criteria evaluated the general ridership potential of each alternative, the final screening criteria evaluated the actual ridership of each alternative based on the daily boardings and boardings per mile.

While the final screening criteria were quantitative, there was not a fixed threshold for each category. Instead, the alternatives were evaluated relative to each other using the quantitative data available. For example, there is not a fixed threshold for ridership, but rather the alternatives were evaluated relative to each other based on the daily boardings and boardings per mile.

Detailed environmental analysis would take place during the environmental documentation phase to comply with the National Environmental Policy Act (NEPA) and the California Environmental Policy Act (CEQA). The environmental documentation phase would begin after adoption of the LPA. Service planning, stop configurations, and effects to existing transit services (including transit service equity) due to streetcar implementation would also be examined during the environmental documentation phase.

Table 12 further describes the criteria used in the final screening analysis to evaluate potential alternatives.

Table 12: Final Screening Evaluation Criteria

Criteria	Description/Measurement
Ridership	What is the ridership for each alternative?
Capital costs	What is the capital cost of each alternative?
O&M costs	What is the operating and maintenance (O&M) cost of each alternative?
Cost/benefit	What is the cost/benefit of each alternative using cost per user (Annualized Capital Cost + Annualized O&M Cost / Daily Boardings)?
Destinations	What districts and destinations are served by the alternative?
Circulation	
Transit operations and facilities	What are the transit issues (transit operations, transit stops, transit integration, and expansion) associated with each alternative?
Traffic operations	What are the traffic operation issues associated with each alternative?
Bicycle/pedestrian integration	What are the bicycle/pedestrian integration issues associated with each alternative?
Design	
Physical constraints	What are the physical constraints (street grade, crossings, right-of-way, and bridge structures) of each alternative?
Transit system constraints	What are the transit system issues (track and guideway, system configuration, and expansion) associated with each alternative?
Traffic constraints	What are the traffic constraints (travel lanes and left turns) associated with each alternative?
Environmental	
Property impacts	Does the alternative require additional right-of-way?
Land Use	What are the existing and future land use implications of each alternative?
Communities and neighborhoods	Does the alternative have community and neighborhood issues?
Visual and aesthetics	Does the alternative have visual and aesthetic issues?
Historic and cultural resources	Does the alternative affect historic resources?
Parklands	Does the alternative affect parklands?
Noise and vibration	Does the alternative affect sensitive noise receptors?
Energy	Does the alternative positively or negatively affect overall energy consumption?
Hazardous materials	Does the alternative have hazardous material issues?
Public safety and security	Does the alternative have public safety and security issues?
Soils, geology and seismic	Does the alternative have soil, geology, and seismic issues?
Ecosystem and natural environment	Does the alternative affect the ecosystem and natural environment?
Water quality and hydrology	Does the alternative affect water quality and hydrology?
Air quality	Does the alternative have air quality issues?
Construction	Does the alternative have construction issues that differentiate it from the other alternatives? Does the alternative include bridge decks or structures that have construction issues (construction staging, noise, etc.)?
Economic development	What are the opportunities for economic development for each alternative?

3.0 INITIAL SCREENING OF ALTERNATIVES

This section describes the initial screening of alternatives for the project.

3.1 Initial Screening Alternatives

The Build Alternatives include the proposed improvements to reintroduce streetcar service into Downtown Los Angeles. Multiple Build Alternatives were considered for initial screening. In order to better evaluate the range of alternatives, the initial screening alternatives were divided into three segments, as shown in Figure 19:

- Segment A: North of 5th Street
- Segment B: Between 5th Street and 9th Street
- Segment C: South of 9th Street

Dividing the corridor into segments reduced the number of potential combinations that needed to be evaluated and allowed the differences between the alternatives to be clearly identified. In addition, it was easier to illustrate the alternatives by segment since the corridor is very linear.

Figure 19: Initial Screening Alternatives

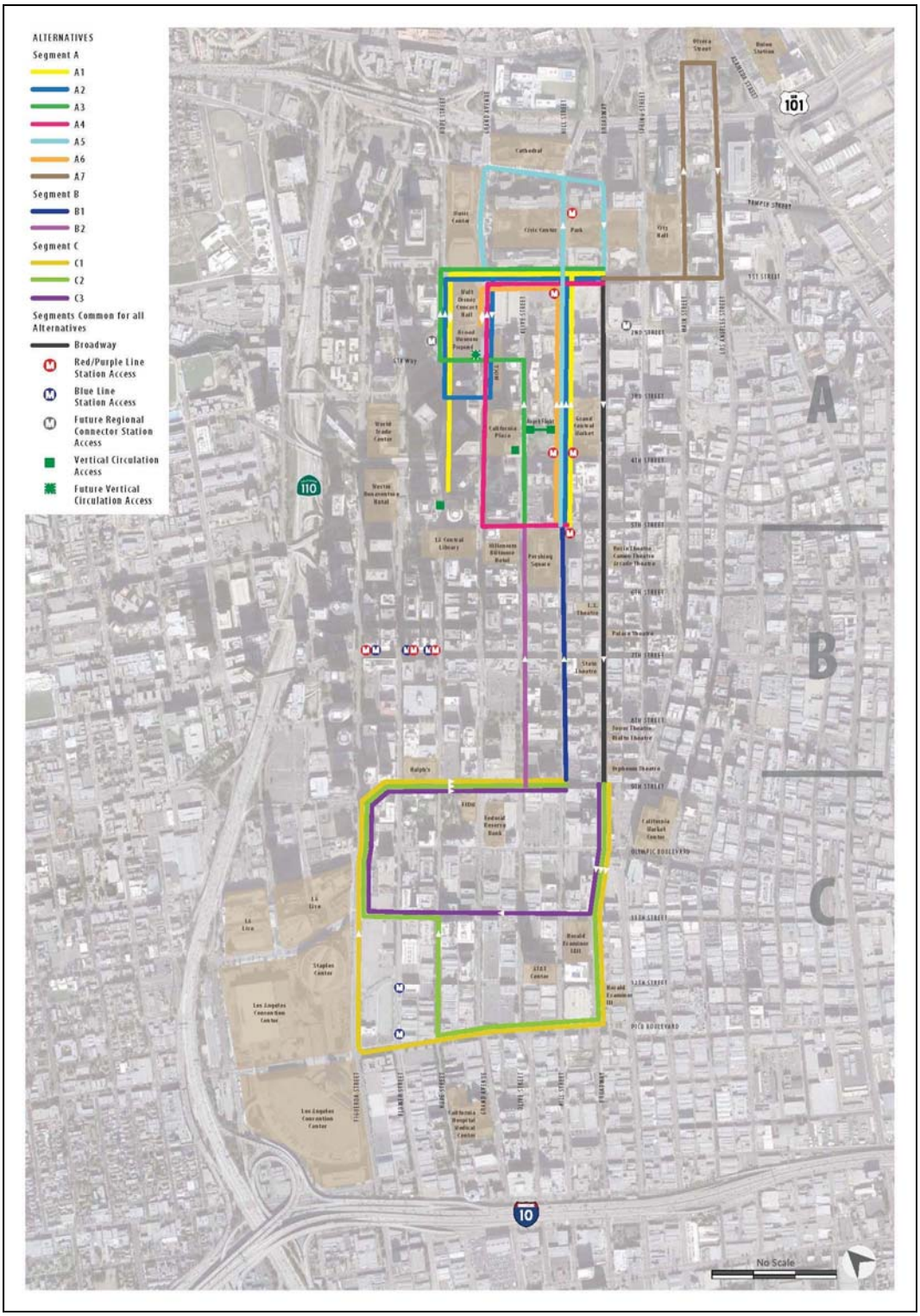


Table 13 includes a description of the initial screening alternatives by segment. The initial screening alternatives are illustrated in Figures 20 through 34. It should be noted that southbound Broadway between 1st Street and 9th Street is common for all alternatives. This is consistent with prior planning efforts which identified streetscape improvements on Broadway to complement the streetcar and meets a primary purpose and need of the project, which is to serve as a catalyst for the restoration of the Historic Broadway Theatre District.

Table 13: Description of Initial Screening Alternatives by Segment

Alt.	Description	Details
Segment A		
A1	Northbound on Hill St between 5th St and 1st St, westbound on 1st St between Hill St and Hope St, two-way on Hope St between 1st St and Hope Pl, and eastbound on 1st between Hope St and Broadway.	– Uses Broadway/Hill St couplet. – Uses 1st St and Hope St to access Bunker Hill. – Two-way segment on Hope St between 1st St and Hope St could be single track. – Serves Bunker Hill. – Does not serve Union Station.
A2	Northbound on Hill St between 5th St and 1st St, westbound on 1st St between Hill St and Grand Ave, southbound on Grand Ave between 1st St and 3rd St, westbound on 3rd St between Grand Ave and Hope St, northbound on Hope St between 3rd St and 1st St, and eastbound on 1st St between Hope St and Broadway.	– Uses Broadway/Hill St couplet. – Uses 1st St and a Grand Ave/3rd St/Hope St clockwise loop to access Bunker Hill. – Serves Bunker Hill. – Does not serve Union Station.
A3	Northbound on Olive St between 5th St and General Thad Kosciuszko (GTK) Way, westbound on GTK Way between Olive St and Hope St, northbound on Hope St between GTK Way and 1st St, and eastbound on 1st St between Hope St and Broadway.	– Uses Olive Street and GTK Way to access Bunker Hill. – GTK Way passes under Grand Ave bridge deck. – Serves Bunker Hill. – Does not serve Union Station. – Forms a continuous loop.
A4	Westbound on 5th St between from Hill St or Olive St to Grand Ave, northbound on Grand Ave between 5th St and 1st St, and eastbound on 1st St between Grand Ave and Broadway.	– Uses Grand Ave (14% grade). – Requires custom vehicle technology and operation because of 14% grade on Grand Ave. – Risk to determine grade solution (feasibility cannot be determined until final design). – Creates one-way clockwise loop. – Serves Bunker Hill. – Does not serve Union Station. – Forms a continuous loop.

Note: Southbound Broadway between 1st Street and 9th Street is common for all alternatives.

Table 13 (Continued): Description of Initial Screening Alternatives by Segment

Alt.	Description	Details
A5	Northbound on Hill St between 5th St and Temple St, westbound on Temple St between Hill St and Grand Ave, two-way on Grand Ave between Temple St and 1st St, eastbound on Temple St between Grand Ave and Broadway, and southbound on Broadway between Temple St and 1st St.	– Uses Broadway/Hill St couplet. – Uses Temple St and Grand Ave to access Bunker Hill. – Two-way segment on Grand Ave between Temple St and 1st St could be single track. – Serves Bunker Hill. – Does not serve Union Station.
A6	Northbound on Hill St between 5th St and 1st St, westbound on 1st St between Hill St and Grand Ave, two-way on Grand Ave between 1st St and the Grand Ave bridge deck just north of 2nd St, and eastbound on 1st St between Grand Ave and Broadway.	– Uses Broadway/Hill St couplet. – Uses 1st St and Grand Ave to access Bunker Hill. – Two way segment on Grand Ave could be single track, as could the track on 1st St. – Serves Bunker Hill. – Does not serve Union Station.
A7	Eastbound on 1st St between Hill St and Main St, northbound on Main St between 1st St and Paseo de la Plaza, southbound on Los Angeles St between Paseo de la Plaza and 1st Street, and westbound on 1st St between Los Angeles Street and Broadway.	– Uses Broadway/Hill St couplet. – Uses Main St/Los Angeles St couplet to access Union Station. – Crosses U.S. 101 freeway. – Serves Union Station. – Does not serve Bunker Hill. – Forms a continuous loop.
Segment B		
B1	Northbound on Hill St between 9th St and 5th St.	– Uses Broadway/Hill St couplet. – Uses peak hour travel lane/off peak parking lane on Hill St (one or the other would need to be eliminated since they currently share the same travel lane).
B2	Northbound on Olive St between 9th St and 5th St	– Uses Broadway/Olive St couplet.
Segment C		
C1	Southbound on Broadway, westbound on Pico Blvd, northbound on Figueroa, eastbound on 9th St.	– Can use Broadway/Hill St or Broadway/Olive St couplet. – Crosses Blue Line at grade at Pico Blvd.
C2	Southbound on Broadway, westbound on Pico Blvd, northbound on Hope St, westbound on 11th St, northbound on Figueroa St, eastbound on 9th St.	– Can use Broadway/Hill St or Broadway/Olive St couplet. – Does not cross Blue Line at grade.
C3	Southbound on Broadway, westbound on 11th St, northbound on Figueroa St, eastbound on 9th St.	– Can use Broadway/Hill St or Broadway/Olive St couplet. – Does not cross Blue Line at grade.

Note: Southbound Broadway between 1st Street and 9th Street is common for all alternatives.

Figure 20: Segment A: North of 5th Street

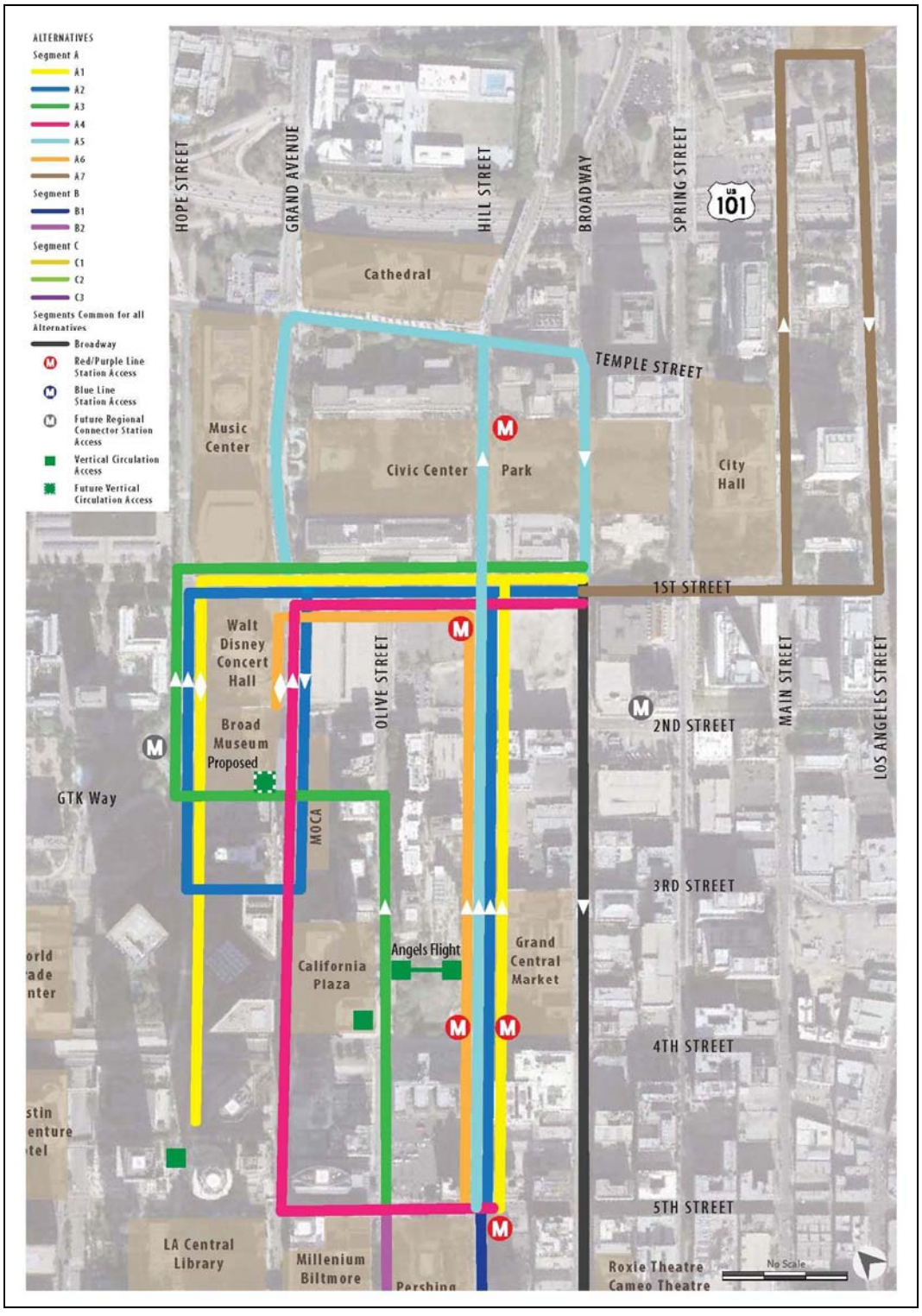


Figure 21: Alternative A1

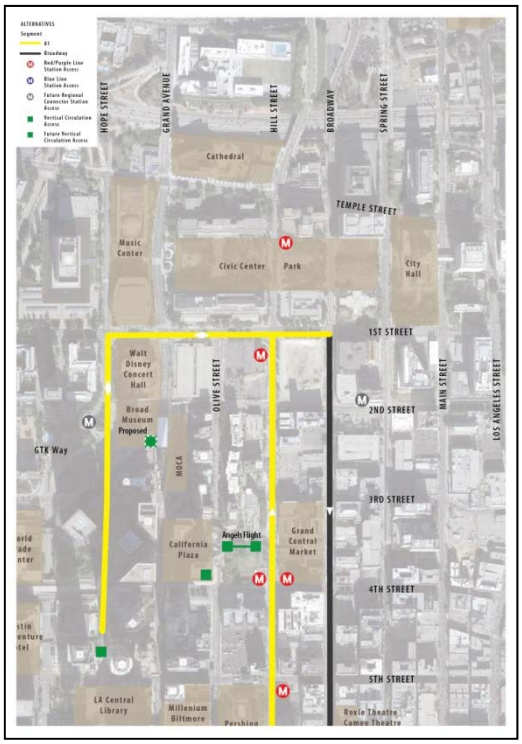


Figure 22: Alternative A2

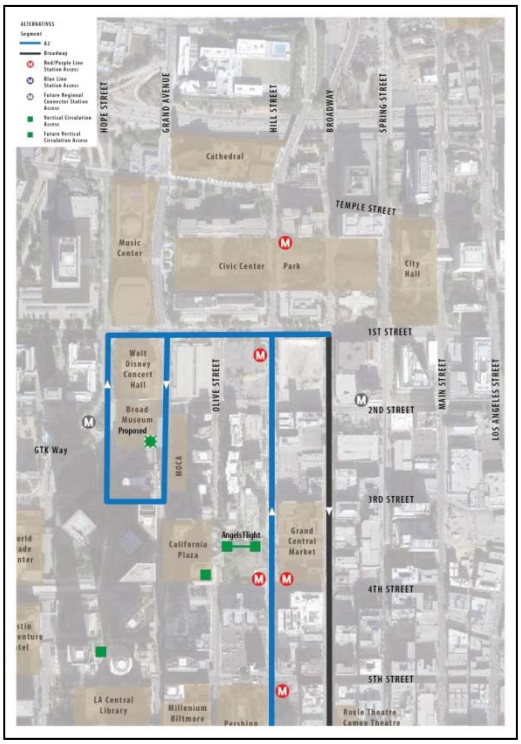


Figure 23: Alternative A3

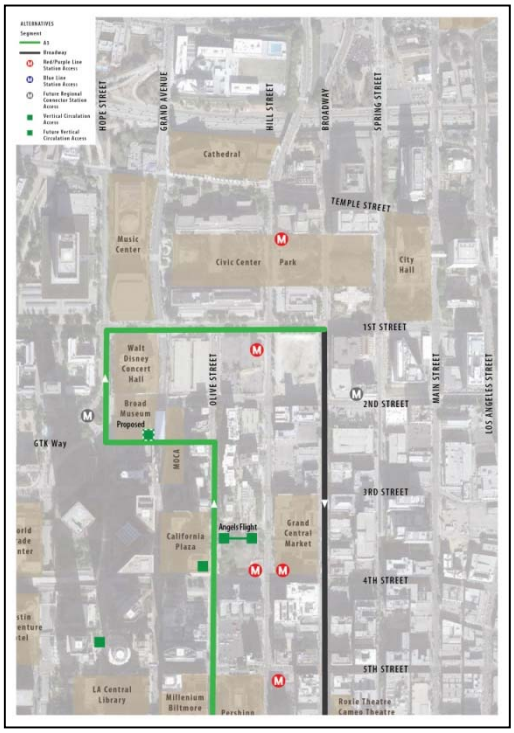


Figure 24: Alternative A4

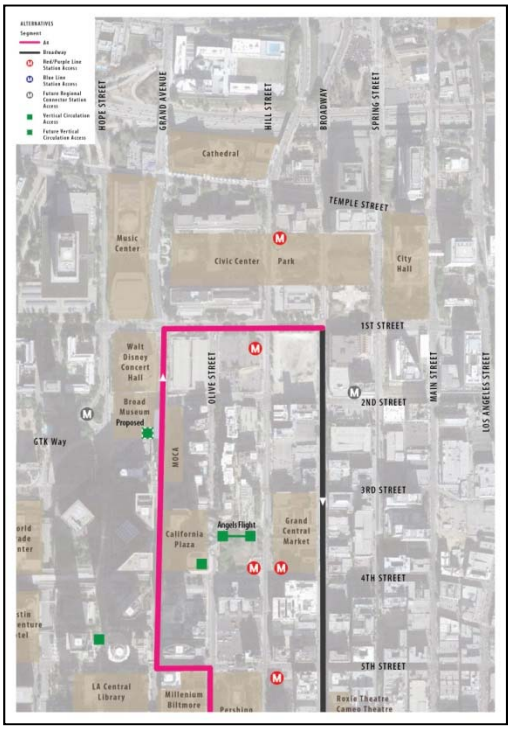


Figure 25: Alternative A5

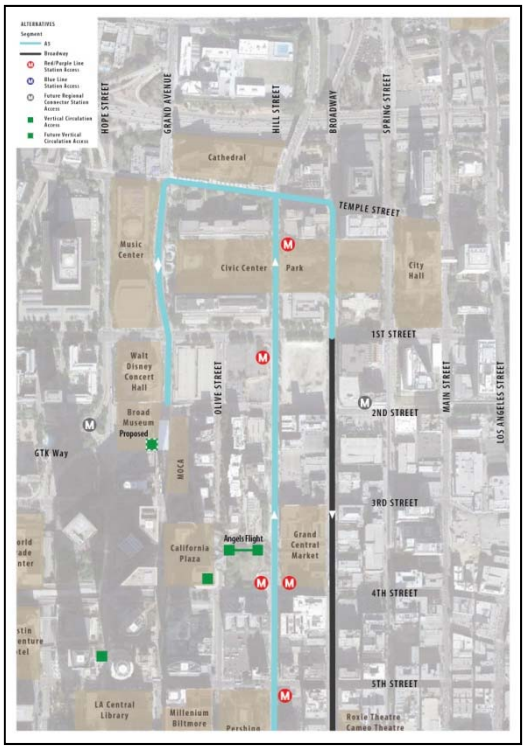


Figure 26: Alternative A6

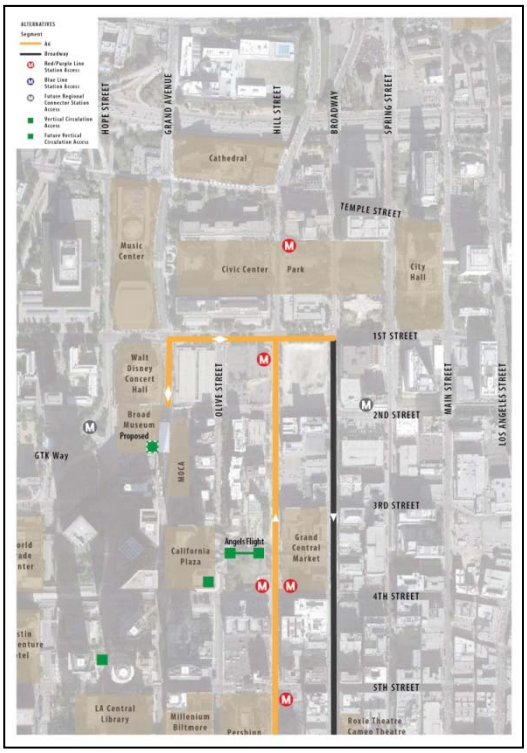


Figure 27: Alternative A7

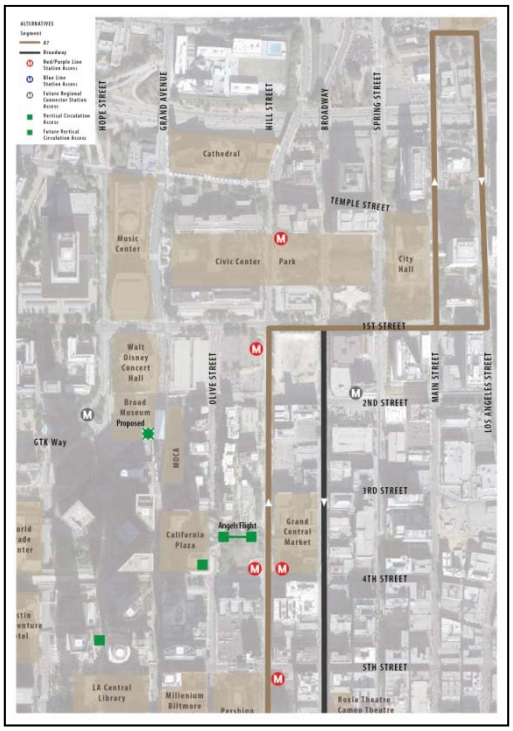


Figure 28: Segment B: Between 5th Street and 9th Street

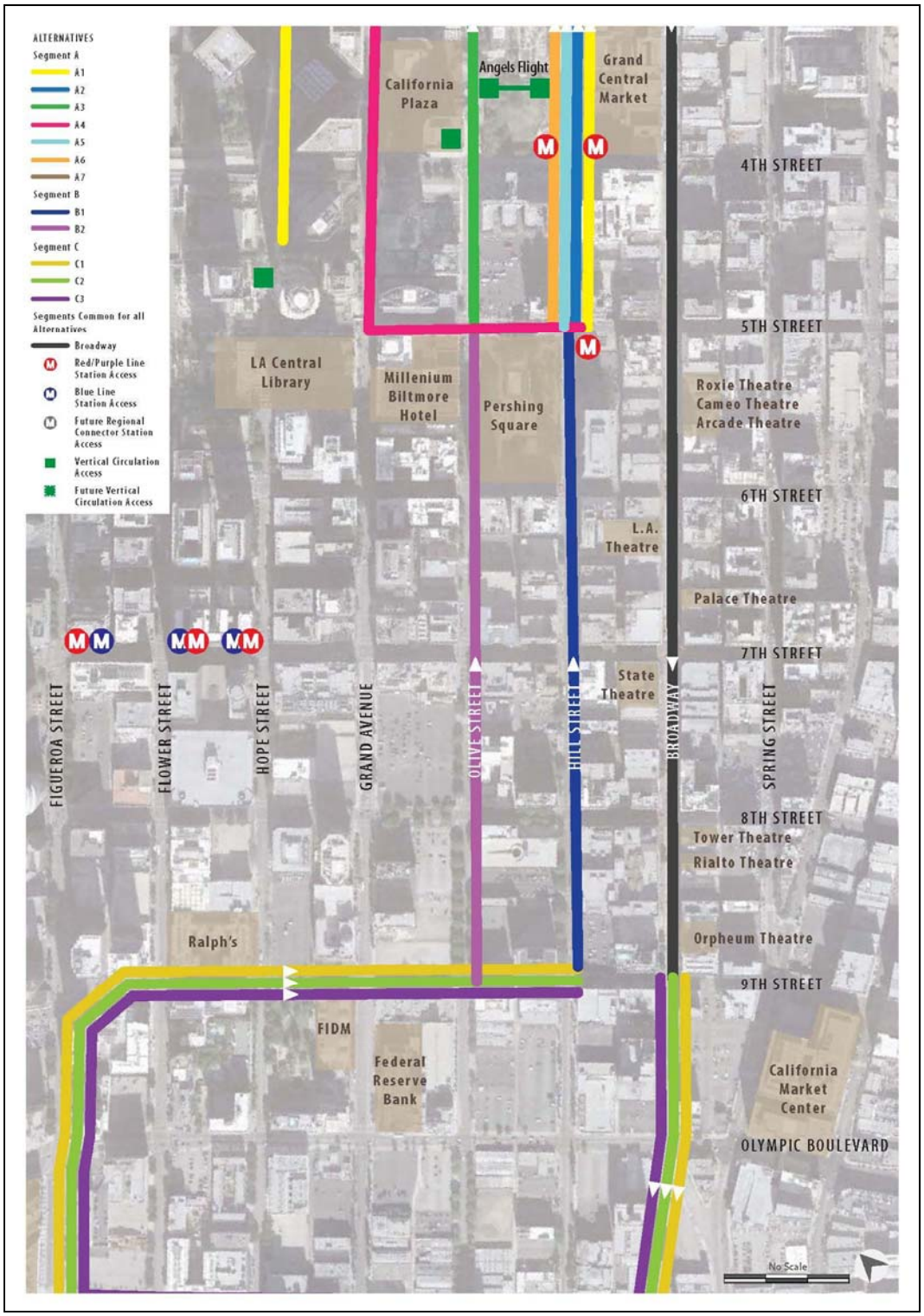


Figure 29: Alternative B1

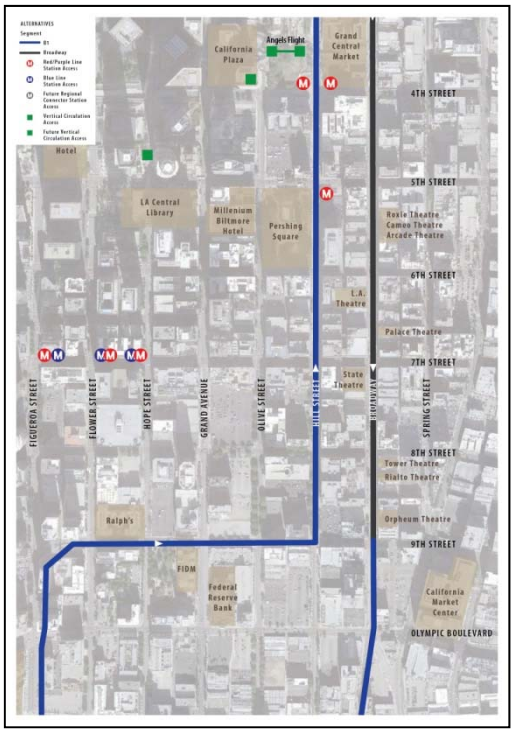


Figure 30: Alternative B2

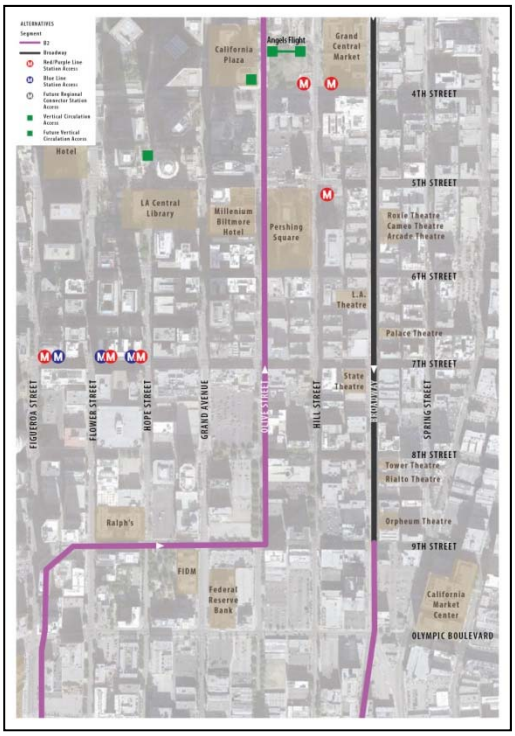


Figure 31: Segment C: South of 9th Street

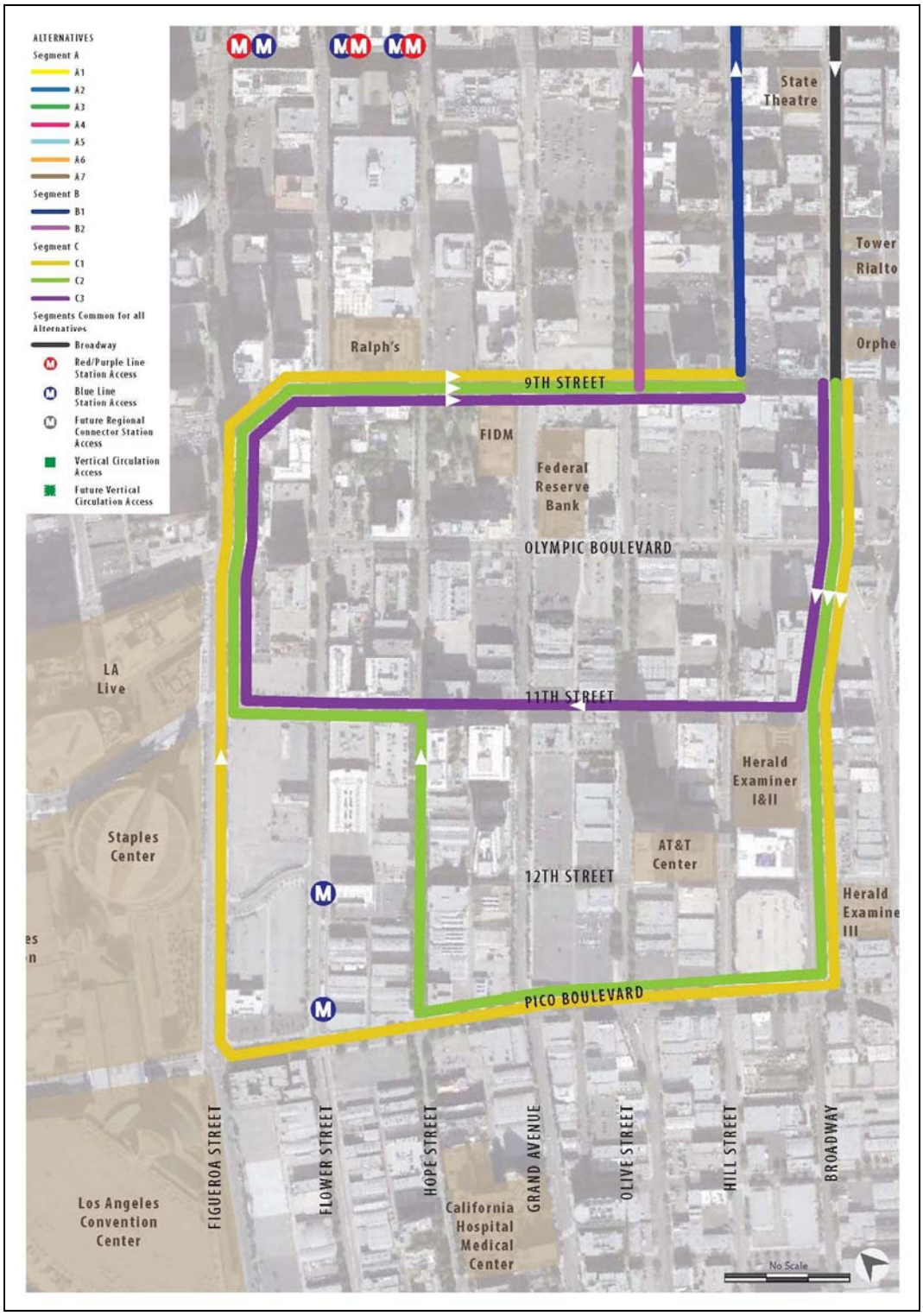


Figure 32: Alternative C1

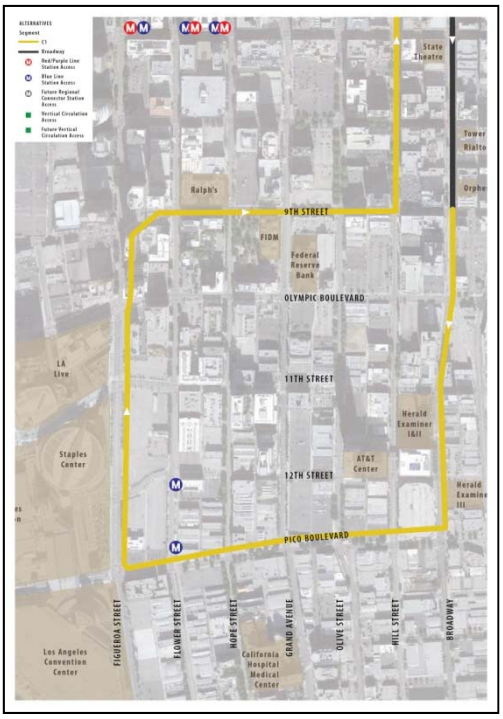


Figure 33: Alternative C2

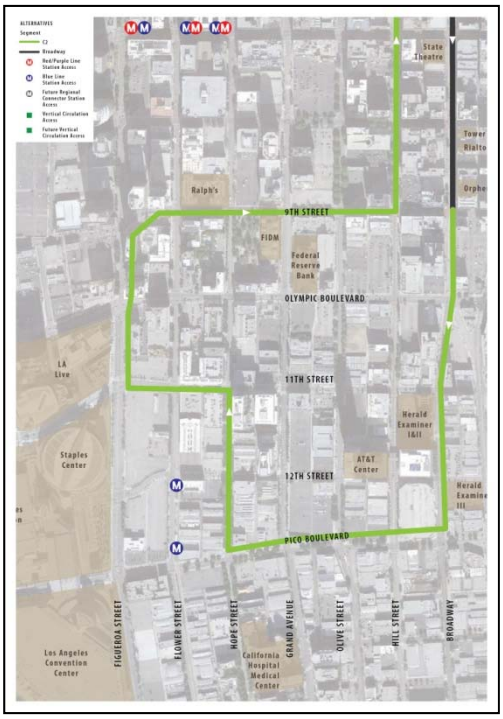
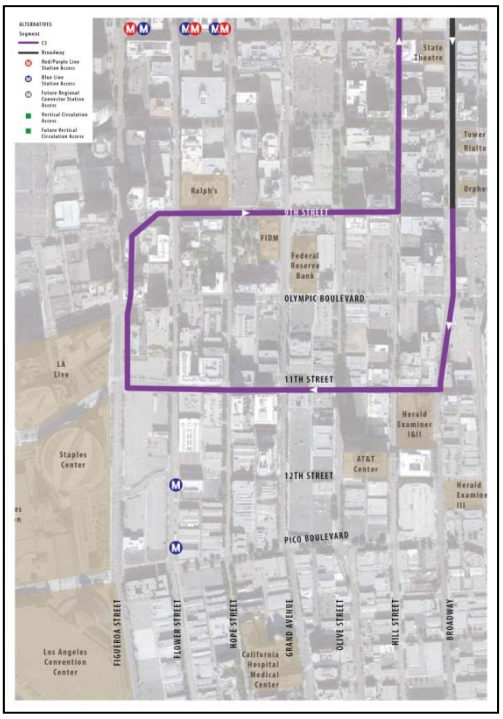


Figure 34: Alternative C3



3.2 Initial Screening Evaluation

This section includes the initial screening evaluation for Segments A, B, and C. The alternatives were rated High (1), Medium (2), or Low (3) for each criteria, with High (1) meaning optimal performance and Low (3) indicating sub-standard performance. All of the criteria were weighted equally for the initial screening. Overall, the lower the score equals the higher the performance of the alternative. Tables 14 through 16 show the results of the initial screening for Segments A, B, and C, respectively. Table 17 presents a comparison of the advantages and disadvantages of the alternatives.

Table 14: Initial Screening - Segment A

Criteria	A1	A2	A3	A4	A5	A6	A7	Details
Length	2	2	1	1	2	1	2	– A3, A4, and A6 are the shortest alignments. – A1 and A7 are the longest alignments.
Connectivity	1	1	3	2	1	1	1	– A3 and A4 create wide loops that do not serve the north end of Historic Broadway effectively because they require out of direction travel to get there from south.
Missed destinations	2	2	2	2	2	2	2	– A1, A2, A3, A4, A5, and A6 do not serve Union Station. – A7 does not serve Bunker Hill.
Required connections	2	2	3	2	2	2	1	– A3 requires vertical circulation at Grand Ave. – A3 does not serve Angels Flight. – A1, A2, A3, A4, A5, and A6 require a transfer to reach Union Station.
Street grade	2	2	2	3	1	2	1	– A1, A2, A3, A4, and A6 have grade issues on 1st St (9%). – A3 has a grade issue on Olive St (9%). – A4 has a grade issue on Grand Ave (14%). – A5 and A7 have no grade issues.
Out-of-direction	2	2	3	2	3	1	1	– A1, A2, and A4 travel slightly out-of-direction to serve Bunker Hill. – A3 travels below Grand Ave which requires vertical circulation. – A5 travels out-of-direction by using Temple St as an alternative to 1st St. – A6 and A7 do not travel out-of-direction.

High (1) = Optimal Performance, Medium (2) = Moderate Performance, and Low (3) = Substandard Performance.

Table 14 (Continued): Initial Screening - Segment A

Criteria	A1	A2	A3	A4	A5	A6	A7	Details
Ridership potential	1	1	3	1	2	1	1	– A3 and A5 have the lowest ridership potential because they are confusing to the passenger and miss destinations and connections. – A1, A2, A4, and A6 have good ridership potential because they serve more destinations and make more connections – A7 has the highest ridership potential because it serves Union Station.
Capital costs	2	2	3	3	2	1	2	– A6 has the lowest capital cost because it is the shortest and most simple alignment. – A4 has the highest capital cost because it requires custom technology.
O&M cost	2	2	2	1	2	1	2	– A6 has the lowest O&M cost because it is the shortest and most simple alignment.
Transit integration	1	1	3	1	2	1	1	– A1, A2, A3, A4, and A6 serve the Regional Connector station at 2nd St and Hope St. – A1, A2, A5, A6, and A7 serve the Regional Connector station at 2nd St and Broadway and the Red Line/Purple Line Pershing Square and Civic Center stations. – A3 does not serve Angels Flight. – A3 requires a vertical circulation element at Grand Ave for transit integration. – A1, A2, A3, A4, A5, and A6 require a transfer to reach Union Station.
Expandability	3	2	2	2	2	1	1	– A1 terminates at Hope Pl and cannot be expanded. – A2, A3, and A4 have limited expansion opportunities because how they serve Bunker Hill. – A6 and A7 have the most flexibility for expansion because they are simple, linear alignments.

High (1) = Optimal Performance, Medium (2) = Moderate Performance, and Low (3) = Substandard Performance.

Table 14 (Continued): Initial Screening - Segment A

Criteria	A1	A2	A3	A4	A5	A6	A7	Details
Historic integrity	2	2	2	2	1	1	1	– A1, A2, A3, and A4 serve Bunker Hill which did not have historic streetcar service. – A5, A6, and A7 serve streets that were part of the historic streetcar system.
Traffic delay	1	1	1	1	1	1	1	– A1, A2, A3, A4, A5, A6, and A7 use intersections and street segments with similar traffic characteristics.
Traffic and parking	2	2	2	2	2	2	2	– A1, A2, A3, A4, A5, A6, and A7 have similar traffic and parking characteristics.
Risks	1	2	3	2	1	1	2	– A1, A2, and A3 have risk because they must follow Regional Connector construction on Hope St which would delay the project – A2 has risk because of bridge deck on Hope St over 4th St. – A3 has risk because of vertical clearance on Olive St. – A4 has a risk because of the 14% grade on Grand Ave, since the feasibility cannot be determined until further research is completed.
Economic development	1	1	3	1	2	1	2	– A1, A2, and A6 have the most economic development potential because they serve Bunker Hill. – A5 and A7 have less economic development potential because they serve more civic buildings. – A3 has the least economic development potential because of its alignment on Olive St and GTK Way.
Local funding	1	1	2	1	2	2	2	– A1, A2, A3, and A6 have the most local funding potential because they serve Bunker Hill. – A5 and A7 have less funding potential because the serve more civic buildings. – A3 has less funding potential because of its alignment on Olive St and GTK Way.

High (1) = Optimal Performance, Medium (2) = Moderate Performance, and Low (3) = Substandard Performance.

Table 14 (Continued): Initial Screening - Segment A

Criteria	A1	A2	A3	A4	A5	A6	A7	Details
Consistency with plans and guidelines	1	1	3	1	1	1	1	– A1, A2, A4, A5, A6, and A7 include segments that have been previously identified as potential streetcar alignments in local and regional plans. – A3 has not been identified previously because of its operation on GTK Way.
Community support	2	2	3	1	2	1	1	– A4, A6, and A7 received the most support at the public scoping meeting and public workshops. – A1, A4, and A6 received support for serving Bunker Hill. – A7 received support for serving Union Station.
Fatal flaw	3	3	3	1	1	1	1	– A1, A2, and A3 have a fatal flaw because they must follow Regional Connector construction on Hope St which would delay the project. This schedule delay is considered a fatal flaw since it would delay project implementation until 2019. It could also jeopardize the ability to establish a benefit assessment district, which would provide local funding for the project.
Total	**34**	**34**	**49**	**32**	**34**	**25**	**28**	**– The lower the score equals the higher the performance of the alternative.**

High (1) = Optimal Performance, Medium (2) = Moderate Performance, and Low (3) = Substandard Performance.

Table 15: Initial Screening - Segment B

Criteria	B1	B2	Details
Length	1	1	– B1 and B2 are the same length.
Connectivity	1	1	– B1 and B2 serve the same districts because they are one block apart.
Missed destinations	1	1	– B1 and B2 serve similar destinations because they are one block apart.
Required connections	1	2	– B1 is a one block couplet and Hill St is served by Red/Purple Line Pershing Square station. – B2 is a two block couplet and Olive St is one block away from Red/Purple Line Pershing Square station.
Street grade	1	1	– B1 and B2 have no grade issues.
Out-of-direction	1	1	– B1 and B2 do not travel out of direction.
Ridership potential	1	1	– B1 and B2 have similar ridership potential because they are one block apart.
Capital costs	1	1	– B1 and B2 have similar capital costs because they are the same length.
O&M cost	1	1	– B1 and B2 have similar O&M costs because they are the same length.
Transit integration	1	1	– B1 and B2 have similar opportunities for transit integration.
Expandability	1	1	– B1 and B2 have the same potential for expansion.
Historic integrity	1	2	– B1 and B2 previously had streetcar service, although it was only for one block on Olive St.
Traffic delay	2	2	– B1 and B2 intersections and street segments are characterized by peak hour delay and high transit and pedestrian volumes.
Traffic and parking	2	2	– B1 and B2 have shared peak hour travel/off peak parking lanes that would need to be modified by either eliminating the peak hour travel lane (between 4pm and 7pm) and preserving the on-street parking all day or eliminating the on-street parking and preserving the travel lane all day.
Risks	2	1	– B1 has medium risk because of the elimination of the shared peak hour travel/off peak parking lanes.
Economic development	1	1	– B1 and B2 have similar potential for economic development because they have similar coverage and density.
Local funding	1	1	– B1 and B2 have similar potential for local funding through property assessments because they have similar coverage.
Plans and guidelines	1	1	– B1 and B2 have both been identified in plans and guidelines as potential streetcar alignments.
Community support	1	2	– B1 received more support than B2 at the public scoping meeting and project workshops.
Fatal flaw	1	1	– B1 and B2 do not have any fatal flaws.
Total	***23***	***25***	**The lower the score equals the higher the performance of the alternative.**

High (1) = Optimal Performance, Medium (2) = Moderate Performance, and Low (3) = Substandard Performance.

Table 16: Initial Screening - Segment C

Criteria	C1	C2	C3	Details
Length	2	2	1	– C1 and C2 are the same length while C3 is a shorter alignment.
Connectivity	2	2	2	– C1, C2, and C3 serve the same districts.
Missed destinations	2	2	2	– C1 does not serve the heart of South Park. – C2 and C3 do not serve the front door of the Convention Center. – C3 does not serve California Hospital Medical Center.
Required connections	2	2	2	– C1 is two blocks from the heart of South Park. – C2 and C3 are two blocks from the Convention Center. – C3 is one block away from the Blue Line Pico station
Street grade	1	1	1	– C1, C2, and C3 have no grade issues.
Out-of-direction	2	2	1	– C1 and C2 require more out-of-direction travel because the distance is longer between 9th St and Pico Blvd. – C3 requires less out-of-direction travel because the distance is shorter between 9th St and 11th St.
Ridership potential	1	1	1	– C1, C2, and C3 have similar ridership potential, but different ridership characteristics (C1 and C2 serve more special event locations while C3 is more neighborhood focused).
Capital costs	2	2	1	– C1 and C2 have higher capital costs because they are longer alignments than C3. – C1 would require automatic train control.
O&M cost	2	2	1	– C1 and C2 have higher O&M costs because they are longer alignments than C3. – C1 would require automatic train control.
Transit integration	1	2	2	– C1 serves the Blue Line Pico station. – C2 and C3 are one block away from the Blue Line Pico station.
Expandability	1	1	1	– C1, C2, and C3 have similar potential for expansion because they are all one way loop alignments.
Historic integrity	1	1	1	– C1, C2, and C3 previously had streetcar service for all segments.
Traffic delay	2	2	1	– C1, C2, and C3 would be subject to traffic delay on Figueroa St during peak hour and special events. – C2 and C3 bypass the at-grade Blue Line crossing by using 11th St.
Traffic and parking	2	2	2	– C1, C2, and C3 have similar characteristics for traffic and parking.
Risks	2	1	1	– C1 is higher risk because of the at-grade Blue Line crossing.
Economic development	1	1	2	– C1 and C2 have similar potential for economic development because they serve more areas of South Park and serve underutilized parcels on Pico Blvd. – C3 has less potential for economic development because it is a shorter alignment and 11th St is relatively built out.

High (1) = Optimal Performance, Medium (2) = Moderate Performance, and Low (3) = Substandard Performance.

Table 16 (Continued): Initial Screening - Segment C

Criteria	C1	C2	C3	Details
Local funding	1	1	2	– C1 and C2 have similar potential for local funding through property assessments because they have similar coverage. – C3 has less potential for local funding because it serves a smaller geographic area.
Plans and guidelines	1	2	1	– C1 and C3 have been identified in plans and guidelines as potential streetcar alignments.
Community support	1	2	1	– C1 and C3 received more support than C1 at the public scoping meeting and project workshops.
Fatal flaw	1	1	1	– C1, C2, and C3 do not have any fatal flaws.
Total	**30**	**32**	**27**	**The lower the score equals the higher the performance of the alternative.**

High (1) = Optimal Performance, Medium (2) = Moderate Performance, and Low (3) = Substandard Performance.

Table 17 provides a general description of the advantages and disadvantages of the initial screening alternatives.

Table 17: Advantages/Disadvantages of Initial Screening Alternatives

Alt.	Advantages	Disadvantages
Segment A		
A1	– Linear connection through Bunker Hill. – Serves south end of Bunker Hill. – Preserves Broadway/Hill St couplet, which is more user friendly for passenger. – Connects to Regional Connector station at 2nd St and Hope St. – Serves short trips between Library and Regional Connector station at 2nd St and Hope St. – Avoids bridge deck on Grand Ave, which requires special track construction. – More property assessment opportunities, given adjacent density.	– Must follow Regional Connector construction, which may delay implementation. – Requires reconstruction of Hope St. – 9% grade on 1st St. – Serves "back door" of buildings on Hope St. – Cannot be extended south from terminus on Hope St. – Out of direction travel to Bunker Hill by going north to 1st St, then south on Hope St to Bunker Hill. – Requires special track construction on Grand Avenue Bridge deck. – Hope St is not a historic streetcar route.
A2	– Preserves Broadway/Hill St couplet. – Connects to Regional Connector station at 2nd St and Hope St. – Serves "front door" of buildings on Grand Ave.	– Must follow Regional Connector construction, which may delay implementation. – Requires reconstruction of Hope St. – 9% grade on 1st St. – Requires special track construction on Grand Avenue Bridge deck. – Must cross 3rd St tunnel. – Additional track miles with no new attractions. – Out-of-direction travel to Bunker Hill by going north to 1st St, then south on Grand Ave. – Hope St and Grand Ave are not historic streetcar routes.

Table 17 (Continued): Advantages/Disadvantages of Alternatives

Alt.	Advantages	Disadvantages
A3	– Serves south end of Bunker Hill, including Wells Fargo Center and Library. – Connects to Regional Connector station at 2nd St and Hope St. – Avoids bridge deck on Grand Ave, which otherwise requires special track construction. – Serves more buildings, resulting in more potential property assessments opportunities, given adjacent density (Olive St is closer to the Financial District).	– Must follow Regional Connector construction, which may delay implementation. – Requires reconstruction of Hope St. – 9% grade on 1st St and Olive St. – Tunnel operation on GTK Way, which creates additional design constraints (site distance, lighting, vertical clearance). – Existing pedestrian environment in tunnel is poor (limited visibility, poor lighting, and narrow sidewalks). – Dependent on vertical circulation elements Grand Ave. – Does not connect to Angels Flight. – Wide loop/couplet, which is less user friendly for passenger. – Serves "back door" of buildings and service entrances on Olive St, GTK Way, and Hope St. – Vertical clearance issues at California Plaza. – Olive St is not a historic streetcar route.
A4	– Linear connection through Bunker Hill. – Serves south end of Bunker Hill. – Serves "front door" of buildings on Grand Ave. – More property assessment opportunities, given adjacent density. – Identified in prior studies.	– 14% grade on Grand Ave and 9% grade on 1st St . – Requires special track construction on Grand Avenue Bridge deck. – Requires custom vehicle technology and operation (cog or cable) because of 14% grade on Grand Ave. – Risk to determine grade solution (feasibility cannot be determined until final design). – Wide loop/couplet.
A5	– Avoids grade issues on 1st St to Bunker Hill (approximately 5% on Temple St vs. 9% on 1st St). – Serves additional attractions north of 1st St, including Civic Center, County Administration Buildings, Courthouses, Music Center, Cathedral, and future Civic Park. – Preserves Broadway/Hill St couplet.	– Out of direction travel by going north to 1st St, then south on Grand to Bunker Hill. – May lose through ridership with deviation. – Adjacent government properties cannot provide revenue through property assessments.

Table 17 (Continued): Advantages/Disadvantages of Alternatives

Alt.	Advantages	Disadvantages
A6	– Shortest and most direct connection to Bunker Hill. – Lowest capital cost because it is the shortest distance. – No design flaws. – Preserves Broadway/Hill St couplet, which is user friendly. – Potential for two-way single track on Grand Ave. – Avoids bridge deck on Grand Ave, which requires special track construction. – Serves "front door" of buildings on Grand Ave.	– 9% grade on 1st St. – Fewer property assessment opportunities, given adjacent density. – Does not stop in front of California Plaza or Library.
A7	– Serves Union Station, City Hall, and Olvera St. – Linear connection. – Potential for future extension through Chinatown. – Obvious corridor and connection. – No out-of-direction travel. – Serves regional trips. – Preserves Broadway/Hill St couplet.	– Must cross freeway. – Adjacent government properties cannot provide revenue through property assessments. – Does not serve Bunker Hill. – Serves same activity centers as Red/Purple Line and Regional Connector.
Segment B		
B1	– Preserves Broadway/Hill St couplet. – 1 block couplet. – Simple alignment. – Works well with Metro buses. – Closer to Spring St/Main St and growing residential population.	– Shared parking lane. – Potential trade-off between parking and peak capacity.
B2	– Closer to Financial Core. – Pairs up best with some Bunker Hill alternatives.	– Wide couplet. – Northbound does not serve Broadway effectively. – Less obvious to passenger because couplet is 2 blocks apart. – Farther from Spring St/Main St and growing residential population.

Table 17 (Continued): Advantages/Disadvantages of Alternatives

Alt.	Advantages	Disadvantages
Segment C		
C1	– Economic development potential because of underutilized properties on Pico Blvd. – Serves front door of Convention Center. – Serves more areas of South Park compared to an alternative on 11th St. – Serves California Hospital Medical Center.	– Blue Line grade crossing at Pico Blvd. – Additional mileage (approximately 0.5 miles) to serve Pico Blvd versus 11th St. – Impacts from special events at Staples Center, etc. – Figueroa St congestion during peak hours and special events.
C2	– Serves both Pico Blvd and 11th St. – Economic development potential in underutilized areas on Pico Blvd. – Serves more areas of South Park compared to an alternative on 11th St. – Serves California Hospital Medical Center.	– Additional mileage (approximately 0.5 miles) to serve Pico Blvd versus 11th St. – Does not serve "front door" of Convention Center. – 2 additional turns compared to and alternative using only Pico Blvd or 11th St. – Figueroa St congestion during peak hour and special events.
C3	– Most direct. – Shorter alignment. – Serves existing activity centers and future residential development on 11th St. – Lowest cost capital cost because it is the shortest distance.	– Less economic development potential. – Does not serve area around Pico Blvd. – Impacts from special events at Staples Center, etc. – Figueroa St congestion during peak hour and special events.

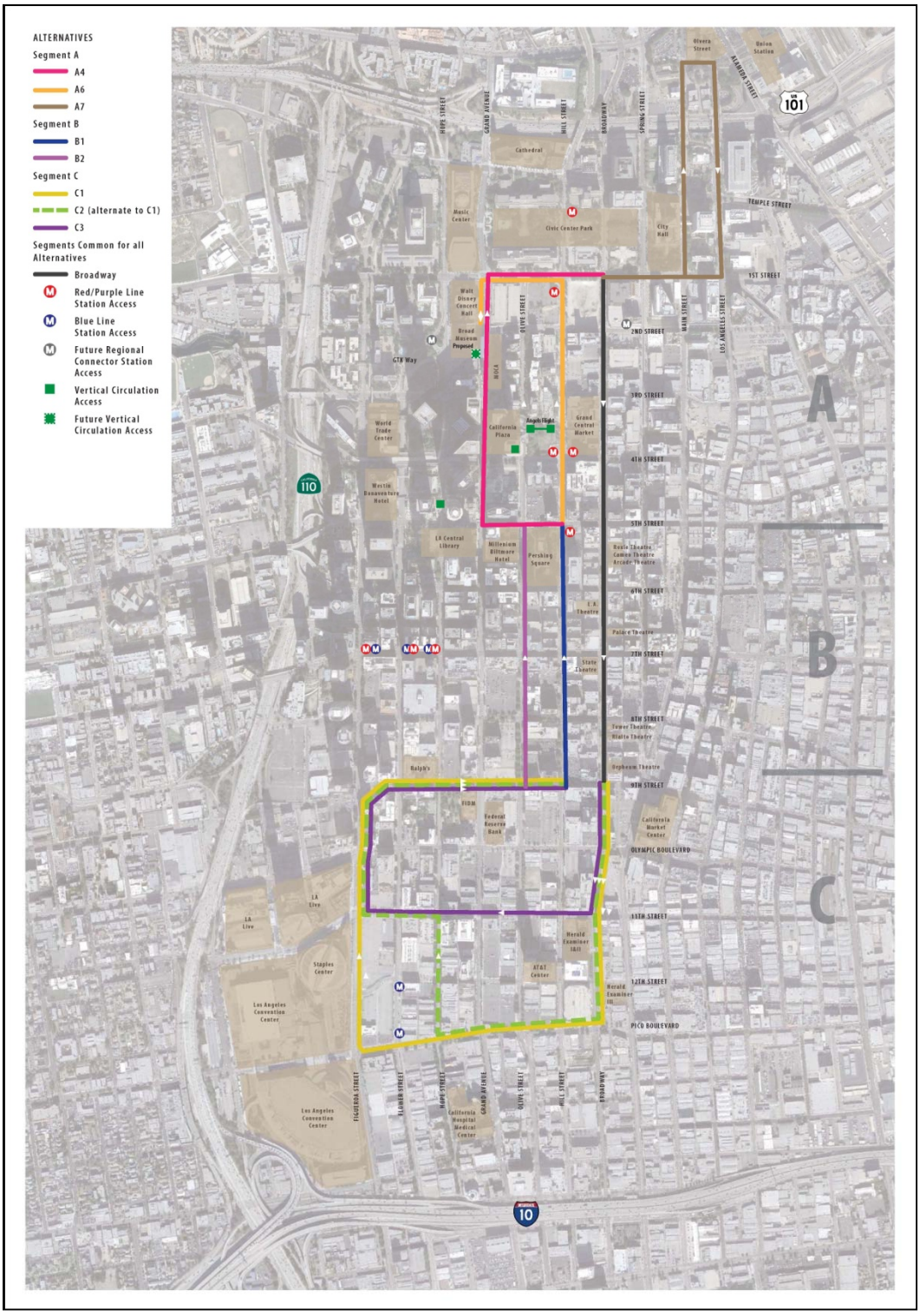
3.3 Initial Screening Recommendations

Based on the results of the initial screening evaluation, the following recommendations were made for alternatives advancing into final screening. Within Segment A (north of 5th St), it was recommended that A4, A6, and A7 be advanced and A1, A2, A3, and A5 be eliminated from further consideration. Within Segment B (between 5th St and 9th St), it was recommended that both B1 and B2 be advanced. Within Segment C (south of 9th St), it was recommended that C1 and C3 be advanced and that C2 be preserved as an alternative variation for C1 because of the at-grade crossing of the Metro Blue/Expo Line. Table 18 summarizes the results of the initial screening. Figure 35 shows the alternatives that advanced from initial screening.

Table 18: Initial Screening Recommendations

Recommendations	Notes
Segment A	
Advance: A4, A6, and A7	– A4 requires additional research regarding the ability to operate on the segment of Grand Ave with 14% grade. While this was considered a major risk, it was not considered a fatal flaw since the use of alternate technologies could allow the alternative to be feasible in the future.
Eliminate: A1, A2, A3, and A5	– A1, A2, and A3 were eliminated because they have a fatal flaw (must follow Regional Connector construction on Hope St which would delay the project). This schedule delay is considered a fatal flaw since it would delay project implementation until 2019. It could also jeopardize the ability to establish a benefit assessment district, which would provide local funding for the project. – A1 and A2 were also eliminated because they serve the "back door" of buildings on Hope St. – A3 was also eliminated because it requires tunnel operation on GTK Way, which creates additional design constraints and has a poor pedestrian environment. – A5 was eliminated because it travels out of direction and has limited opportunity to capture revenue through property assessments.
Segment B	
Advance: B1 and B2	– Minimal differences between B1 and B2 so both were advanced.
Eliminate: None	
Segment C	
Advance: C1 and C3	– Minimal differences between C1 and C3 so both were advanced.
Variation: C2	– C2 was recommended as an alternative variation for C1 because of the at-grade crossing of the Metro Blue/Expo Line.

Figure 35: Alternatives Advanced from Initial Screening



4.0 FINAL SCREENING OF ALTERNATIVES

This section describes the final screening of alternatives for the project.

4.1 Final Screening Alternatives

Final screening considered the alternatives that advanced from initial screening, which were recommended for segments A, B, and C.

4.1.1 Changes to Alternatives Prior to Final Screening

The following changes were made to the alternatives prior to final screening:

- A4 (revised) and B3 (new alternative): A modification was made to the A4 alternative to address the 14 percent grade on Grand Avenue between 5th Street and 4th Street. The revised A4 alternative uses an elevated bridge structure for the streetcar that starts north of 6th Street, crosses above 5th Street, and ends on Grand Avenue south of 4th Street. The revised A4 alternative requires a new B3 alternative on Grand Avenue between 9th Street and 5th Street so the streetcar can operate northbound on Grand Avenue between 9th Street and 1st Street.

- C1 (eliminated) and C2 (advanced): The C1 alternative was eliminated from consideration and replaced with the C2 alternative, which uses Hope Street and 11th Street to bypass the at-grade crossing of the Metro Blue/Expo Line on Pico Boulevard. It has not been determined whether Metro or another provider would operate the streetcar. However, Metro will not allow another operator to cross the Metro Blue/Expo Line because of safety concerns. Therefore, the C2 alternative was advanced in place of the C1 alternative because it bypasses the at-grade crossing.

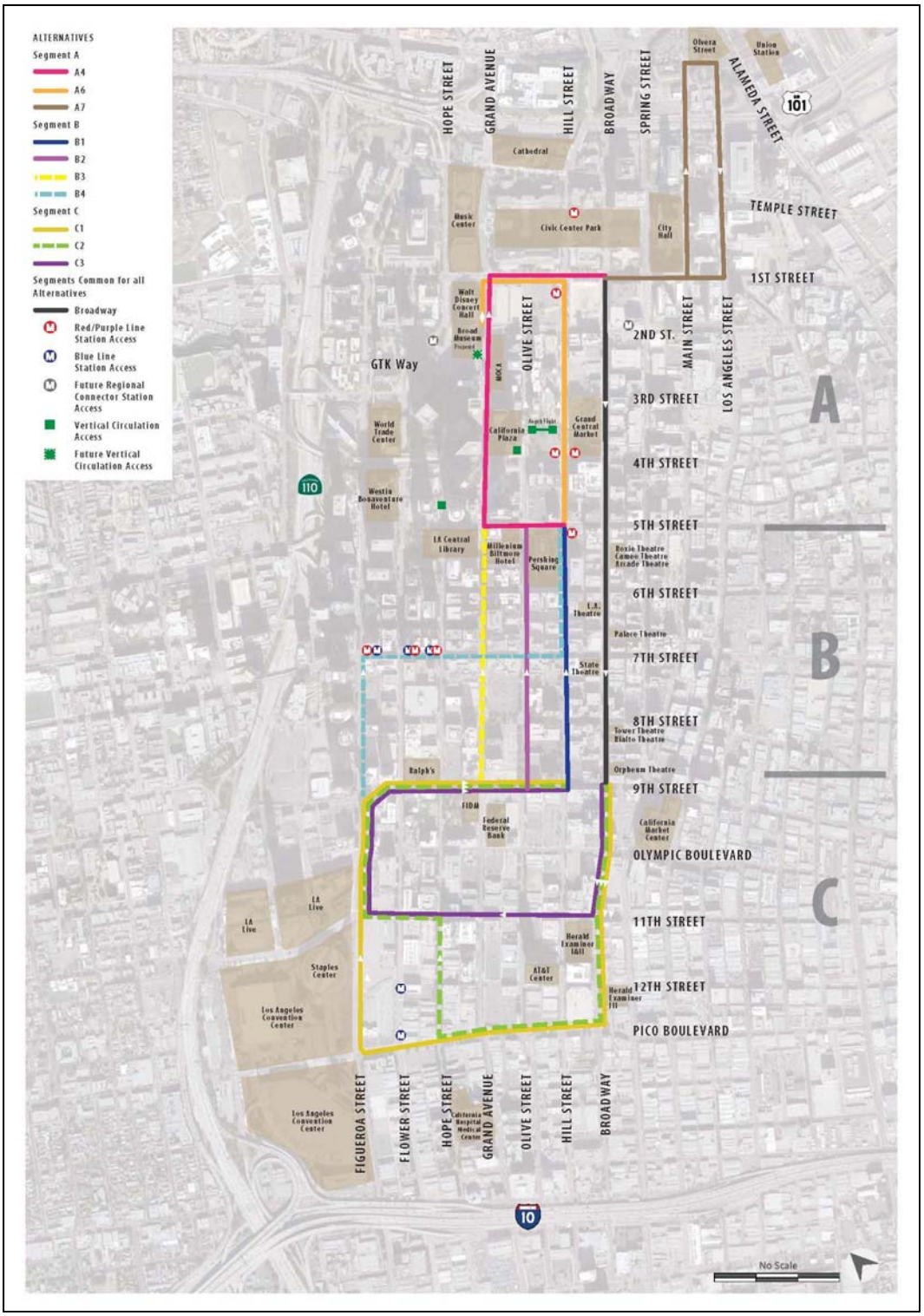
- B4 (new alternative): A new B4 alternative was added that uses Figueroa Street between 9th Street and 7th Street,7th Street between Figueroa Street and Hill Street, and Hill Street between 7th Street and 5th Street. The B4 alternative was added in response to public and stakeholder requests following the presentation of the initial screening results to add an alternative that more directly serves the Financial Core and the 7th Street/Metro Center Station.

The revised alternatives by segment that advanced from initial screening are described below:

- Segment A: Advance A4 (revised), A6, and A7
- Segment B: Advance B1, B3 (new), and B4 (new)
- Segment C: Advance C2 (new) and C3

These changes are illustrated in Figure 36, which shows the new alternatives in dashed lines.

Figure 36: Changes to Alternatives Prior to Final Screening



4.1.2 Combined Alternatives for Final Screening

The alternatives by segment that advanced from initial screening were combined into seven alternatives for final screening. These alternatives are listed below and shown on one map in Figure 37 and individual maps in Figures 38 through 44:

- Alternative 1: A4/B3/C1 (Figure 38)
- Alternative 2: A4/B3/C3 (Figure 39)
- Alternative 3: A6/B1/C1 (Figure 40)
- Alternative 4: A6/B1/C3 (Figure 41)
- Alternative 5: A7/B1/C1 (Figure 42)
- Alternative 6: A7/B1/C3 (Figure 43)
- Alternative 7: A6/B4/C3 (Figure 44)

Figure 37: Final Screening Alternatives

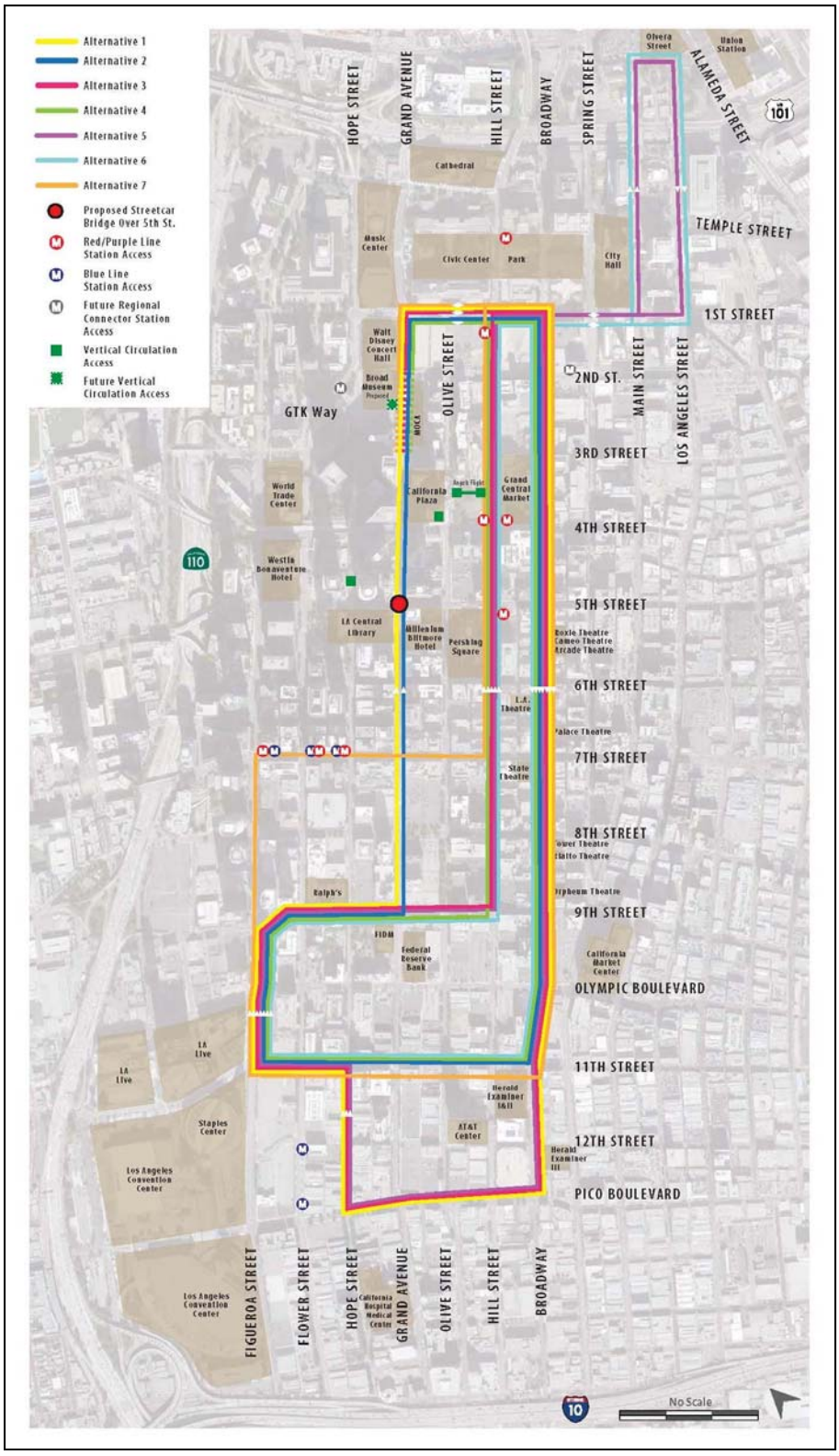


Figure 38: Alternative 1

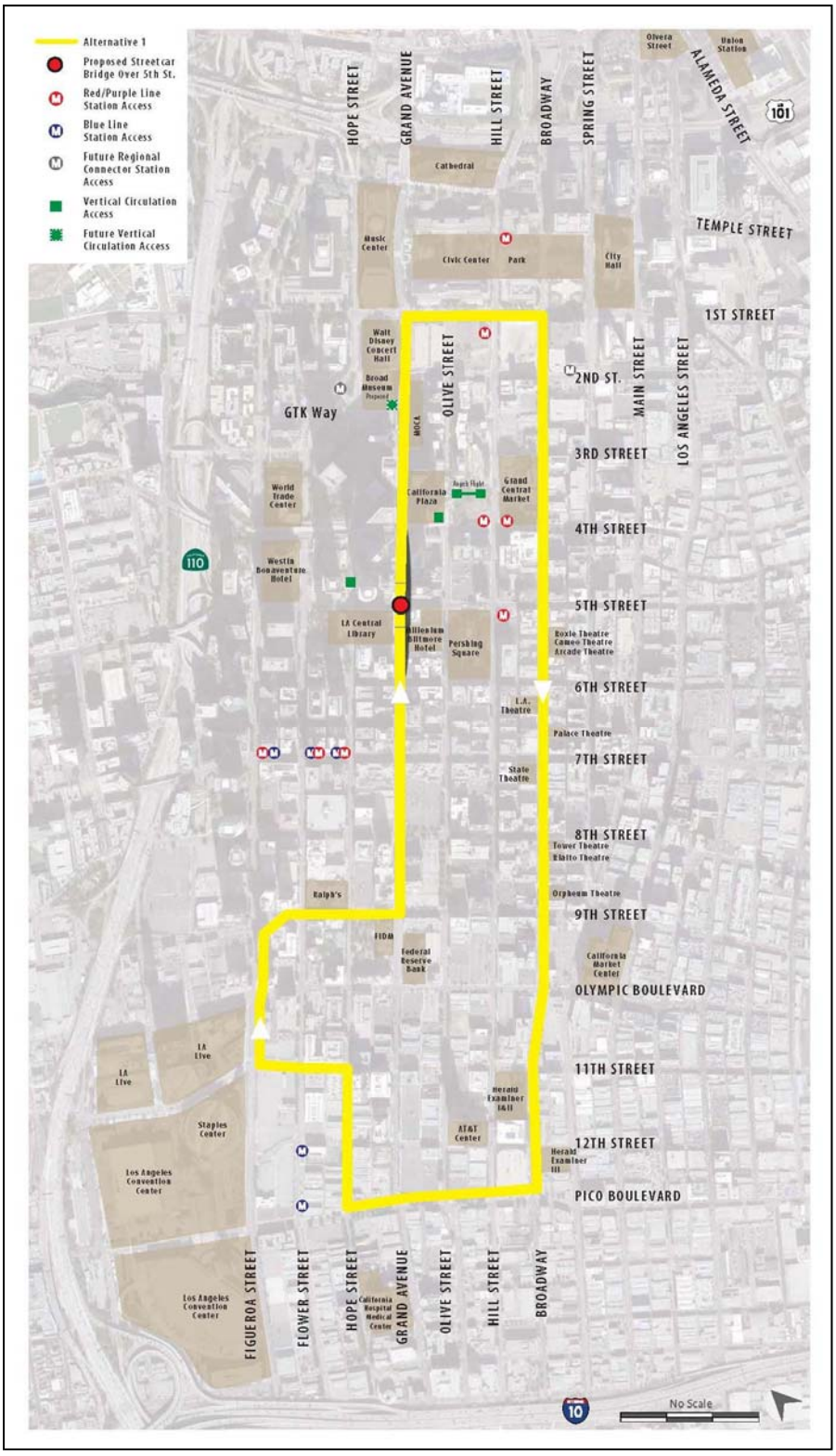


Figure 39: Alternative 2

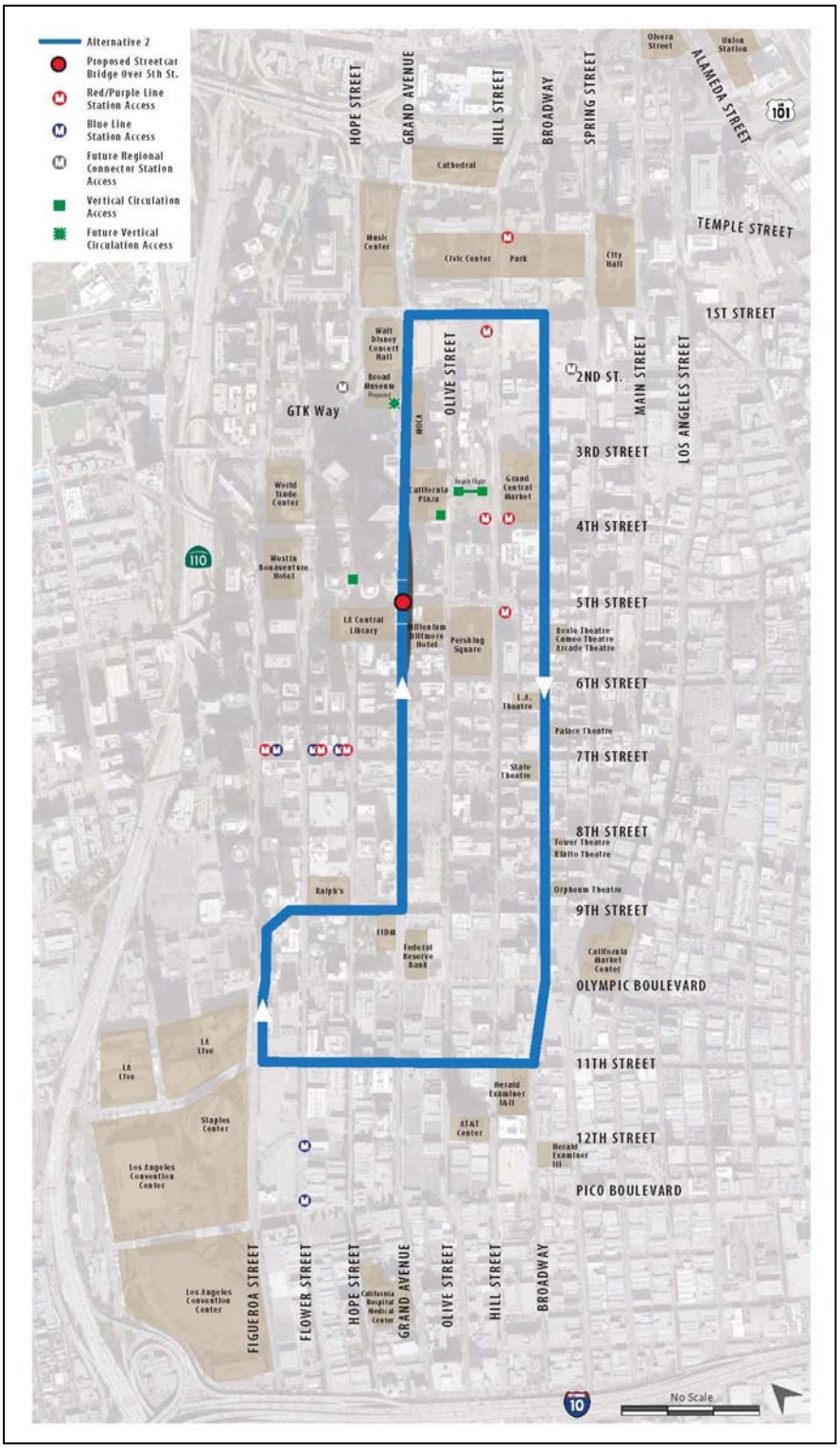


Figure 40: Alternative 3

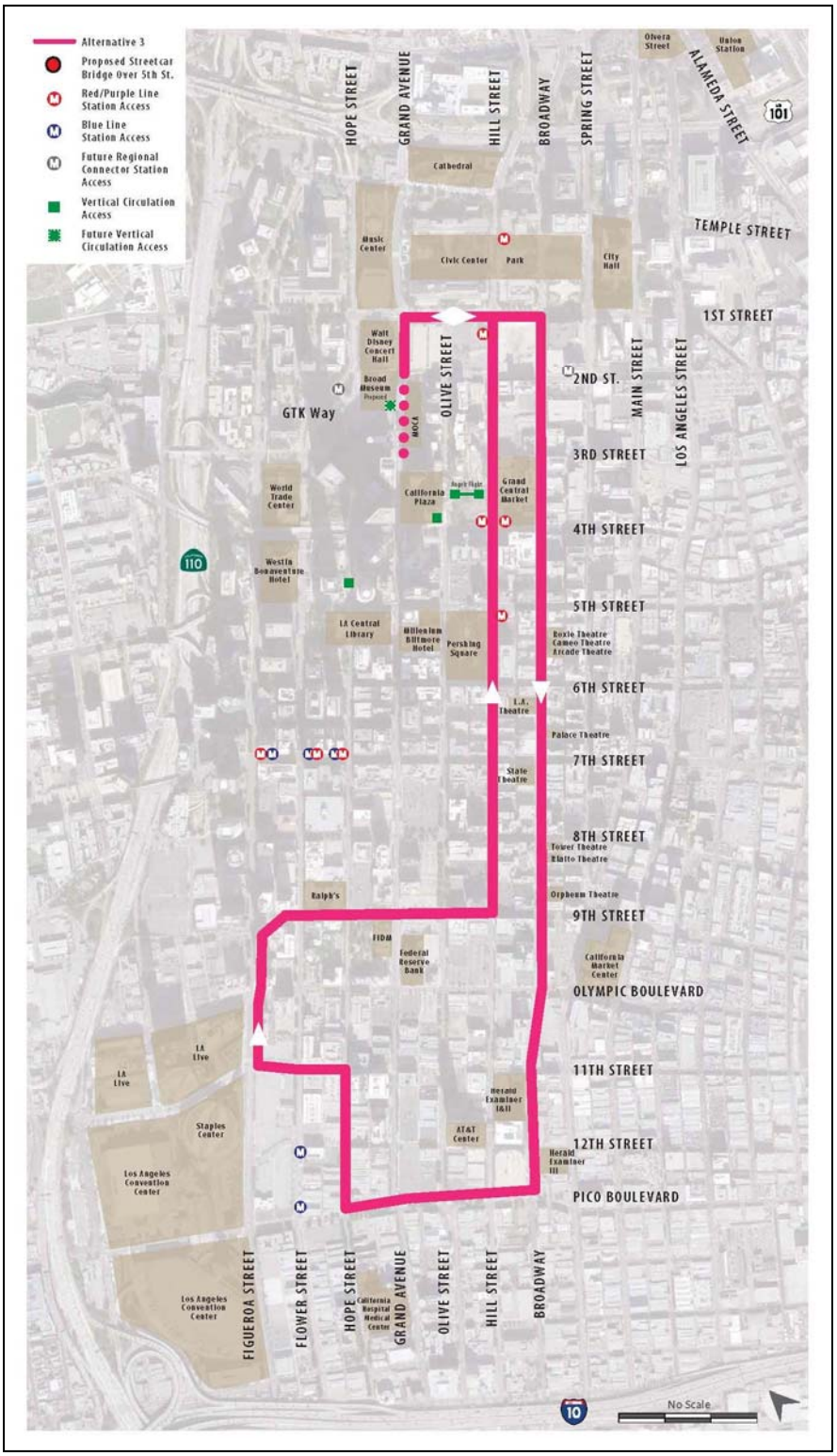


Figure 41: Alternative 4

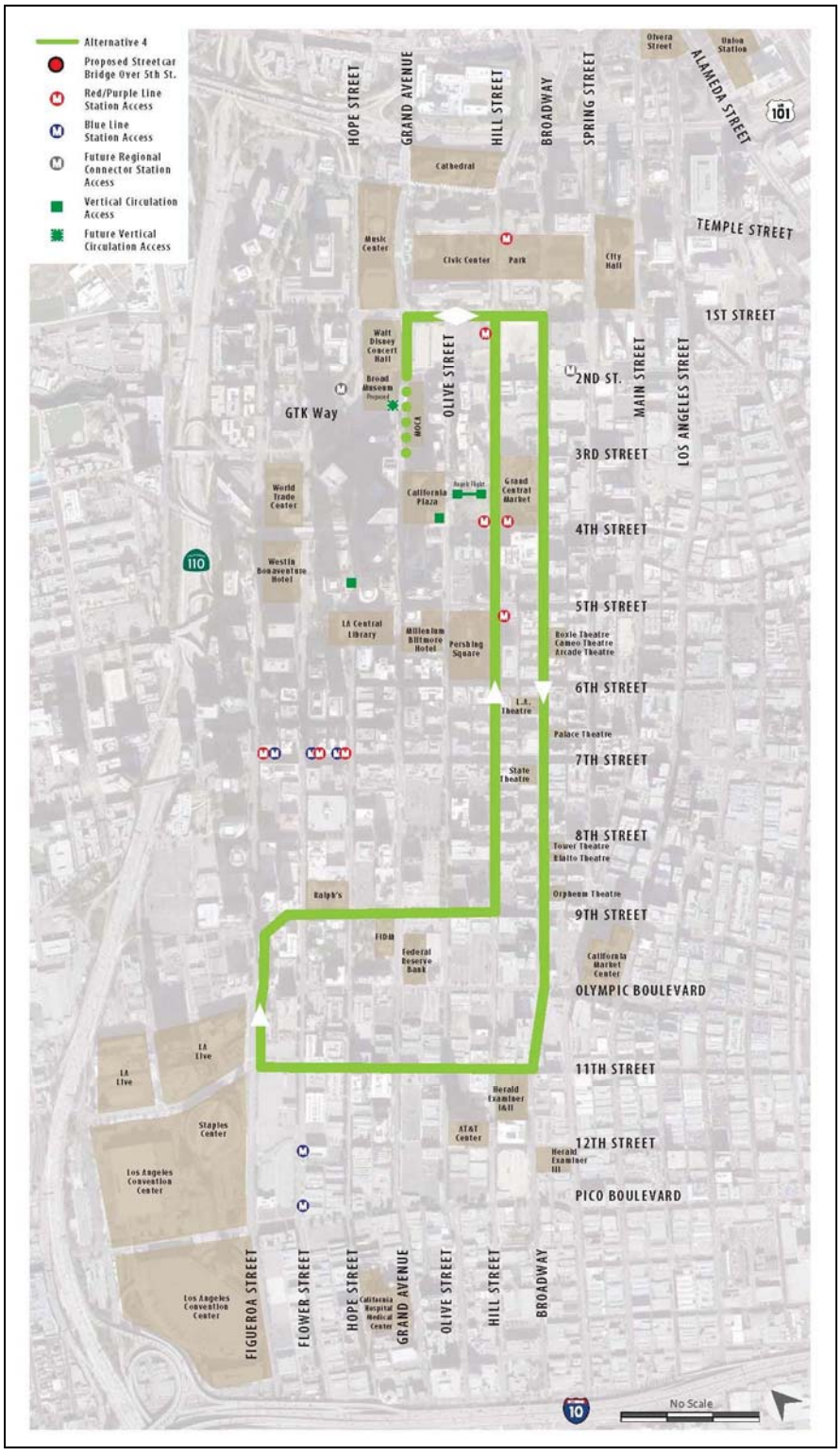


Figure 42: Alternative 5

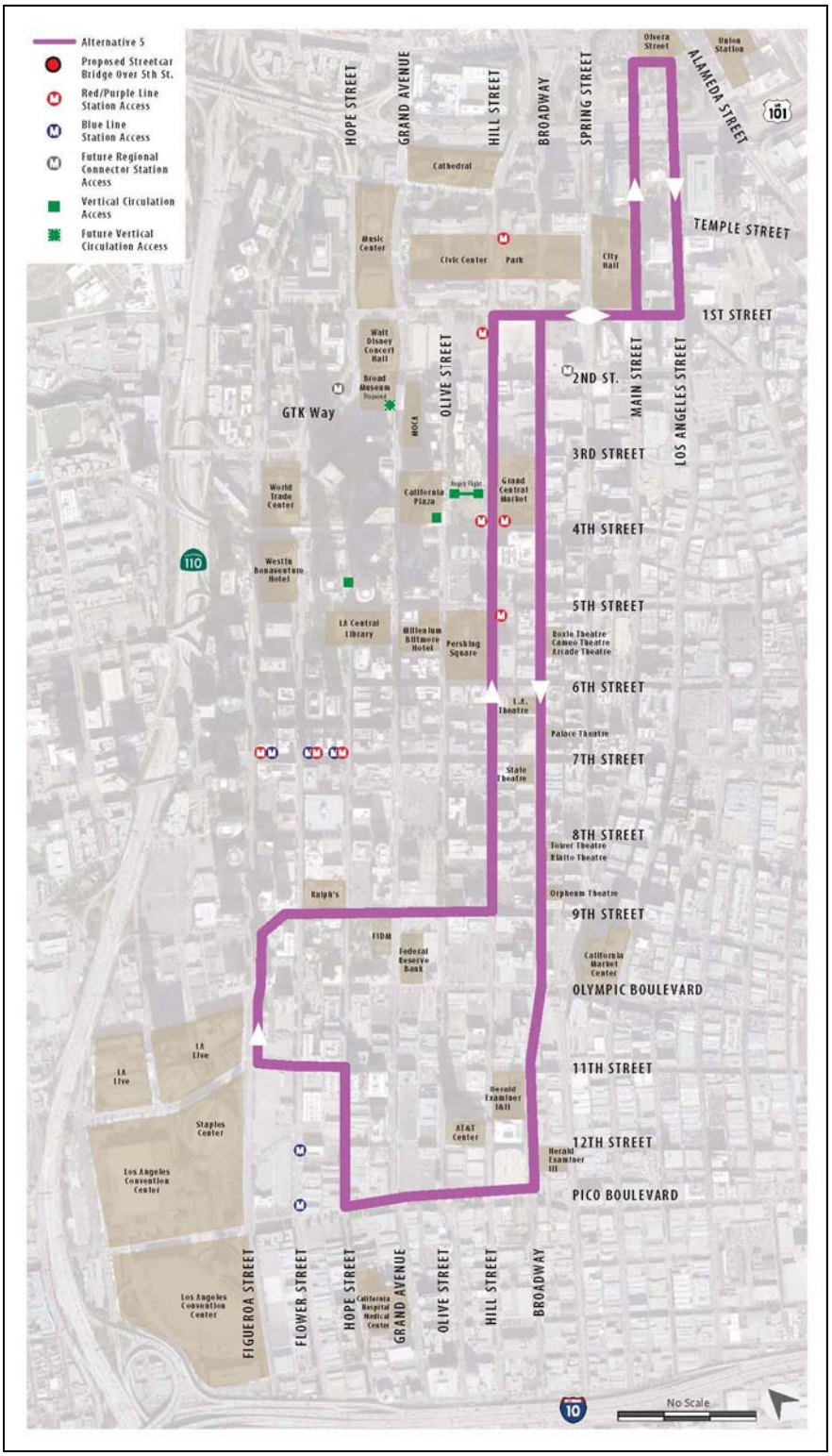


Figure 43: Alternative 6

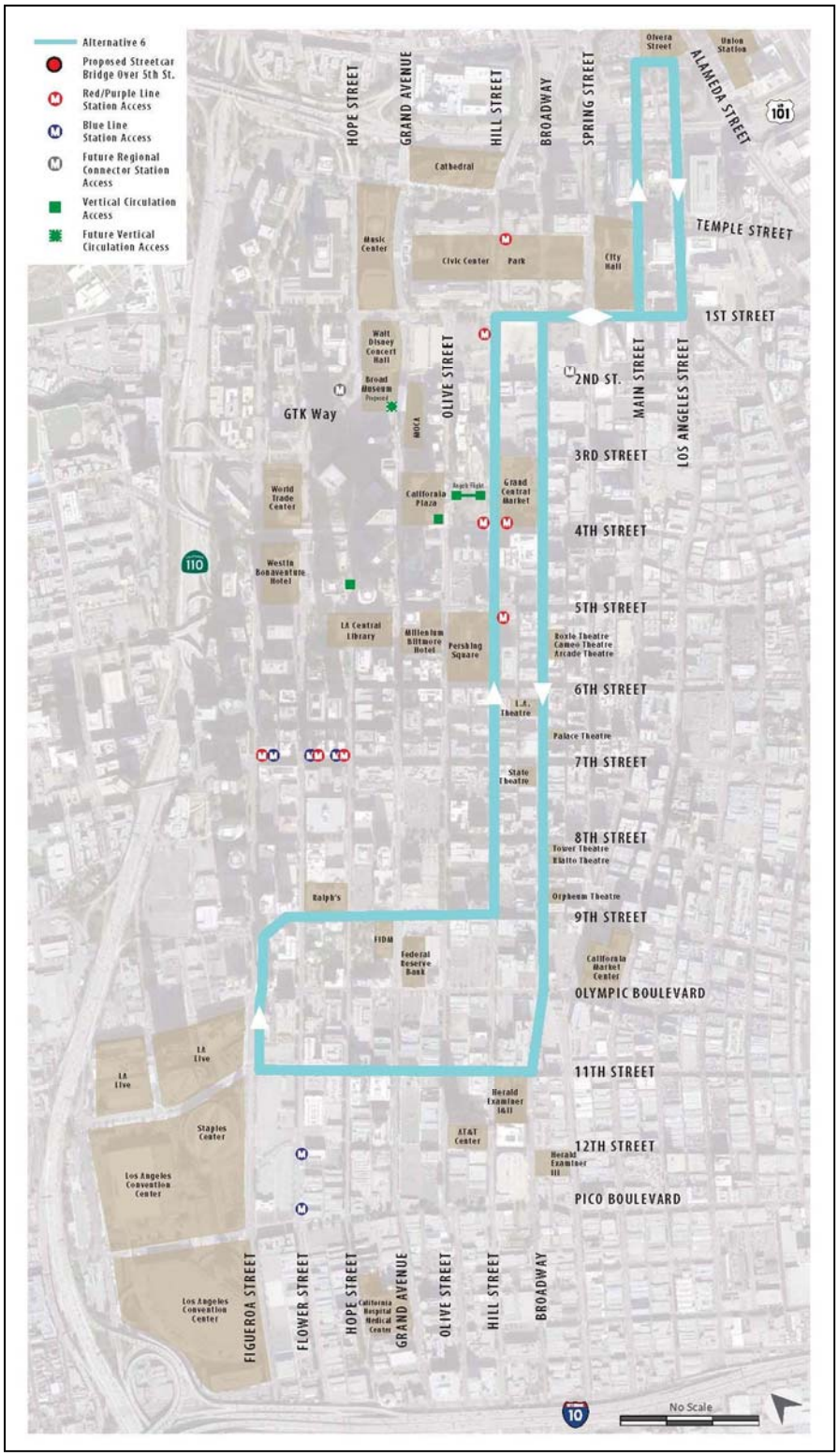
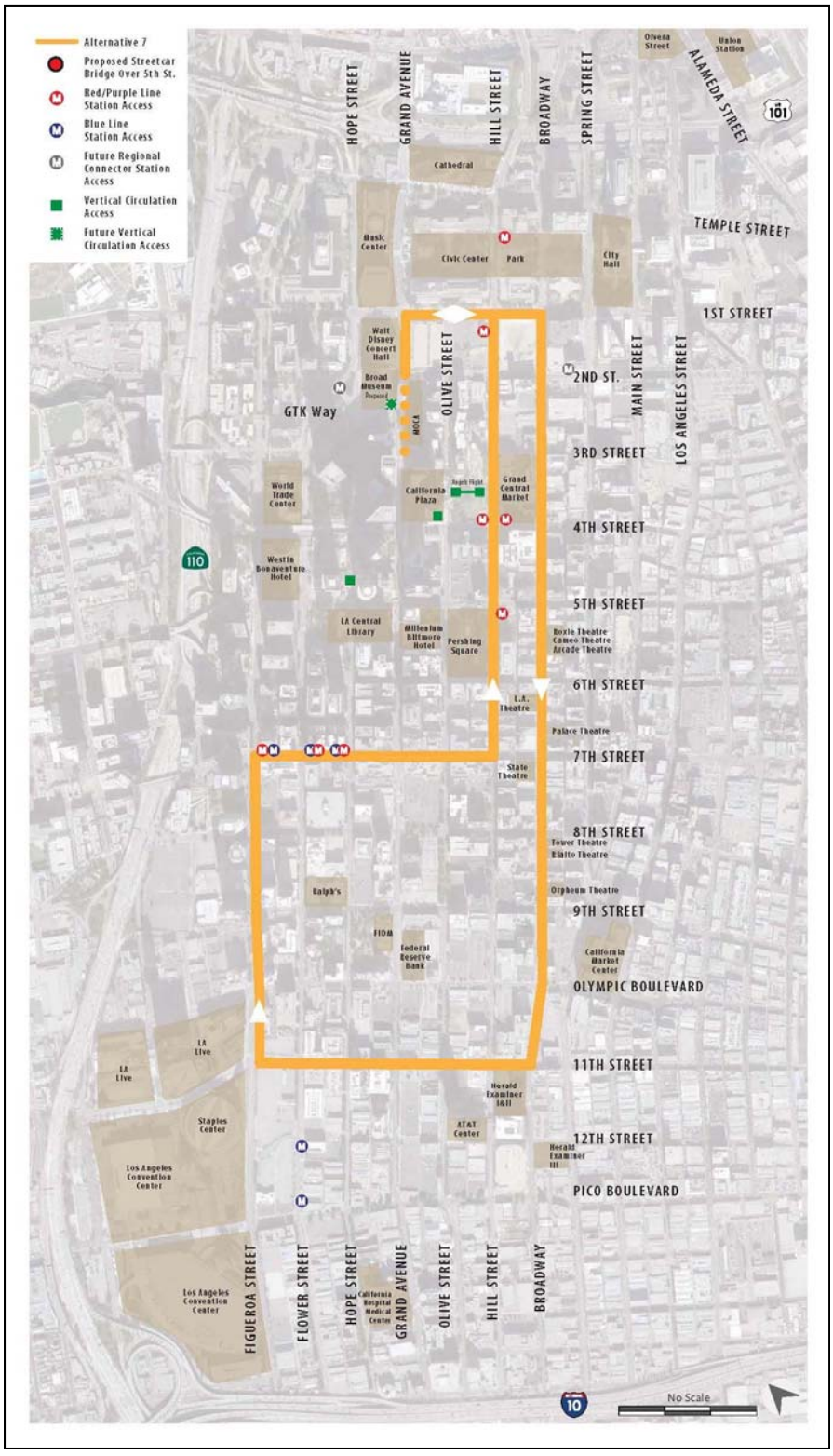


Figure 44: Alternative 7



The seven alternatives evaluated in final screening are described in Table 19.

Table 19: Description of Final Screening Alternatives

Alt	Description
1	Southbound on Broadway between 1st St and Pico Blvd, westbound on Pico Blvd between Broadway and Hope St, northbound on Hope St between Pico Blvd and 11th St, westbound on 11th St between Hope St and Figueroa St, northbound on Figueroa St between Pico Blvd and 9th St, eastbound on 9th St between Figueroa St and Grand Avenue, northbound on Grand Avenue between 9th St and 1st St with the streetcar elevated from 6th St to 4th St, eastbound on 1st St between Grand Ave and Broadway.
2	Southbound on Broadway between 1st St and 11th St, westbound on 11th St between Broadway and Figueroa St, northbound on Figueroa St between 11th St and 9th St, eastbound on 9th St between Figueroa St and Grand Avenue, northbound on Grand Avenue between 9th St and 1st St with the streetcar elevated from 6th St to 4th St, eastbound on 1st St between Grand Ave and Broadway.
3	Southbound on Broadway between 1st St and Pico Blvd, westbound on Pico Blvd between Broadway and Hope St, northbound on Hope St between Pico Blvd and 11th St, westbound on 11th St between Hope St and Figueroa St, northbound on Figueroa St between Pico Blvd and 9th St, eastbound on 9th St between Figueroa St and Hill St, northbound on Hill St between 9th St and 1st St, westbound on 1st St between Hill St and Grand Ave, two-way on Grand Ave between 1st St and 2nd St, and eastbound on 1st St between Grand Ave and Broadway.
4	Southbound on Broadway between 1st St and 11th St, westbound on 11th St between Broadway and Figueroa St, northbound on Figueroa St between 11th St and 9th St, eastbound on 9th St between Figueroa St and Hill St, northbound on Hill St between 9th St and 1st St, westbound on 1st St between Hill St and Grand Ave, two-way on Grand Ave between 1st St and 2nd St, and eastbound on 1st St between Grand Ave and Broadway.
5	Southbound on Broadway between 1st St and Pico Blvd, westbound on Pico Blvd between Broadway and Hope St, northbound on Hope St between Pico Blvd and 11th St, westbound on 11th St between Hope St and Figueroa St, northbound on Figueroa St between Pico Blvd and 9th St, eastbound on 9th St between Figueroa St and Hill St, northbound on Hill St between 9th St and 1st St, eastbound on 1st St between Hill St and Main St, northbound on Main St between 1st St and Paseo de la Plaza, southbound on Los Angeles St between Paseo de la Plaza and 1st Street, and westbound on 1st St between Los Angeles Street and Broadway.
6	Southbound on Broadway between 1st St and 11th St, westbound on 11th St between Broadway and Figueroa St, northbound on Figueroa St between 11th St and 9th St, eastbound on 9th St between Figueroa St and Hill St, northbound on Hill St between 9th St and 1st St, eastbound on 1st St between Hill St and Main St, northbound on Main St between 1st St and Paseo de la Plaza, southbound on Los Angeles St between Paseo de la Plaza and 1st Street, and westbound on 1st St between Los Angeles Street and Broadway.
7	Southbound on Broadway between 1st St and 11th St, westbound on 11th St between Broadway and Figueroa St, northbound on Figueroa St between 11th St and 7th St, eastbound on 7th St between Figueroa St and Hill St, northbound on Hill St between 9th St and 1st St, westbound on 1st St between Hill St and Grand Ave, two-way on Grand Ave between 1st St and 2nd St, and eastbound on 1st St between Grand Ave and Broadway.

Note: Southbound Broadway between 1st Street and 11th Street is common for all alternatives.

4.2 Final Screening Evaluation

4.2.1 Ridership

Methodology

Ridership forecasts were generated for the seven alternatives in final screening using a Direct Ridership Model (DRM). Traditional methods of forecasting transit ridership often employ regional travel demand models to predict ridership. Such models are relatively unresponsive to changes in station-level land use and transit service characteristics. In the case of Los Angeles, the large sizes of the traffic analysis zones in the Metro travel demand model preclude detailed land use data collection and differentiation at the station-level. Because streetcars serve a local travel market, DRMs are better at analyzing ridership at the local level versus traditional regional travel demand models. Furthermore, the Metro travel demand model does not have a streetcar calibrated mode, meaning its use would require calibration and validation of a new streetcar mode of travel in the model. Alternatively, the streetcar would have to be classified using a mode that currently exists in the model such as bus or light rail, which have different ridership characteristics than streetcar.

DRMs are directly and quantitatively responsive to land use and transit service characteristics within the immediate vicinity and catchment area of streetcar stops. They can predict ridership at individual stops based on local stop area and system characteristics. DRMs are based on empirical relationships found through statistical analysis of stop ridership and local stop characteristics. The effects of stop-level variables are highly significant in accurately forecasting streetcar ridership. While streetcar systems are used for traditional commute trips, research with transit agencies suggests they more often provide access and circulation for downtown or city center areas. They serve tourist needs and often duplicate existing transit service provided by bus. Thus, it was expected that individual stop-area characteristics greatly affect boardings and overall ridership projections.

Recognizing that variables affecting streetcar ridership are different than those for regional rail systems, the basis for analysis draws from the characteristics of existing streetcar systems in Portland, Seattle, and Tacoma. These systems were chosen because they are similar to the proposed streetcar. Ridership data was collected for each system at the system level, and where available, at the individual stop level. Variables were collected at the system level including route length, opening year, frequency of service, train capacity, fare (including presence of free stops), and transfer policy. At the stop level, data were gathered for the area within a quarter-mile (5 minute walk) of the stop and included, intersecting transit, retail and general employment density, household density, street connectivity, distance between stops, number of hotels and number of special events centers. Table 20 shows the characteristics of existing streetcar systems.

Table 20: Existing Streetcar Systems

System	Route Length (Both Directions)	Number of Stops
Portland Streetcar System	8.0 miles	47
Seattle South Lake Union Line	2.6 miles	12
Tacoma Streetcar System	2.7 miles	8

The stop level data collected from Portland, Seattle, and Tacoma were used to perform ordinary least squares (OLS) regression analysis to predict daily boardings. This analysis was based on empirical relationships found through statistical analysis of stop ridership and local stop characteristics. Multiple iterations of all collected data were tested in the regression model, but the variables that entered into the DRM model as significant were the following:

- Households: A measure of residential density.
- Retail Employment: A measure of retail intensity.
- Number of Feeder Trains: A measure of the number of regional transit connections.
- Start of Line: Applies to bi-directional lines where more passengers tend to board at the first station; does not apply to loop alignments.
- Center: Stop located near a special events center (such as the Staples Center).
- Free vs. Paid: Assumes a paid system but a comparison as a free system is made.

Data for each of these variables were collected for potential stop locations along the alternatives. These variables were used to predict daily boardings at each stop and were summed for each configuration to estimate daily boardings.

Post Model Processing

Frequency of Service

A post-model adjustment for frequency of service was considered to account for variables not included in the DRM model. There is not enough data to make a statistically significant relationship between frequency and boardings, but this variable has been identified as an important factor distinguishing the project's alternatives from the other streetcar systems. Among the other streetcar systems studied, the average frequency is 3.6 trains per hour. However, the project's alternatives are planned to have 8.6 trains per hour (one train every 7 minutes) during the peak.

Although no research exists that provides an elasticity value for frequency of service specifically for streetcar systems, according to TCRP Synthesis 66, New York City reported an elasticity value of 0.2 for transit service frequency. Elasticity is the ratio of the percentage

change in one variable to the percentage change in another variable. An elasticity value for frequency of service of 0.2 means that for every 100 percent increase in frequency there is a corresponding 20 percent increase in ridership. Therefore, increasing service frequency from 3.6 to 8.6 trains per hour equals a 138 percent increase in service frequency. Multiplying that increase by 0.2 yields an expected ridership increase of 28 percent for the seven alternatives. This increase was applied as a post-model process to the results of the DRM model to account for increased ridership due to the more frequent service of the project's alternatives.

Consideration of Angels Flight

Angels Flight is funicular railway connecting Hill Street and California Plaza in Bunker Hill. Each ride costs $0.25 and the railway averages approximately 2,100 weekday boardings. While this service is well utilized by office workers traveling between the Broadway area and Bunker Hill, it is also a tourist attraction. Alternatives 3, 4, 5, 6, and 7 would provide a direct connection to the Angels Flight terminus on Hill Street. Overall, it is estimated that approximately 30 percent of weekday boardings on Angels Flight are attributable to tourists. Considering a likely synergy between the use of Angels Flight and streetcar among tourists, a post model adjustment equal to one third of projected daily tourist boardings on Angels Flight was distributed proportionally among the alternatives serving the funicular railway.

Reduced Fare

A sensitivity test of a reduced fare versus full fare was completed to better understand the results, differences in alternatives, and how they compare to other system types. The Tacoma streetcar system and significant portions of the Portland streetcar system are free fare. The variable Free/Paid was found to have a statistically significant influence on ridership in the DRM model. To test the impact of applying a fare free system to the streetcar alternatives, a comparison of ridership estimates of free versus paid systems was conducted using the free/paid variable in the model. While the DRM model can distinguish between free fare and full fare systems, it does not measure changes in the level of fare. Rather than charging the full Metro fare of $1.50 per ride, Metro assumed that the streetcar alternatives charge a reduced fare of $0.50 per ride which would be similar to DASH. A widely accepted value for fare to ridership elasticity is -0.4 (although this value is not streetcar specific). According to this elasticity value, a fare decrease from $1.50 to $0.50 per ride would result in a 27 percent increase in ridership for all alternatives.

Ridership Results

The daily ridership and performance (boardings per mile) of each alternative are summarized in Table 21. This includes the results of the DRM model and post model processing. A technical memorandum on ridership is included as Appendix A.

Table 21: Ridership

Alternative	Number of Stops	Daily Boardings	Boardings per Mile
1	25	9,090	2,370
2	21	7,390	2,230
3	30	9,880	2,300
4	26	8,180	2,160
5	34	11,190	2,170
6	30	9,500	2,040
7	25	8,390	2,210

Alternative 5 (11,190) and Alternative 3 (9,880) have the highest number of daily boardings. This is due to better access to major trip generators and the most number of stops. In general, the higher the number of stops (assuming the stop is located near factors that influence ridership), the higher the ridership. Alternative 2 (7,390) has the lowest number of boardings, but is also the shortest alignment. Alternative 1 (2,370) has the highest boardings per mile while Alternative 6 (2,040) has the lowest boardings per mile.

Overall, Alternatives 1, 3, and 7 perform the best in terms of ridership with a high number of daily boardings and boardings per mile. Alternatives 5 and 6 have the highest number of daily boardings, but also the lowest boardings per mile.

4.2.2 Capital Costs

Methodology

Capital costs were generated for each of the alternatives in final screening using the FTA Standard Cost Category (SCC) workbooks. The SCC workbook methodology includes the following categories:

Construction categories

- Guideway and track elements: Guideway (at-grade or aerial), track, and special trackwork (turnouts).
- Stops: Stops, shelters, platforms, and passenger amenities.
- Support facilities: Maintenance and storage facility, shops, and administration buildings.
- Sitework and special conditions: Demolition, clearing, earthwork, utilities, civil improvements, roadway improvements, curb, gutter, sidewalk, and paving.
- Systems: Train control, train signals, automatic train protection, traction power (substations and equipment), traffic signals, communications, and fare collection.

Other categories

- Right-of-way: Purchase or lease of land.
- Vehicles: Vehicles and spare parts.
- Professional services: Preliminary engineering, final design, program management, construction management, insurance, permits, and inspections.
- Project reserve: Unallocated contingency.

Capital Costs

The capital costs for each alternative are summarized in Table 22. The full capital cost estimate is included as Appendix B.

Table 22: Capital Costs

SCC	Item	Alternative						
		1	2	3	4	5	6	7
10	Guideway and Track Elements	$14,577	$12,964	$13,693	$12,143	$17,437	$15,824	$12,143
20	Stops	$2,520	$2,117	$2,923	$2,520	$3,326	$2,923	$2,520
30	Support Facilities	$11,193	$11,193	$11,193	$11,193	$11,193	$11,193	$11,193
40	Sitework and Special Conditions	$13,796	$11,660	$12,334	$10,415	$16,696	$14,724	$10,417
50	Systems	$12,536	$11,366	$13,826	$11,994	$15,327	$14,156	$12,267
	Construction Subtotal	$54,622	$49,300	$53,970	$48,265	$63,979	$58,821	$48,540
60	Right-of-Way	$1,809	$1,740	$1,877	$1,775	$1,979	$1,911	$1,775
70	Vehicles	$30,240	$30,240	$34,020	$30,240	$37,800	$37,800	$30,240
80	Professional Services	$18,328	$16,726	$18,364	$16,418	$21,600	$20,048	$16,501
	Subtotal	$104,999	$98,007	108,230	$96,697	125,359	118,580	$97,055
	Project Reserve (10%)	$10,500	$9,801	$10,823	$9,670	$12,536	$11,858	$9,706
	Total	**$115,499**	**$107,807**	**$119,053**	**$106,367**	**$137,895**	**$130,438**	**$106,761**
	Track Miles	3.83	3.32	4.08	3.59	5.16	4.65	3.59
	Cost per Track Mile	**$30,156**	**$32,472**	**$29,180**	**$29,629**	**$26,724**	**$28,051**	**$29,738**

Note: All costs in thousands and $2011.

Alternative 4 ($106.4 million) and Alternative 7 ($106.8 million) have the lowest capital cost. These alternatives are shorter alignments, use 11th Street instead of Pico Boulevard, and serve Bunker Hill instead of Union Station. Alternative 5 ($137.9 million) and Alternative 6 ($130.4 million) have the highest capital cost. These alternatives are the longest alignments by over a mile and serve Union Station.

The capital cost is generally a function of the route length, number of stops, and number of vehicles. For example, the longer the route the higher the capital cost. The exception to this is when the alternative has a large capital cost item, such as the Grand Avenue bridge structure associated with Alternatives 1 and 2.

The cost per track mile is relatively similar between all of the alternatives and ranges from approximately $27 million to $32 million. Alternative 5 ($26.7 million) and Alternative 6 ($28.1 million) have the lowest capital cost per mile despite having the highest capital cost overall. Alternative 2 ($32.5 million) and Alternative 1 ($30.2 million) have the highest capital cost per mile.

4.2.3 Operation and Maintenance (O&M) Costs

Methodology and Assumptions

The operation and maintenance (O&M) costs were generated for each alternative in final screening using a cost per hour. The O&M costs were based on the following assumptions:

- O&M cost estimates assumed a streetcar cost of $200 per hour, which is an average of the existing Portland, Seattle, and Tacoma streetcar systems.
- Annual operating requirements based on 254 weekdays, 52 Saturdays, and 59 Sundays and holidays per year.
- Frequency is 7 minutes during the peak, 10 minutes during midday, and 15 minutes during the evening.
- Operating hours are 6a.m. to 12a.m. on Monday through Friday and 7a.m. to 12a.m. on Saturdays and Sundays/Holidays.
- Annual revenue miles and hours can both be used to calculate O&M costs, although revenue hours are more common for streetcar systems.
- Annual revenue miles and hours include layover time, but do not include report and deadhead time.

O&M Costs

The O&M costs for each alternative in final screening are summarized in Table 23. The full O&M cost estimate is included as Appendix C.

Table 23: O&M Costs

Alternative	Route Length	Run Time	Peak Vehicles	Fleet Vehicles	Annual Vehicle-Hours	Annual Vehicle-Miles	Annual O&M Cost ($2011)
1	3.83	0:34:27	6	8	26,590	145,900	$5,318,000
2	3.32	0:31:21	6	8	26,590	126,400	$5,318,000
3	4.29	0:40:21	7	9	30,740	163,400	$6,148,000
4	3.78	0:35:25	6	8	26,590	143,900	$5,318,000
5	5.16	0:49:10	8	10	37,210	196,400	$7,442,000
6	4.65	0:45:04	8	10	34,580	177,000	$6,916,000
7	3.79	0:35:12	6	8	26,590	144,300	$5,318,000

Note: Assumes streetcar cost of $200 per hour. All costs in $2011.

Alternatives 1, 2, 4, and 7 ($5.3 million) have the lowest O&M cost and are also the shortest alignments. Alternative 5 ($7.4 million) and Alternative 6 ($6.9 million) have the highest O&M cost and are the longest alternatives (both serve Union Station). Overall, the O&M cost is generally a function of the route length and the number of vehicles.

4.2.4 Cost/Benefit

The cost/benefit was determined by using the ridership, capital costs and operation and maintenance (O&M) costs of each alternative to calculate the cost per user. This provided an additional comparison, since in many cases the performance of the alternative is a function of the route length, number of stops and vehicles. For example, the following trends have been observed for ridership, capital cost, and O&M cost:

- Ridership is often a function of the number of stops (the more stops the more riders).
- Capital cost is often a function of the route length, number of stops, and number of vehicles (the longer route the higher capital cost).
- O&M cost is often a function of the route length and number of vehicles (the longer the route the higher the O&M cost).

In order to compare the alternatives more effectively, the cost/benefit of each alternative can be determined by calculating the cost per user. The formula that is used to calculate the cost per user of each alternative is described below:

Cost per User = (Annualized Capital Cost + Annualized O&M Cost) / Daily Boardings

Note that the annualized capital cost is based on a 50-year amortization of costs at a 5 percent interest rate. Table 24 summarizes the ridership, capital cost, and O&M cost and calculates the cost per user for each alternative.

Table 24: Cost/Benefit

Alternative	Boardings	Capital Cost	Annualized Capital Cost	Annual O&M Cost	Annualized Capital + O&M Cost	Cost per User
1	9,090	$115,499	$6,327	$5,318	$11,645	$1.28
2	7,390	$107,807	$5,905	$5,318	$11,223	$1.52
3	9,880	$119,053	$6,521	$6,148	$12,669	$1.28
4	8,180	$106,367	$5,826	$5,318	$11,144	$1.36
5	11,190	$137,895	$7,553	$7,442	$14,995	$1.34
6	9,500	$130,438	$7,145	$6,916	$14,061	$1.48
7	8,390	$106,761	$5,848	$5,318	$11,166	$1.33

Note: All costs in thousands and $2011. The annualized capital cost is based on a 50-year amortization of costs at a 5 percent interest rate.

Alternatives 1 and 3 ($1.28) have the lowest cost per user, followed by Alternative 7 ($1.33). The cost per user is generally less for alternatives that generate a greater number of users. Alternative 2 ($1.52) and Alternative 6 ($1.48) have the highest cost per user, which suggest a weak investment relative to the other alternatives.

4.2.5 Destinations

This section describes the districts and destinations served by the alternatives evaluated in final screening. The following highlights the key differences between the alternatives in terms of destinations served:

- Alternatives 1, 3, 4, and 7 serve the most destinations overall.
- Alternatives 1 and 2 serve Grand Avenue instead of Hill Street.
- Alternatives 3, 4, and 7 use a Broadway/Hill Street couplet and Alternatives 1 and 2 use a Broadway/Grand Avenue loop.
- Alternatives 1, 2, 3, 4, and 7 serve Bunker Hill, but do not serve Union Station.
- Alternatives 5 and 6 serve Union Station, but do not serve Bunker Hill.
- Alternatives 1, 3, and 5 directly serve Pico Boulevard.
- Alternatives 2, 4, 6, and 7 directly serve 11th Street.
- All alternatives serve Broadway between 1st Street and 11th Street.
- Alternatives 1, 2, 3, 4, and 7 do not go north of 1st Street or east of Broadway.

Tables 25 and 26 provide a summary of the districts and destinations served by each alternative.

Table 25: Districts Served by Final Screening Alternatives

Districts	Alternative						
	1	2	3	4	5	6	7
Bunker Hill	●	●	●	●			●
Civic Center	●	●	●	●	●	●	●
El Pueblo					●	●	
Financial Core	●	●					●
Historic Core	●	●	●	●	●	●	●
Jewelry District			●	●	●	●	●
South Park	●	●	●	●	●	●	●
Los Angeles Sports and Entertainment District (LASED)	●	●	●	●	●	●	●

Table 26: Destinations Served by Final Screening Alternatives

Destinations	Alternative						
	1	2	3	4	5	6	7
7th St / Restaurant Row	●	●	●	●	●	●	●
Ahmanson Theatre	●	●	●	●			●
Angels Flight			●	●	●	●	●
Broad Museum	●	●	●	●			●
California Hospital Medical Center	●		●		●		
California Plaza	●	●	●	●			●
City Hall					●	●	
Civic Center Park	●	●	●	●	●	●	●
Convention Center	●	●	●	●	●	●	●
El Pueblo de Los Angeles					●	●	
Grand Central Market	●	●	●	●	●	●	●
Historic Broadway Theatre District	●	●	●	●	●	●	●
LA Live	●	●	●	●	●	●	●
Mark Taper Forum	●	●	●	●			●
Metro Civic Center Station	●	●	●	●	●	●	●
Metro Pershing Square Station			●	●	●	●	●
Metro 7th St/Metro Center Station							●
Metro Pico Boulevard Station	●		●		●		
Metro Regional Connector Hope Station	●	●	●	●			●
Metro Regional Connector Broadway Station	●	●	●	●	●	●	●
Museum of Contemporary Art	●	●	●	●			●
Music Center	●	●	●	●			●
Nokia Theater	●	●	●	●	●	●	●
Olvera Street					●	●	
Ralph's Grocery Store	●	●	●	●	●	●	●
Staples Center	●	●	●	●	●	●	●
Union Station					●	●	
Walt Disney Concert Hall	●	●	●	●			●
Total	**21**	**19**	**23**	**21**	**19**	**17**	**22**

4.2.6 Circulation

This section addresses circulation issues associated with the alternatives evaluated in final screening. Potential circulation issues were grouped related to transit, traffic, and bicycle/pedestrian. The following highlights the circulation issues associated with each alternative.

Transit operations and facilities

- All alternatives would have transit operation issues on southbound Broadway following the implementation of the Broadway streetscape improvements proposed by a separate project which would reduce southbound Broadway to one lane with no turn lane or turn restrictions; this configuration would make southbound travel time unreliable because of queues created by left and right turning vehicles and pedestrian crossings.
- All alternatives would have transit operation issues with bus volumes on Broadway and either Grand Avenue or Hill Street. This conflict would affect both bus and streetcar operations depending on the location and stop configuration. The streetcar would be affected by the delay from bus boarding/alighting (especially high floor buses).
- Alternatives 3, 4, 5, 6, and 7 could affect the shared peak hour travel lane on Hill Street (used by buses and other vehicles between 4p.m. and 7p.m.). The peak hour travel lane and the off peak parking lane use the same travel lane so one or the other would need to be eliminated.
- Alternatives 1 and 2 would not serve stops on Grand Avenue between 3rd Street and 6th Street because of the slope of the elevated bridge structure.
- Alternatives 1 and 2 do not serve the Metro Pershing Square Station.
- Alternatives 2, 4, 6, and 7 do not serve the Metro Pico Station.
- Alternatives 1, 2, 3, 4, and 7 do not serve Union Station.
- Alternatives 3, 4, 5, 6, and 7 affect the peak hour travel lane or the off peak parking lane on Hill Street.

Traffic operations

- All alternatives would have traffic capacity issues on southbound Broadway following the implementation of the Broadway streetscape improvements proposed by a separate project which would reduce southbound Broadway to one lane with no turn lane or turn restrictions; this configuration would make southbound travel time unreliable because of queues created by left and right turning vehicles and pedestrian crossings.
- Alternatives 1 and 2 require a contra-flow lane on Grand Avenue between 5th Street and 9th Street which requires a southbound lane reduction.
- Alternatives 3, 4, 5, 6, and 7 would eliminate either the peak hour travel lane or the off peak parking lane on Hill Street. The peak hour travel lane and the off peak parking

lane use the same travel lane so one or the other would need to be eliminated because the streetcar uses a fixed-guideway and cannot shift lanes depending on time of day.

- Alternatives 5 and 6 cross US 101 freeway on-ramp/off-ramps which are subject to traffic congestion and high vehicular speeds.
- Alternatives 1 and 2 require one left turn while Alternatives 3, 4, 5, 6, and 7 require three left turns; left turns sometimes require a transit only signal.
- Alternative 7 may be affected by traffic congestion on 7th Street if a proposed lane reduction is implemented.

Bicycle/pedestrian integration

- All alternatives have potential conflict with bicycles because of the inherent conflict between bicycle tires and tracks, particularly at side stops where the distance between the track and the stop narrows and locations where the streetcar curves or turns at an intersection.
- All alternatives require coordination with a proposed bicycle facility on Figueroa Street
- Alternative 7 requires coordination with proposed bicycle facility on 7th Street which may result in an eastbound lane reduction.
- Alternatives 1 and 2 create one-way loops which limit access in one direction for pedestrians.
- Alternatives 1 and 2 use a contra-flow lane on Grand Avenue between 5th Street and 9th Street, which may impact bicycle and pedestrian movements depending on how the contra-flow lane is designed.

Table 27 provides a summary of the circulation issues for each alternative.

Table 27: Circulation Issues

Issues	Alternative						
	1	2	3	4	5	6	7
Transit							
Operations	– Broadway lane reduction – Bus volumes on Broadway and Grand Ave	– Broadway lane reduction – Bus volumes on Broadway and Grand Ave	– Broadway lane reduction – Bus volumes on Broadway and Hill St	– Broadway lane reduction – Bus volumes on Broadway and Hill St	– Broadway lane reduction – US 101 freeway on-ramps/off-ramps – Bus volumes on Broadway and Hill St	– Broadway lane reduction – US 101 freeway on-ramps/off-ramps – Bus volumes on Broadway and Hill St	– Broadway lane reduction – Bus volumes on Broadway and Hill St – Bus volumes and loading zones on 7th St
Stops	– Cannot serve stops on Grand Ave between 3rd St and 6th St because of elevated bridge structure – Bus volumes on Broadway and Grand Ave	– Cannot serve stops on Grand Ave between 3rd St and 6th St because of elevated bridge structure – Bus volumes on Broadway and Grand Ave	– Bus volumes on Broadway and Hill St	– Bus volumes on Broadway and Hill St	– Bus volumes on Broadway and Hill St	– Bus volumes on Broadway and Hill St	– Bus volumes on Broadway and Hill St – 7th St/ Metro Center Station over capacity
Transit Integration	– Does not serve Pershing Square Station – Does not serve Union Station	– Does not serve Pershing Square Station or Pico Station – Does not serve Union Station	– Does not serve Union Station – Affects peak hour travel lane on Hill St for Metro	– Does not serve Pico Station – Does not serve Union Station – Affects peak hour travel lane on Hill St for Metro	– Does not serve Regional Connector Hope Station – Affects peak hour travel lane on Hill St for Metro	– Does not serve Pico Station or Regional Connector Hope Station – Affects peak hour travel lane on Hill St for Metro	– Does not serve Pico Station – Does not serve Union Station – 7th St/ Metro Center Station over capacity
Expansion	– No issues identified						

Table 27 (Continued): Circulation Issues

Issues	Alternative						
	1	2	3	4	5	6	7
Traffic							
Capacity	– Traffic capacity issues on southbound Broadway following the implementation of the Broadway streetscape improvements which would reduce southbound Broadway to one lane with no turn lane or turn restrictions						
Travel Lane	– Contra-flow lane on Grand Avenue between 5th St and 9th St	– Contra-flow lane on Grand Avenue between 5th St and 9th St	– Peak hour travel/off peak parking lane on Hill St	– Peak hour travel/off peak parking lane on Hill St	– Peak hour travel/off peak parking lane on Hill St	– Peak hour travel/off peak parking lane on Hill St	– Peak hour travel/off peak parking lane on Hill St
Left Turns	– 1 left turn	– 1 left turn	– 3 left turns	– 3 left turns	– 3 left turns	– 3 left turns	– 3 left turns
Bicycle/Pedestrian							
Bicycle	– Potential conflict with bicycle and tracks, particularly at turn/curve locations, outside lane streetcar operation, and side stops – Conflict with Figueroa bicycle facility as outlined in Figueroa Corridor Project; require potential modification to lane figuration and stops for streetcar or changes to bicycle facility						
Pedestrian	– Creates large one-way loop which limits access in one direction – Contra-flow lane on Grand Ave between 5th St and 9th St	– Creates large one-way loop which limits access in one direction – Contra-flow lane on Grand Ave between 5th St and 9th St	– No issues identified	– No issues identified	– Streetcar operation pedestrian plaza (Paseo de la Plaza)	– Streetcar operation pedestrian plaza (Paseo de la Plaza)	– No issues identified

4.2.7 Design

This section addresses potential design issues associated with the alternatives evaluated in final screening. These are issues that would need to be addressed in the next phase after the LPA is selected. Potential design issues were grouped into physical constraints, transit system constraints, and traffic constraints.

Physical constraints (street grade, crossings, right-of-way, bridge structures, etc.)

- Alternatives 1 and 2 require an elevated bridge structure between 4th Street and 6th Street to avoid the 14 percent grade on Grand Avenue.
- Alternatives 1, 2, 3, 4, and 7 use 1st Street which is 9 percent grade between Grand Avenue and Broadway.
- Alternatives 1 and 2 require modification of the Grand Avenue bridge deck.
- Alternatives 3, 4, and 7 require modification of the Grand Avenue bridge deck if it is decided to provide a stop at 3rd Street and Grand Avenue.
- Alternatives 5 and 6 require modification of the Main Street and Los Angeles Street bridge decks over US 101.
- Alternatives 5 and 6 cross US 101 freeway on-ramp/off-ramps, which may require redesign depending on track and stop placement.

Transit system constraints (track and guideway, system configuration, expansion, etc.)

- Alternatives 3, 4, and 7 may require two-way single track operation on 1st Street between Broadway and Grand Avenue and Grand Avenue between 1st Street and 2nd Street or 3rd Street which may limit streetcar headways and require semi-exclusive right-of-way.
- Alternatives 5 and 6 may require two-way single track operation on 1st Street east of Broadway which may limit streetcar headways and require semi-exclusive right-of-way.
- Alternatives 1 and 2 may have system expansion constraints because elevated bridge structure on Grand Avenue is single track, preventing double-track and two-way loop operation.

Traffic constraints (travel lanes, left turns, etc.)

- Alternatives 1 and 2 require a contra-flow lane on Grand Avenue between 5th Street and 9th Street which requires a southbound lane reduction.
- Alternatives 3, 4, 5, 6, and 7 could eliminate the peak hour travel/off peak parking lane on Hill Street.
- Alternatives 1 and 2 require one left turn while Alternatives 3, 4, 5, 6, and 7 require three left turns; left turns require a transit only signal.
- Alternatives 5 and 6 cross US 101 freeway on-ramp/off-ramps which are subject to traffic congestion and high vehicular speeds.

Table 28 provides a summary of the design issues for each alternative.

Table 28: Design Issues

Issues	Alternative						
	1	2	3	4	5	6	7
Physical Constraints							
Street Grade	– 9% grade on 1st St – Elevated bridge structure at 8% required to mitigate 14% grade on Grand Ave	– 9% grade on 1st St – Elevated bridge structure at 8% required to mitigate 14% grade on Grand Ave	– 9% grade on 1st St	– 9% grade on 1st St	– No issues identified	– No issues identified	– 9% grade on 1st St
Crossings	– No issues identified	– No issues identified	– No issues identified	– No issues identified	– US 101 freeway on-ramps/off-ramps	– US 101 freeway on-ramps/off-ramps	– No issues identified
Right-of-Way	– No issues identified – All alternatives are located within the existing street right-of-way – Potential Maintenance and Storage Facility Site to be identified						
Bridge Structures	– Elevated bridge structure on Grand Ave between 4th St and 6th St – Grand Ave bridge deck	– Elevated bridge structure on Grand Ave between 4th St and 6th St – Grand Ave bridge deck	– Optional Grand Ave bridge deck	– Optional Grand Ave bridge deck	– Main St and Los Angeles St bridge decks over US 101	– Main St and Los Angeles St bridge decks over US 101	– Optional Grand Ave bridge deck
Transit System Constraints							
System Configuration	– Loop operation	– Loop operation	– Loop operation plus couplet	– Loop operation plus couplet	– Loop operation plus couplet	– Loop operation plus couplet	– Loop operation plus couplet
Track and Guideway	– No issues identified	– No issues identified	– Potential two-way single track operation on 1st St and/or Grand Ave	– Potential two-way single track operation on 1st St and/or Grand Ave	– Potential two-way single track operation on 1st St	– Potential two-way single track operation on 1st St	– Potential two-way single track operation on 1st St and/or Grand Ave

Table 28 (Continued): Design Issues

Issues	Alternative						
	1	2	3	4	5	6	7
Expansion	– No issues identified						
Traffic Constraints							
Travel Lanes	– Contra-flow lane on Grand Avenue between 5th St and 9th St – Broadway lane reduction	– Contra-flow lane on Grand Avenue between 5th St and 9th St – Broadway lane reduction	– Broadway lane reduction – Peak hour travel/off peak parking lane on Hill St	– Broadway lane reduction – Peak hour travel/off peak parking lane on Hill St	– Broadway lane reduction – Peak hour travel/off peak parking lane on Hill St – US 101 freeway on-ramps/off-ramps	– Broadway lane reduction – Peak hour travel/off peak parking lane on Hill St – US 101 freeway on-ramps/off-ramps	– Broadway lane reduction – Peak hour travel/off peak parking lane on Hill St
Left Turns	– 1 left turn	– 1 left turn	– 3 left turns	– 3 left turns	– 3 left turns	– 3 left turns	– 3 left turns

4.2.8 Environmental

This section identifies potential environmental issues related to each alternative in final screening. Potential environmental issues were identified for each alternative relative to the environmental impact categories:

- Property Impacts
- Land Use
- Communities and Neighborhoods
- Visual and Aesthetics
- Historic and Cultural Resources
- Parklands
- Noise and Vibration
- Energy
- Hazardous Materials
- Public Safety and Security
- Soils, Geology and Seismic
- Ecosystem and Natural Environment
- Water Quality and Hydrology
- Air Quality
- Construction

Table 29 provides a summary of potential environmental issues for each alternative. The goal was to determine if there were differences between the alternatives relative to the environmental impact categories. Because the seven alternatives overlap in many locations and there has been limited conceptual design work completed for the alternatives, this table only identified the potential major issues that differentiated the alternatives. Detailed environmental analysis would take place during the subsequent environmental documentation phase to comply with the National Environmental Policy Act (NEPA) and the California Environmental Policy Act (CEQA). The environmental documentation phase would begin after adoption of the LPA.

Alternatives 1 and 2 have the most potential environmental issues. This is primarily due to the transportation, visual aesthetic, public safety, and construction issues associated with the elevated bridge structure on Grand Avenue between 4th Street and 6th Street as well as the contra-flow lane that would be required for the streetcar between 5th Street and 9th Street. Alternatives 1 and 3 have the most potential for sensitive noise and vibration receptors because of the proximity to the California Hospital Medical Center (residential areas were not screened as sensitive noise and vibration receptors but will be evaluated in the environmental documentation phase). Alternatives 4 and 7 have the least environmental issues because of their relative simplicity and avoidance of grade issues and bridge structures.

Table 29: Potential Environmental Issues

Issues	Alternative						
	1	2	3	4	5	6	7
Property Impacts	– No issues identified – All alternatives are located within existing street right-of-way and will not require property acquisition – Property acquisition will likely be required for the maintenance and storage facility (MSF); MSF site(s) will be identified after identification of the LPA						
Land Use	– No issues identified – All alternatives are compatible with existing and future land use; the PSA is comprised primarily of commercial land use but is seeing a substantial increase in residential land uses						
Community and Neighbor-hoods	– Potential gentrification along Broadway and in South Park for all alternatives						
Visual and Aesthetics	– Elevated bridge structure on Grand Ave between 4th St and 6th St – Overhead wires	– Elevated bridge structure on Grand Ave between 4th St and 6th St – Overhead wires	– Overhead wires	– Overhead wires	– Overhead wires	– Overhead wires	– Overhead wires
Historic and Cultural Resources	– No issues identified – All alternatives serve the Historic Core District, which includes the Historic Broadway Theatre District – There is no anticipated use or alternation of historic buildings for all alternatives						
Parklands	– No issues identified – All alternatives are located within existing street right-of-way and will not affect parklands during construction and operation						
Noise and Vibration	– Disney Concert Hall – Music Center – Broadway Historic Theaters – California Hospital Medical Center – Nokia Theatre	– Disney Concert Hall – Music Center – Broadway Historic Theaters – Nokia Theatre	– Disney Concert Hall – Music Center – Broadway Historic Theaters – California Hospital Medical Center – Nokia Theatre	– Disney Concert Hall – Music Center – Broadway Historic Theaters – Nokia Theatre	– El Pueblo – Broadway Historic Theaters – California Hospital Medical Center – Nokia Theatre	– El Pueblo – Broadway Historic Theaters – Nokia Theatre	– Disney Concert Hall – Music Center – Broadway Historic Theaters – Nokia Theatre

Table 29 (Continued): Potential Environmental Issues

Issues	Alternative						
	1	2	3	4	5	6	7
Energy	– No issues identified – All alternatives would result in an overall conservation of energy that would otherwise be required to transport people within the PSA						
Hazardous Materials	– All alternatives are located within existing street right-of-way so potential for hazardous materials is low – Maintenance and storage facility (MSF) sites will be identified after identification of the LPA; subsequent hazardous materials analysis will be performed on MSF site(s)						
Public Safety and Security	– Elevated bridge structure on Grand Ave between 4th St and 6th St (require safe exit routes) – Special event operation on Figueroa St (pedestrian conflicts)	– Elevated bridge structure on Grand Ave between 4th St and 6th St (require safe exit routes) – Special event operation on Figueroa St (pedestrian conflicts)	– Special event operation on Figueroa St (pedestrian conflicts)	– Special event operation on Figueroa St (pedestrian conflicts)	– Special event operation on Figueroa St (pedestrian conflicts) – Streetcar operation in Paseo de la Plaza (pedestrian conflicts)	– Special event operation on Figueroa St (pedestrian conflicts) – Streetcar operation in Paseo de la Plaza (pedestrian conflicts)	– Special event operation on Figueroa St (pedestrian conflicts)
Soils, Geology and Seismic	– Elevated bridge structure on Grand Ave between 4th St and 6th St (seismic)	– Elevated bridge structure on Grand Ave between 4th St and 6th St (seismic) – Grand Ave bridge deck (seismic)	– Grand Ave bridge deck (seismic)	– Grand Ave bridge deck (seismic)	– Main St and Los Angeles St bridge decks over US 101 (seismic)	– Main St and Los Angeles St bridge decks over US 101 (seismic)	– Grand Ave bridge deck (seismic)
Ecosystem and Natural Environment	– No issues identified – All alternatives are located with the existing street right-of-way and a highly urbanized area so the potential for natural environment issues is low						
Water Quality and Hydrology	– All alternatives are located with the existing street right-of-way so the potential for water quality and hydrology issues is low and primarily relates to storm water runoff						

Table 29 (Continued): Potential Environmental Issues

Issues	Alternative						
	1	2	3	4	5	6	7
Air Quality	– An air quality hot spot analysis may be necessary if there are significant traffic impacts to intersections						
Construction	– Longer construction phasing and sequence because of elevated bridge structure on Grand Ave between 4th St and 6th St – Modification to Grand Ave bridge deck would increase construction duration	– Longer construction phasing and sequence because of elevated bridge structure on Grand Ave between 4th St and 6th St – Modification to Grand Ave bridge deck would increase construction duration	– Modification to Grand Ave bridge deck (if extended south to 3rd St) could increase construction duration	– Modification to Grand Ave bridge deck (if extended south to 3rd St) could increase construction duration	– Modification to Main St and Los Angeles St bridge decks over US 101 would increase construction duration	– Modification to Main St and Los Angeles St bridge decks over US 101 would increase construction duration	– Modification to Grand Ave bridge deck (if extended south to 3rd St) could increase construction duration

4.2.9 Economic Development

This section details the economic development potential for each alternative in final screening. The analysis focused on the potential for new development for the area south of 9th Street in the South Park district of Downtown Los Angeles. In other areas of the PSA, the alternatives either share common alignments or are located in areas with limited opportunities for economic development. While Broadway has immense economic development potential, all of the alternatives share a common alignment on Broadway between 1st Street and 11th Street and therefore it is not possible to differentiate between the alternatives in this segment. In addition, most of the other areas of the PSA (Financial Core, Bunker Hill, Union Station, etc.) are relatively built-out with limited opportunity for new development or redevelopment.

In order to compare economic development potential in the South Park, an inventory of surface parking lots and vacant lots was taken in the area. These lots have the lowest land use intensity and are the most likely to develop in the future. The analysis was divided into two zones: (1) parcels within 350 feet (approximately one east-west block) and (2) parcels within 750 feet (approximately two east-west blocks). Table 30 provides a summary of the economic development potential in South Park. Figures 45 and 46 illustrate the surface parking lots and vacant lots within the 350 feet and 750 feet buffer.

Table 30: Economic Development Potential

Buffer	Alternatives 1, 3, and 5 (Pico Blvd)	Alternatives 2, 4, 6, and 7 (11th St)
350 feet (1 block)	32.38 acres	25.80 acres
750 feet (2 blocks)	55.03 acres	39.92 acres

The analysis showed that the alternatives using Pico Boulevard (Alternatives 1, 3, and 5) provide a 20 percent increase in economic development potential within 1 block and 26 percent increase within 2 blocks in economic development potential relative to the alternatives using 11th Street (Alternatives 2, 4, 6, and 7). This correlates to an additional 6.58 acres within one block and 15.11 acres within two blocks of Alternatives 1, 3, and 5 due to greater opportunities around Pico Boulevard.

Figure 45: Surface Parking and Vacant Lots (Alternatives 1, 3, and 5)

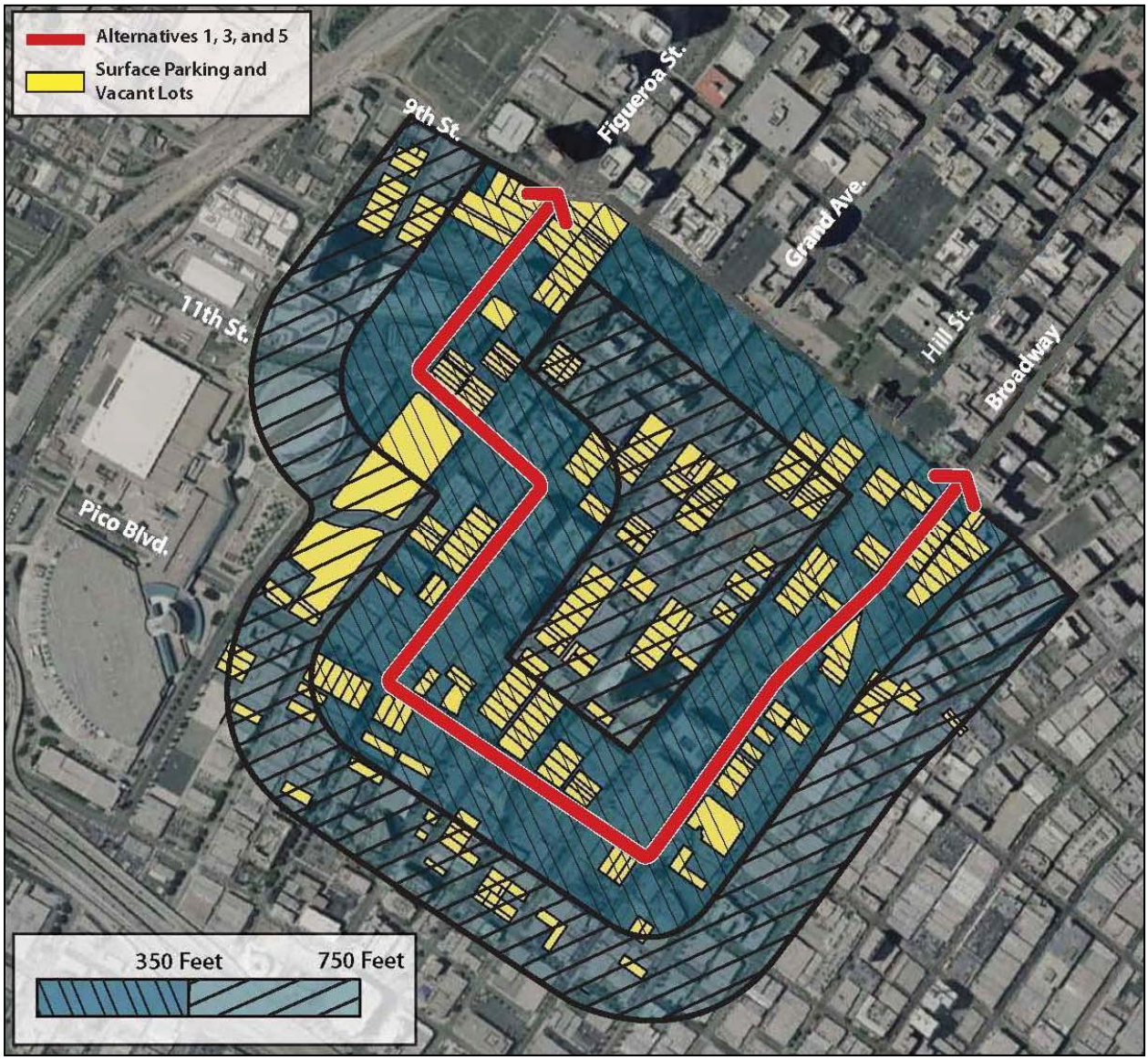
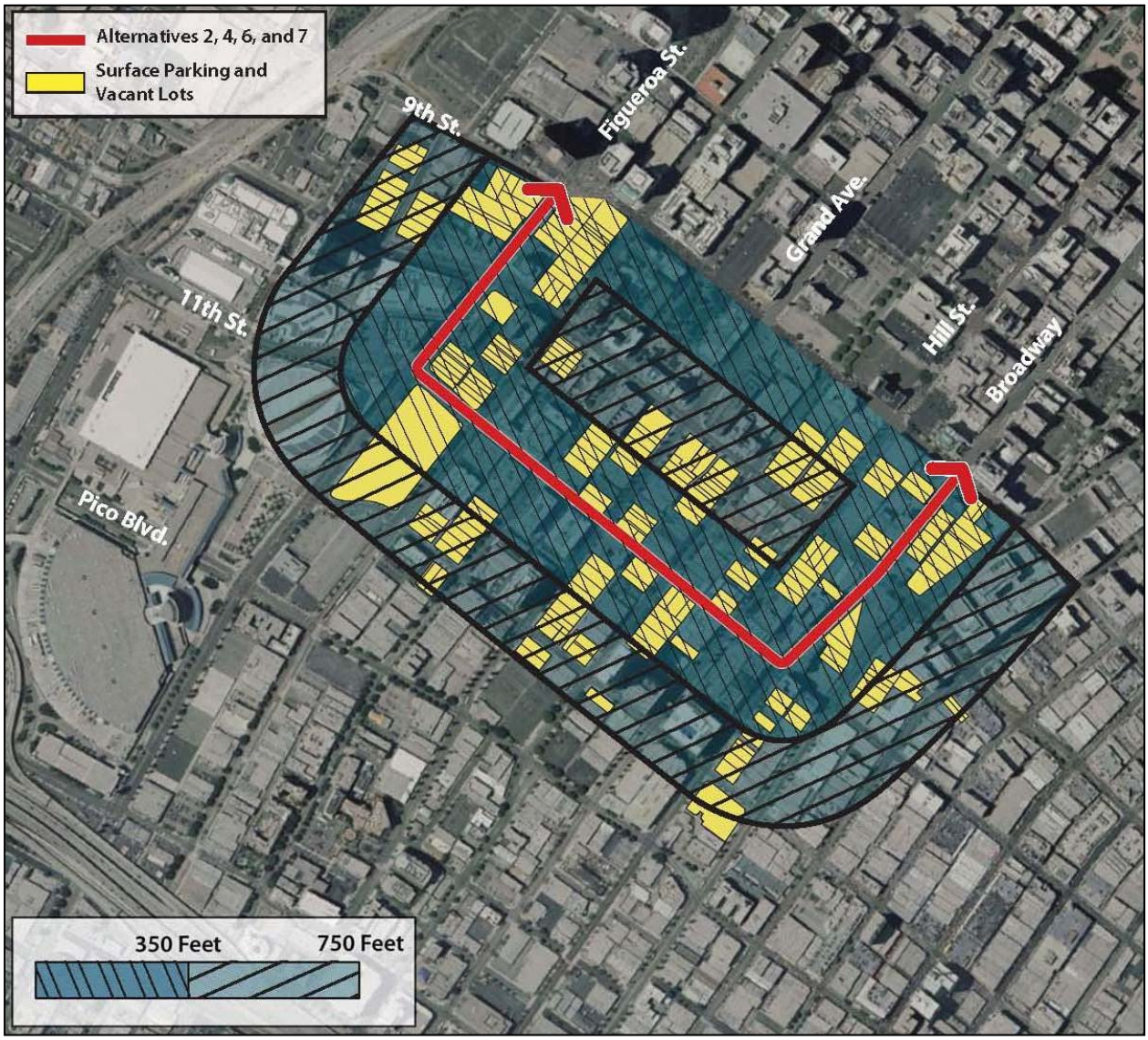


Figure 46: Surface Parking and Vacant Lots (Alternatives 2, 4, 6, and 7)



4.2.10 Results of Final Screening

The following summarizes the results of the final screening for each alternative. Table 31 shows the ridership, capital cost, operation and maintenance (O&M) cost, and cost per user results for each alternative.

Table 31: Summary of Ridership and Cost Results

Alternative	Ridership		Capital Cost	Annual O&M Cost	Cost per User
	Daily Boardings	Boardings Per Mile			
1	9,090	2,370	$115,499,000	$5,318,000	$1.28
2	7,390	2,230	$107,807,000	$5,318,000	$1.52
3	9,880	2,300	$119,053,000	$6,148,000	$1.28
4	8,180	2,160	$106,367,000	$5,318,000	$1.36
5	11,190	2,170	$137,895,000	$7,442,000	$1.34
6	9,500	2,040	$130,438,000	$6,916,000	$1.48
7	8,390	2,210	$106,761,000	$5,318,000	$1.33

Note: Cost per User = (Annualized Capital Cost + Annualized O&M Cost) / Daily Boardings

Table 32 shows the results of the final screening using the final screening criteria. The alternatives were rated High (1), Medium (2), or Low (3) for each criteria, with High (1) meaning optimal performance and Low (3) indicating sub-standard performance. All of the criteria were weighted equally for the final screening.

Table 32: Final Screening Results

Criteria	Alternative							Summary
	1	2	3	4	5	6	7	
Ridership	1	3	1	3	2	1	1	– Alternatives 1, 3, 6, and 7 have the highest combined average of daily boardings and boardings per mile
Capital Costs	2	2	2	1	3	3	1	– Alternative 4 ($106.4 million) and Alternative 7 ($106.8 million) have the lowest capital cost
O&M Costs	1	1	2	1	3	3	1	– Alternatives 1, 2, 4, and 7 ($5.3 million) have the lowest O&M cost
Cost/Benefit	1	3	1	1	1	3	1	– Alternatives 1 and 3 ($1.28) have the lowest cost per user, followed by Alternative 7 ($1.33), Alternative 5 ($1.34), and Alternative 4 ($1.36)
Destinations	1	1	1	1	1	1	1	– Alternatives 1, 2, 3, 4, and 7 serve Bunker Hill, while Alternatives 5 and 6 serve Union Station
Circulation	3	3	2	1	3	3	1	– Alternatives 1 and 2 cannot serve stops on Grand Ave between 3rd St and 6th St because of elevated bridge structure – Alternatives 5 and 6 cross US 101 freeway on-ramp/off-ramps
Design	3	3	2	1	3	3	1	– Alternatives 1 and 2 require an elevated bridge structure on Grand Ave – Alternatives 1 and 2 require modification of the Grand Ave bridge deck – Alternatives 5 and 6 require modification of the Main St and Los Angeles St bridge decks over US 101
Environmental	3	3	2	2	2	2	2	– Alternatives 1 and 2 have the most potential environmental issues because of elevated bridge structure on Grand Ave
Economic Development	1	2	1	2	1	2	2	– Alternatives 1, 3, and 5 (Pico Blvd) have more economic development potential than Alternatives 2, 4, 6, and 7 (11th St).
Total	**16**	**21**	**14**	**13**	**19**	**21**	**11**	**– The lower the score equals the higher the performance of the alternative.**

High (1) = Optimal Performance, Medium (2) = Moderate Performance, and Low (3) = Substandard Performance.

Table 33 shows the final rankings of the alternatives evaluated in final screening. Overall, the lower the score equals the higher the performance of the alternative.

Table 33: Ranking of Alternatives after Final Screening

Rank	Alternative	Total Points
1	Alternative 7	11
2	Alternative 4	13
3	Alternative 3	14
4	Alternative 1	16
5	Alternative 5	19
6 (tie)	Alternative 2	21
6 (tie)	Alternative 6	21

Note: The lower the score equals the higher the performance of the alternative.

4.3 Final Screening/Locally Preferred Alternative (LPA) Recommendation

Based on the results of the final screening evaluation, which examines the ability of an alternative to meet the purpose and need of the project, Alternative 7 was recommended as the LPA. Alternative 7 was recommended as the LPA because:

- It was tied for highest combined average of daily boardings and boardings per mile.
- It had the lowest capital cost.
- It was tied for the lowest operation and maintenance cost.
- It had the third lowest cost per user.
- It had the fewest number of potential circulation, design, and environmental issues.
- It received a high level of community support.
- It had the most potential for generating revenue through a property assessment.

The LPA includes a service connection on 7th Street between Hill Street and Broadway to provide operational flexibility.

The LPA also includes an alternative alignment that would use 9th Street between Figueroa Street and Hill Street instead of 7th Street. This is the same alignment as Alternative 7 (except it uses 9th Street instead of 7th Street as in Alternative 4). This alternative alignment is being included because:

- The Los Angeles Department of Transportation (LADOT) is proposing a potential lane reduction on 7th Street that includes the addition of bicycle lanes. This project has not been designed, so it is unclear if it would affect the LPA on 7th Street. Identifying an alternative alignment provides a contingency plan for the LPA should the LADOT project preclude streetcar operation on 7th Street.

- Metro and LADOT will continue to work together on both projects, including during the advanced conceptual engineering and environmental documentation phases.

In addition, the LPA includes a variation to extend the terminus south on Grand Avenue from 2nd Street to 3rd Street. This variation is being proposed to maximize flexibility for stop and terminus locations on Grand Avenue.

The LPA is described in Table 34 and shown in Figure 47.

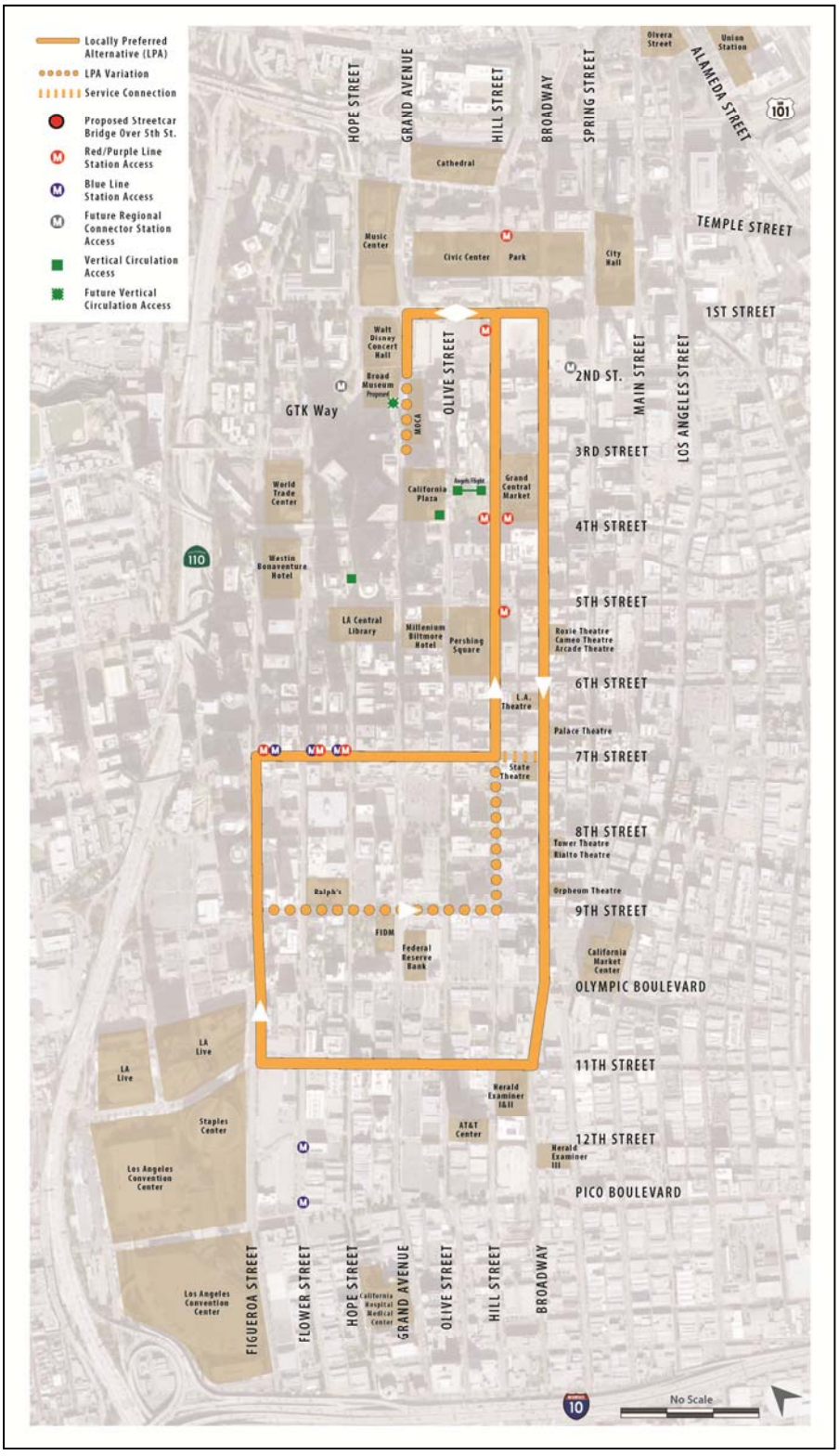
Table 34: Final Screening/LPA Recommendation

Recommendation	Description
Alternative 7	Southbound on Broadway between 1st St and 11th St, westbound on 11th St between Broadway and Figueroa St, northbound on Figueroa St between 11th St and 7th St, eastbound on 7th St between Figueroa St and Hill St, northbound on Hill St between 9th St and 1st St, westbound on 1st St between Hill St and Grand Ave, two-way on Grand Ave between 1st St and 2nd St, and eastbound on 1st St between Grand Ave and Broadway.

4.3.1 Future Extension to Union Station

While Alternative 7 was recommended as the LPA, there remains strong support for a connection to Union Station (as shown in Alternatives 5 and 6 earlier). Therefore, it was recommended that an extension to Union Station be evaluated in a future study. This extension could function as a second streetcar line paired with Bunker Hill or South Park.

Figure 47: Final Screening/LPA Recommendation



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Appendix A

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FEHR PEERS

Technical Memorandum

Date: October 4, 2011

To: Jim Hecht, HDR

From: Fehr & Peers

Subject: Preliminary Estimates of Ridership for the Downtown Los Angeles Streetcar

1.0 Description of Methodology

Traditional methods of forecasting transit ridership often employ regional travel demand models to predict ridership. Such models are relatively unresponsive to changes in station-level land use and transit service characteristics. In the case of Los Angeles, the large sizes of the traffic analysis zones in the Metro travel demand model preclude detailed land use data collection and differentiation at the station-level. Furthermore, the Metro travel demand model does not have a streetcar calibrated mode, meaning its use would require calibration and validation of a new streetcar mode of travel in the model. Alternatively the streetcar would have to be classified using a mode that currently exists in the model such as bus or light rail, which have different ridership characteristics than streetcar. Therefore, for the purposes of the Alternatives Analysis (AA) Study, we have chosen not to use the Metro travel demand model for forecasting Downtown Los Angeles Streetcar (LA Streetcar) ridership and instead use a Direct Ridership Model calibrated and validated to streetcar for ridership forecasting.

Direct Ridership Models (DRMs) are directly and quantitatively responsive to land use and transit service characteristics within the immediate vicinity and within the catchment area of transit stations. They can predict ridership at individual stations based on local station area and system characteristics. DRMs are based on empirical relationships found through statistical analysis of station ridership and local station characteristics.

The effects of station-level variables are expected to be highly significant in accurately forecasting streetcar ridership. While streetcar systems are used for traditional commute trips, our research with transit agencies suggests they more often provide access and circulation for downtown or city center areas. They serve tourist needs and often duplicate existing transit service provided by bus. Thus, it was expected that individual station-area characteristics greatly affect boardings and overall ridership projections. Recognizing that variables affecting streetcar ridership are different than those for regional rail systems, the basis for analysis draws from the characteristics of existing streetcar systems in Portland, Seattle, and Tacoma. These systems were chosen because they are most similar to the proposed LA Streetcar.

1.1 Data Collection

Ridership data was collected for the Portland, Seattle and Tacoma streetcar systems at the system level, and where available, at the individual station level. Variables collected at the system level include route length, opening year, frequency of service, train capacity, fare (including presence of free stations), and transfer policy. At the station level, data were gathered for the area within a quarter-mile[1] of the station and included intersecting transit, retail and general employment density, household density, street connectivity, distance between stations, number of hotels and number of special events centers. Table 1 shows the characteristics of the comparative systems. Table 2 shows the data collected at the corridor level. Table 3 shows data collected at the station area level.

TABLE 1 Researched Streetcar Systems

System	Route Length (both directions)	Number of Stations	Fare	Weekday Span of Service	Peak Weekday Frequency (trains/hour)	Daily System Boardings	Daily Boardings per Mile
Portland Streetcar System	8.0 Miles	47	$2.10 (Free at majority of stops)	5:30AM – 11:30PM	4.6	11,700	1,460
Seattle South Lake Union Line	2.6 Miles	12	$2.50	6:00AM – 9:00PM	4.0	2,300	880
Tacoma Streetcar System	2.7 Miles	8	Free	5:20AM – 10:10PM	5.0	2,900	1,070

TABLE 2 Corridor Level Data Collection

Variable Class	Variable List
Ridership	• Average Weekday Boardings, Peak Month • Average Weekend Boardings, Peak Month • Average Weekday Boardings, Off-Peak Month • Average Weekend Boardings, Off-Peak Month
Service Characteristics	• Route Length (miles, counting both directions) • Opening Year • AM Peak Frequency (minutes) • PM Peak Frequency (minutes) • Daily Average Frequency (minutes) • Train Capacity • Intersecting Feeder Buses During Operating Hours • Intersecting Feeder Trains During Operating Hours

[1] The Streetcar DRM treats all employment and households within a ¼ mile walk equally and does not estimate a capture rate within the ¼ walk that decreases by distance from the stop.

Variable Class	Variable List
	• Number of Stops on Streetcar Line • Regular Fare • Transfer Accepted • Passes Accepted
Population & Employment (within ¼ mile of corridor)	• Retail Employment • Non-Retail Employment • Job Mix (Retail/Non-Retail Ratio) • Employment Density • Households • Household Density • Jobs/Housing Ratio

TABLE 3 Station Level Data Collection

Variable	Description	Source
Boardings	Average daily boardings.	Transit Agency
Alightings	Average weekday alightings.	Transit Agency
Start of Line	Binary variable indicating station is the first stop on the line (0/1).	Fehr & Peers
Intersections	Number of intersections within a quarter mile of the station. Limited access highways and ramps not included.	Fehr & Peers (Calculated in GIS)
Stops to Terminus	Number of stations until the terminus of the line. (A measure of how many destinations are accessible)	Fehr & Peers (Calculated in GIS)
Buses	Number of intersecting buses within one block of the station.	Transit Agency
Number of Feeder Trains	Number of daily trains on intersecting rail lines within one block of the station.	Transit Agency
Rail Access	Binary variable indicating the station has a transfer to a rail line (0/1).	Fehr & Peers
Free/Paid	Binary variable indicating whether the station is fare free or paid (0/1).	Transit Agency
Distance to Nearest Station	Distance to closest directional station. (Closer spaced stations have a smaller catchment area than further spaced stations)	Fehr & Peers (Calculated in GIS)
Retail Employment	Number of retail employees within ¼ mile radius of station.	U.S Census Bureau Longitudinal Employer Household Dynamics
Non-Retail Employment	Number of all other (non-retail) employees within ¼ mile radius of station.	U.S Census Bureau Longitudinal Employer Household Dynamics
Retail Mix	Ratio of retail employees to non-retail employees (Retail Employment / Non-Retail Employment).	U.S Census Bureau Longitudinal Employer Household Dynamics
Total Employment	Total number of employees within ¼ mile radius of station.	U.S Census Bureau Longitudinal Employer Household Dynamics

Variable	Description	Source
Households	Number of households within ¼ mile radius of station.	2010 Census
Jobs Housing Balance	Number of jobs per household within ¼ mile radius of station (Total Employment / Households).	2010 Census and U.S Census Bureau Longitudinal Employer Household Dynamics
Urban Density	Sum of Retail Employment and Households within ¼ mile radius of station.	Fehr & Peers
Hotel	Binary variable indicating that a hotel is located near the station (0/1)	Fehr & Peers
Center	Binary variable indicating that a special events center is located near the station	Fehr & Peers
Center Size	A variable that captures the magnitude of the special events center, based on square footage	Fehr & Peers

1.2 Direct Ridership Forecasting

The station level data collected from Portland, Seattle and Tacoma were used to perform ordinary least squares (OLS) regression analysis to predict daily boardings per station. This analysis is based on empirical relationships found through statistical analysis of station ridership and local station characteristics. Multiple iterations of all collected data were tested in the regression model, but the variables that entered into the direct ridership forecasting (DRF) model as significant were the following:

- *Urban Density* – a measure of retail intensity and residential density of the station area
- *Number of Feeder Trains* – a measure of the magnitude of regional transit connections
- *Start of Line* – this variable only applies to bi-directional lines where more passengers tend to board at the first station, but does not apply to loop systems
- *Center Size* – a measure of the magnitude of a special events center served by the station
- *Free/Paid* – a binary variable indicating whether the station is free or paid (but not providing information about the level of fare)

The R^2 value of the model is 0.56 which represents a fairly high goodness of fit. One of the limits to the model is the limited number of built streetcar systems in the US and thus limited data availability. Although intuitively more variables than those included in the model influence ridership, due to the limited data availability we were unable to distinguish statistically significant relationships between all variables. That being said, we were able to find significant relationships between boardings and several station level variables in order to create a statistically significant model with a good fit.

Another factor that could affect goodness of fit is the close spacing of stops along streetcar lines. Streetcar lines such as the ones studied in Portland, Seattle and Tacoma tend to have closer stop spacing than regional transit systems such as buses and light rail. Due to the close stop spacing, the catchment area of some stops may overlap. This could result in variation among the predicted values at the station level, but should not have a strong impact on the predicted values at the corridor level.

Data for each of these five variables were collected for each potential stop along the LA Streetcar line. These variables were used to predict daily boardings at each station and were summed for each

configuration to estimate daily boardings along the line. The expected system boardings are summarized in Section 3.0.

1.2.1 Urban Density

Urban density is a sum of retail employment and households within ¼ mile of the station. Most stations along the proposed LA Streetcar corridor have either high household density or high retail employment density, but few have both. The areas with the highest household density include 6th and Broadway, and 6th and Hill. The areas with the highest retail employment density are around 9th and Broadway, 11th and Figueroa, and 6th and Hill. Special attention was paid to areas along the corridor where retail employment has been changing over the past five years. The Downtown Center Business Improvement District was consulted to insure that accurate retail employment counts were used as inputs into the model. These areas included:

- 7th + Fig that will be reopened in 2012 as Fig at 7th with Target as the anchor store
- Macy's Plaza
- Downtown Los Angeles Ralphs

1.2.2 Number of Feeder Trains

Number of feeder trains is the daily number of trains on intersecting rail lines with a transfer to the streetcar stop. Several rail lines would have transfers to the proposed LA Streetcar line. These include the Metro Blue Line (with stops at Pico and 7th/Metro Center), Red/Purple Line (with stops at 7th/Metro Center, Perishing Square and Civic Center), Gold Line (which stops at Union Station), Metro Link (which stops at Union Station) and the Expo Line (opening in 2012 with stops at Pico and 7th/Metro Center). Since at some locations several LA Streetcar stops are located near one Metro station, the expected number of riders transferring from a Metro line to the LA Streetcar were distributed among the closest streetcar stations.

1.2.3 Start of Line

Analysis of the Portland, Seattle and Tacoma streetcar systems found that a high number of passengers were boarding at the start of the line station. This does not apply to the LA Streetcar since it will operate in a loop and therefore has no end of the line station. However, in the case that a bi-directional line is proposed, this variable will be applied.

1.2.4 Center Size

This variable takes into account special events centers which are served by the streetcar line and also considers the size of the center and its impact on ridership. The special events centers considered along the LA Streetcar corridor include the following: LA Convention Center, Staples Center, LA Live, MOCA, Disney Theater, City Hall, Olvera Street, and Little Tokyo. Broadway between approximately 3rd and 7th Streets was given consideration as a special generator due to its regional draw. However, since the primary draw is shopping, the Urban Density variable effectively captures the ridership resulting from a shopping rich area. In the model, the Center Size variable is reserved for unique trip generators that cannot be explained by employment or residential population alone. Similar to the Number of Feeder Trains variable, since some centers can be served by multiple streetcar stops, the expected number of streetcar riders generated by each center was distributed among the closest streetcar stops.

1.2.5 Free/Paid

Along the streetcar systems studied, whether or not a station was free or paid was found to have a significant impact on ridership. For the LA Streetcar alternatives discussed in Sections 2 and 3, all LA

Streetcar stops are assumed to be paid. However, for the sensitivity analysis in Section 4, all LA Streetcar stops are assumed to be free.

1.3 Forecast Year

The forecast year for the ridership estimates is 2015 (expected opening year). We did not assume additional development (housing, retail) beyond the 2010 data due to the model's use of parcel by parcel changes within a ¼ mile walkshed when growth forecasts are far more aggregate in nature. The Metro Expo Line (Phase I) is expected to open in 2012 and Feeder Trains at the Pico and 7th/Metro Center Stations were adjusted to reflect this upcoming service. All other regionally significant rail projects are expected after 2015 and were not included in the model.

1.4 Post Model Processing Considerations

Several post-model adjustments were considered to account for variables not included in the DRF model. These are described below.

1.4.1 Frequency of Service

We did not have enough data to make a statistically significant relationship between frequency and boardings, but we have identified this variable as an important factor distinguishing the LA Streetcar from the other streetcar systems studied. Among the stations studied, the average peak hour frequency is 3.6 trains per hour. However, the LA Streetcar is planned to have 8.6 trains per hour during peak hours (one train every 7 minutes). Although no research exists that provides an elasticity value for frequency of service specifically for streetcar systems, according to *TCRP Synthesis 66*, New York City reported an elasticity value of 0.2 for transit service frequency. Considering the increased frequency between the systems studied and the LA Streetcar system, applying this elasticity value would result in an expected ridership increase of 28%. This increase can be applied as a post-model process to the results of the DRF model to account for increased ridership due to the more frequent service of the LA Streetcar than systems studied.

1.4.2 Span of Service

Another variable considered for post model processing was span of service since the LA Streetcar will operated later than the three streetcar systems studied. The LA Streetcar is planned to operate from 6:00 to 12:00 AM Monday through Thursday. This is a span of 18 hours. The average weekday time span of the stations studied is 17.3 hours. This time span is comparable to the LA Streetcar. Furthermore, since the peak boarding hours of streetcar systems are during the day, extending service hours into the night is not expected to have a significant impact on ridership. Late night boardings along the LA Streetcar line are likely to take place at special events centers and these boardings are already accounted for in the model through the *Centers* variable. Therefore, no post-model processing for span of service was performed.

1.4.3 Interactions with LADOT DASH Service

One consideration was whether some level of ridership accounted for in the model would actually take place on the LADOT DASH, Metro Bus, or Metro Rail services and therefore require a post-model adjustment. However, the LA Streetcar route structure (clockwise loop and destinations served), and type of service (streetcar versus shuttle or HRT) suggests that the LA Streetcar would be complementary to existing and planned downtown transit service. While the proposed LA Streetcar alignments duplicate or parallel portions of LADOT DASH Routes B, D, and F, none of these routes could be fully replaced by the LA Streetcar. Further, opportunity does exist to reconfigure LADOT DASH to eliminate duplication with LA Streetcar by modifying route structure. Therefore, post model adjustments do not include direct

transfer of LADOT DASH ridership to the LA Streetcar since they are expected to complement one another. Transit mode choice (LA Streetcar versus shuttle, Metro Bus, or Metro Rail) is effectively captured in the independent variables used in the DRF model.

1.4.4 Consideration of Commuter (Express) Buses

Consideration was given to whether the LA Streetcar could provide a first/last mile connection to the commuter buses that provide access to downtown employment from suburban locations (such as Metro Silver Line, Big Blue Bus Rapid 10, or LADOT Commuter Express). Since the DRF model does not include a variable to account for this type of service, a post model adjustment was explored. Stop locations for the commuter services were identified and determined to provide enough coverage (based on distance between stops) within downtown that transfers to other transit lines would not be needed to complete first mile/last mile trips within downtown Los Angeles. This finding allows us to conclude that no post model adjustment was deemed necessary.

1.4.5 Consideration of a Downtown NFL Stadium

An NFL stadium is currently planned for downtown Los Angeles and would be located on the current site of the West Hall of the Los Angeles Convention Center. It would seat 68,000 for football and could be completed by 2015. How the stadium and its related activity could affect streetcar ridership was considered as a post model adjustment. However, we believe that the Centers variable effectively captures the ridership attributed to the Staples Center/LA Live/Convention Center destination for a typical day. The model assumes events at Staples Center and LA Live and Convention Center. It would be a special circumstance to have events at all four centers on the same day and would represent atypical ridership; therefore no further adjustment was necessary for predicting typical streetcar ridership. A discussion of how ridership could be affected during special event days is included in Section 6.0.

1.4.6 Consideration of Angels Flight

Angles Flight is funicular railway connecting Hill Street and California Plaza in Bunker Hill. Each ride costs $0.25 and the railway averages about 2,100 weekday boardings per day. While this service is well utilized by office workers traveling from Bunker Hill to the Broadway area of downtown, it is also a tourist attraction and the proposed midblock stop on Hill Street between 3rd Street and 4th Street (Alternatives 3, 4, 5, 6 & 7 only) would provide a direct connection to the funicular. Nearby stops at 3rd Street & Grand Avenue (Alternatives 1 & 2 only), 3rd Street & Broadway, and 4th Street & Broadway would also provide access. It is estimated that approximately 30% of average weekday daily boardings are attributable to tourists. Considering a likely synergy between the use of Angels Flight and streetcar among tourists, a post model adjustment equal to 1/3rd of projected daily tourist boardings on Angels Flight (walk and other modes of access would account for the majority of trips to and from the funicular) was distributed proportionally among the four proximate stops.

2.0 Alternatives

Fehr & Peers used the alternatives and stops prepared by HDR to estimate the total daily boardings at each stop, summed to reflect the boardings for each line. The ridership forecasts in this section are based on the following key operating characteristics.

- Hours of Operation: 6:00 am to 12:00 midnight
- Headways: 7 minute peak and 10-15 minute off-peak service
- Fare: $1.50 (Section 4 provides an assessment of reduced fare and fare-free service)

The seven concept alternatives include the following alignment configurations:

- Alternative 1: A4-B3-C2
- Alternative 2: A4-B3-C3
- Alternative 3: A6-B1-C2
- Alternative 4: A6-B1-C3
- Alternative 5: A7-B1-C2
- Alternative 6: A7-B1-C3
- Alternative 7: A6-B1-C4

3.0 Results and Discussion

The results of the DRF for expected daily ridership and performance (boardings per mile) of each alternative are summarized in Table 4:

TABLE 4. Daily Ridership by Alternative from DRF Model

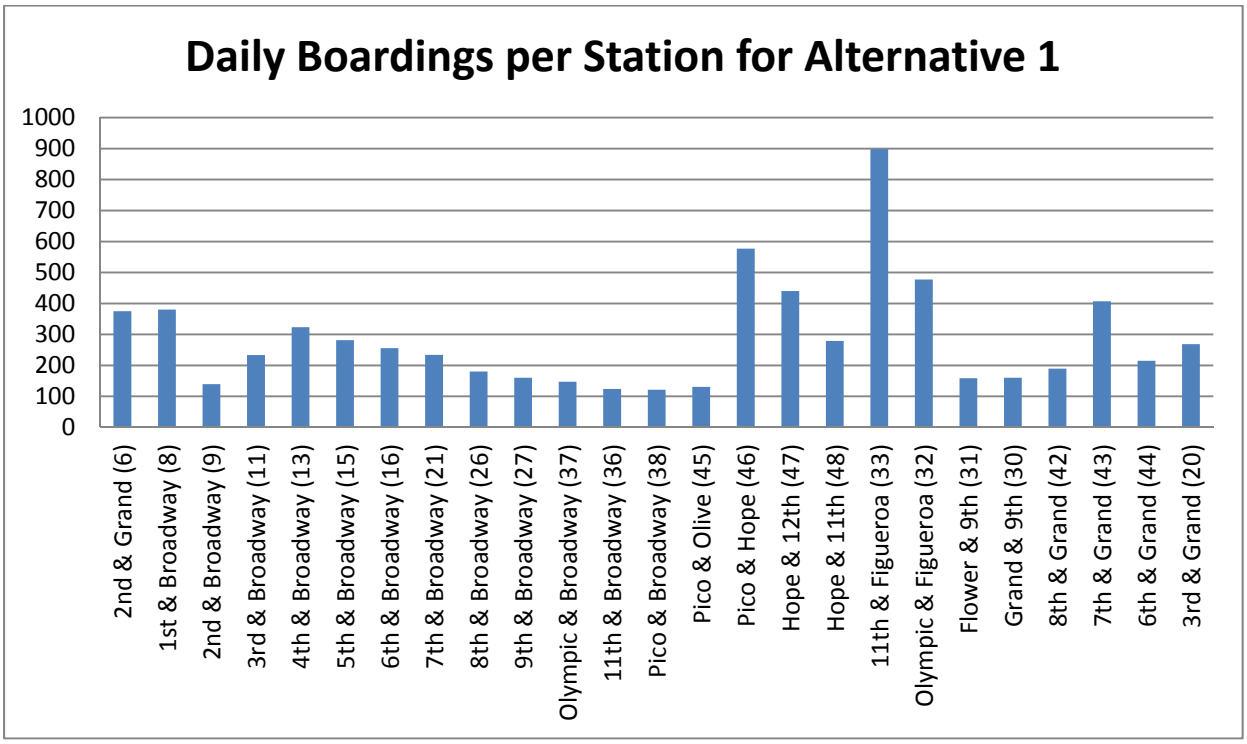
Alignment Configuration	# of Stops	Length (Miles)	System Boardings	Average per Mile
Alternative 1	25	3.83	5,430	1,420
Alternative 2	21	3.32	4,380	1,320
Alternative 3	30	4.29	5,910	1,380
Alternative 4	26	3.78	4,870	1,290
Alternative 5	34	5.16	6,720	1,300
Alternative 6	30	4.65	5,680	1,220
Alternative 7	25	3.79	5,000	1,320

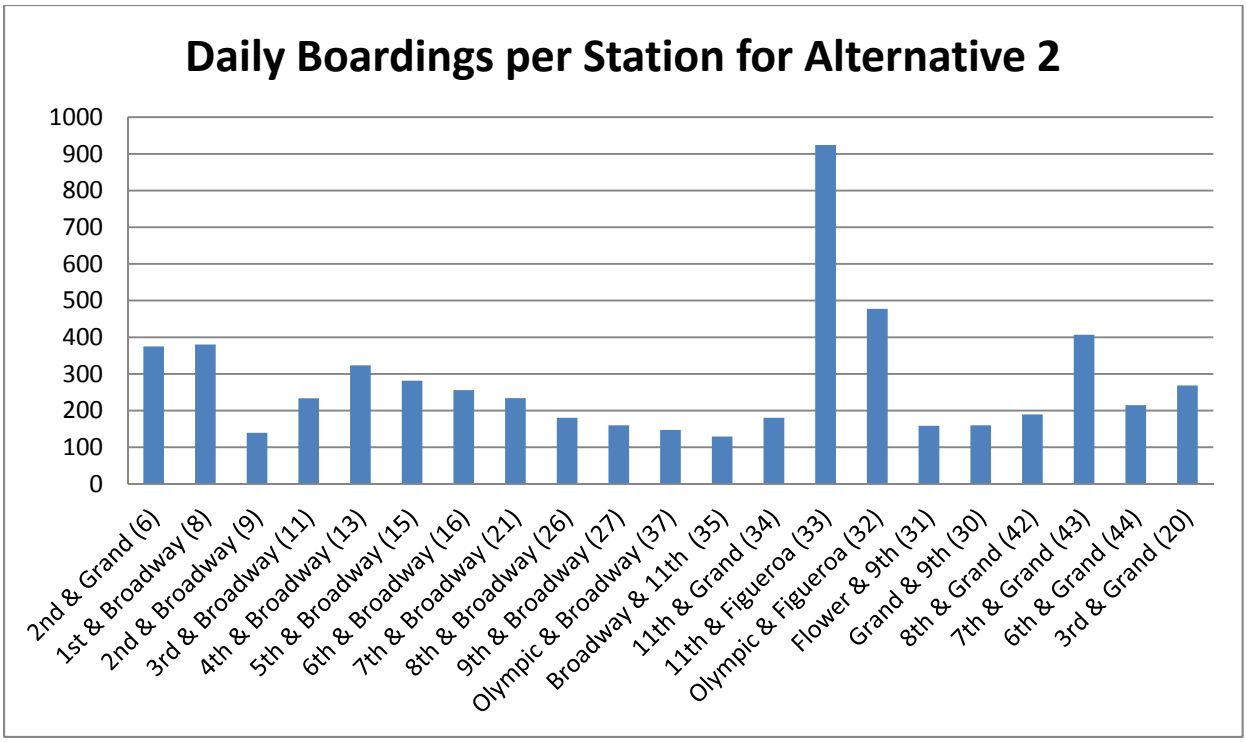
After post-model processing was applied to account for the high frequency of the LA Streetcar line and link to Angels Flight, the following expected daily ridership values were determined, summarized in Table 5:

TABLE 5. Daily Ridership by Alternative from DRF Model with Post-Model Processing

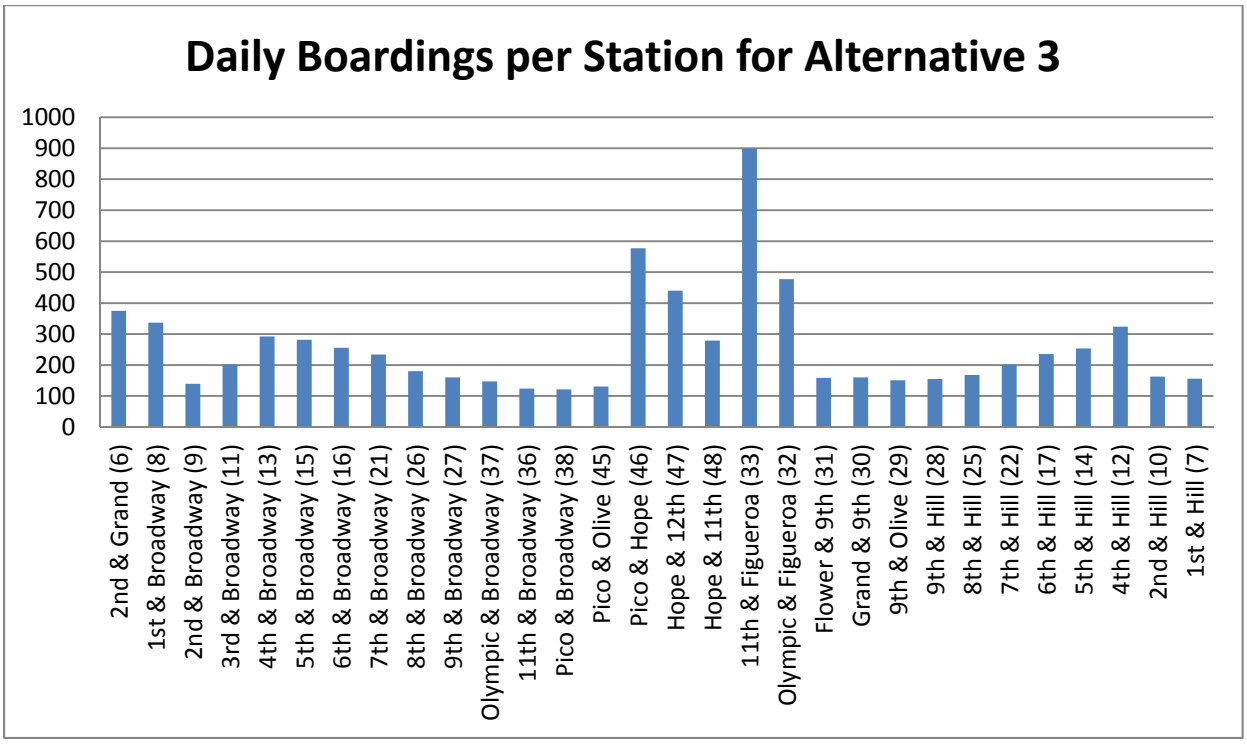
Alignment Configuration	# of Stops	Length (Miles)	System Boardings	Average per Mile
Alternative 1	25	3.83	7,160	1,870
Alternative 2	21	3.32	5,820	1,750
Alternative 3	30	4.29	7,780	1,810
Alternative 4	26	3.78	6,440	1,700
Alternative 5	34	5.16	8,810	1,710
Alternative 6	30	4.65	7,480	1,610
Alternative 7	25	3.79	6,610	1,740

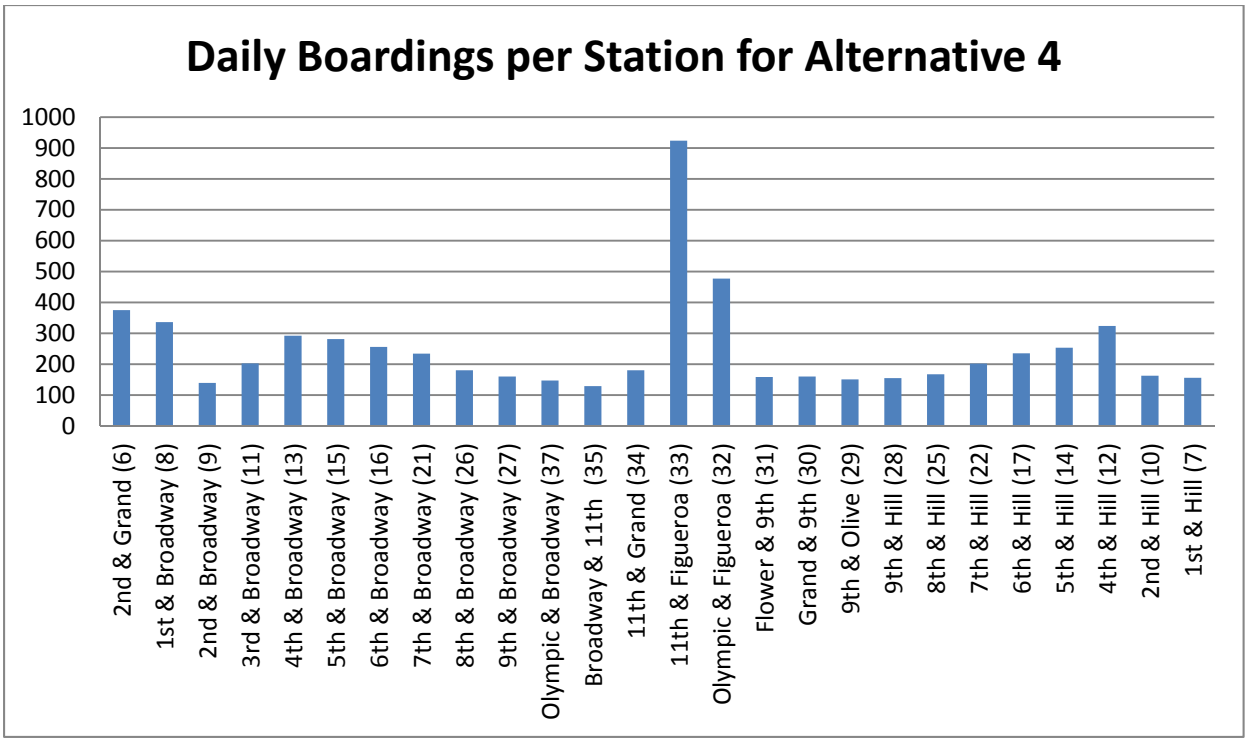
Alternatives 1 & 2 are projected to generate the highest boardings per mile of the seven alternatives. This is due to better access to major trip generators such as major hotels, MOCA, and the 7th/Metro Center Station. Shown below are projected daily boardings by stop. These alternatives are projected to generate fewer system boardings than Alternatives 3, 4 & 7 which is mainly accounted for by the fact that Alternatives 1 & 2 have fewer stops. The stops with the highest projected ridership are located around the Staples Center/LA Live/Convention Center.

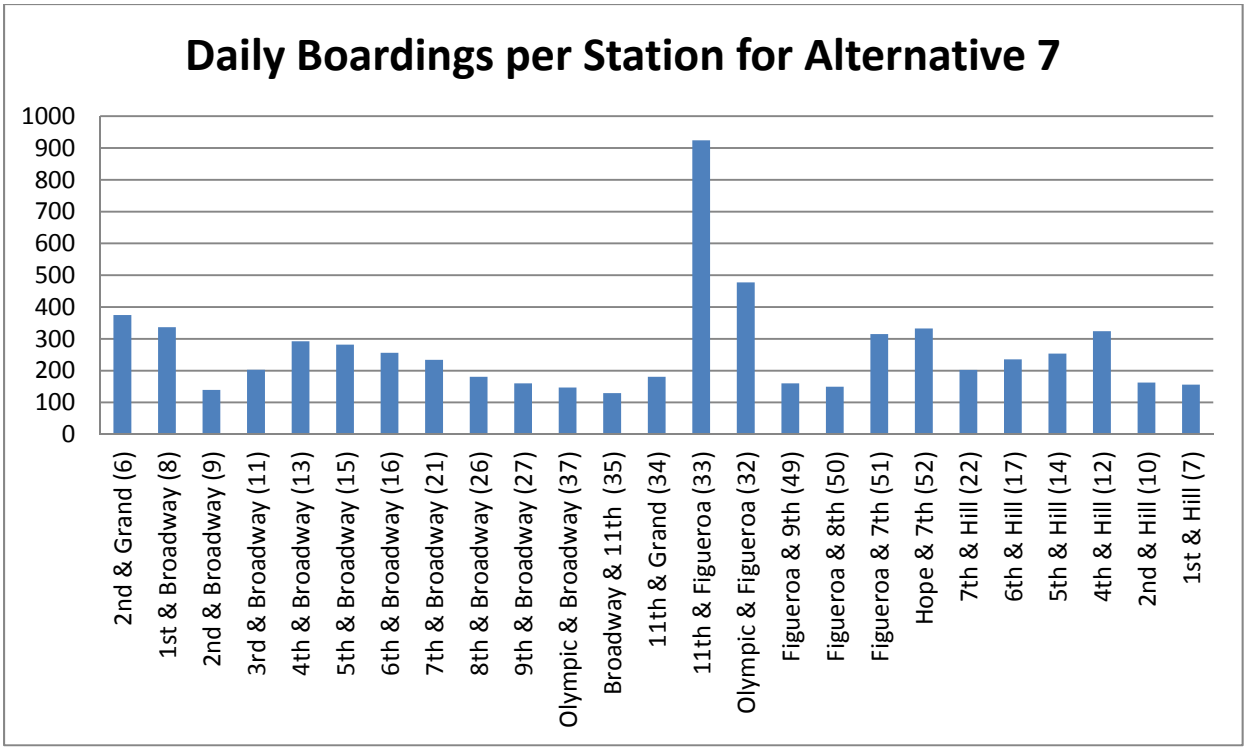




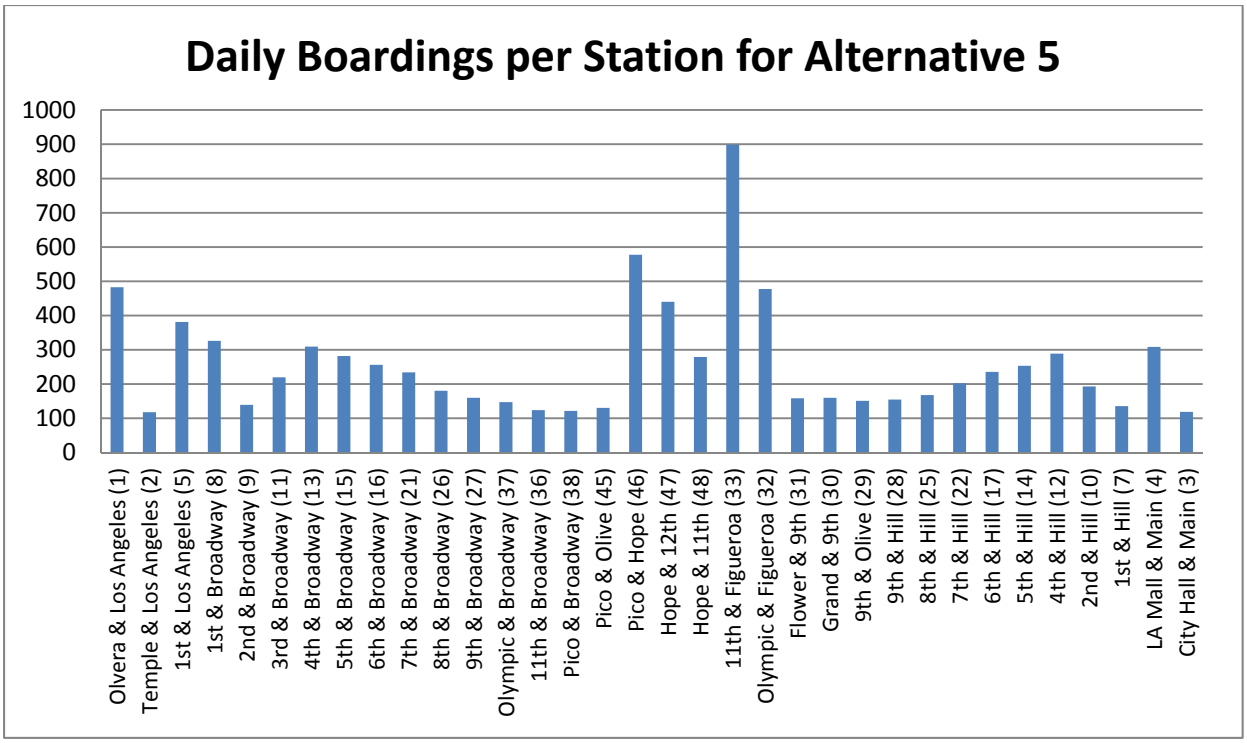
Alternatives 3, 4 & 7 generate more ridership than Alternatives 1 & 2 with fewer average daily boardings per mile. They contain five more stops (4 stops for Alternative 7) than their respective C2/C3 counterpart from Alternatives 1 & 2.

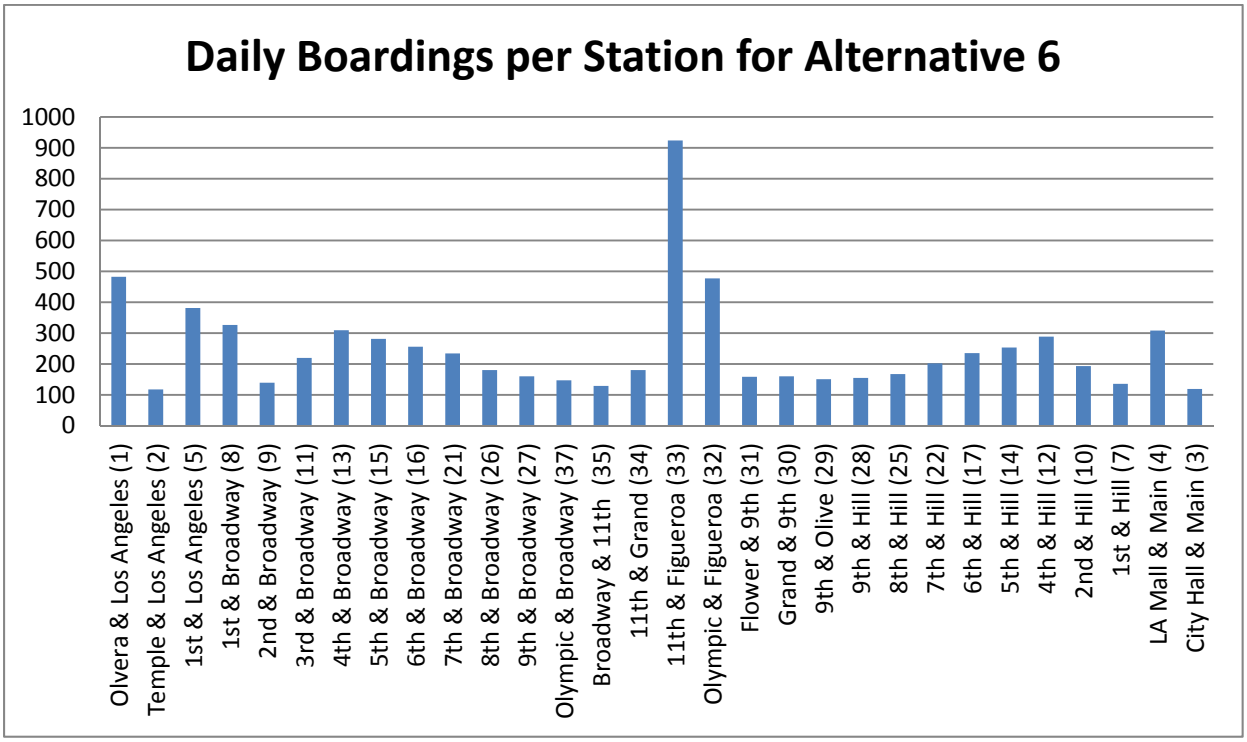






Alternatives 5 & 6 generate the highest system ridership of the seven alternatives. While they generate lower average daily boardings per mile than the other alternatives, they have the highest number of stations among the seven alternatives. Alternatives 5 & 6 add stops at City Hall, Olvera Street/Union Station and Little Tokyo (+2 more) and include more trip attractors (Olvera Street/Little Tokyo) and an additional rail connection.





A major factor in the difference in ridership can be explained by the number of stops. The higher the number of stops (assuming the stop is located near factors that influence ridership) the higher the ridership. For example, the primary reason why the C2 alignments have higher boardings than C3 is number of stations: C2 stops five times before reaching Figueroa/11th and C3 just once. C2 also provides superior access to the Blue Line and Convention Center.

Two factors influencing ridership are retail jobs and households within ¼ mile walk of a stop. While the 11th/Grand stop would provide better access to the new condo towers adjacent to the intersection the 11th/Figueroa and 11th/Pico are within a ¼ mile of 11th/Grand and capture most of the population.

4.0 Performance Comparison

The projected opening day performance of the LA Streetcar (in terms of boardings per mile) was compared to existing and planned streetcar systems, LRT/BRT in Los Angeles, existing DASH service, and existing bus service along Broadway within the corridor (southbound only) where the LA Streetcar would operate.

First, a comparison (Table 6) was made to actual opening month ridership of the Portland, Tacoma, and Seattle streetcar lines and projected opening month ridership of the planned Charlotte, Salt Lake City, Tucson, and Atlanta Streetcar lines. The LA Streetcar outperforms both actual and projected opening month ridership of these systems.

TABLE 6. Comparison to Opening Month/Projected Ridership of Existing/Planned Streetcar Systems

Alignment Configuration	Length (Miles)	System Boardings	Average per Mile
Alternative 3	4.29	7,780	1,810
Alternative 4	3.78	6,440	1,700
Alternative 7	3.79	6,610	1,740
Portland (Starter Line)	4.8	4,982	1,040*
Tacoma	2.7	2,170	800*
Seattle	2.6	1,316	510*
Charlotte (Planned)	2.8	1,500	540**
Salt Lake City (Planned)	4	3,000	750**
Tucson (Planned)	3.9	3,600	920**
Atlanta (Planned)	2.6	2,600	1,000**

*Opening Month Actual
**Projected Opening Day

Second, a comparison (Table 7) was made to actual opening month ridership of the four existing LRT and one BRT lines in Los Angeles. The LA Streetcar outperforms actual opening month ridership in boardings per mile of these lines.

TABLE 7. Comparison to Opening Month Ridership of Metro LRT/BRT

Alignment Configuration	Length (Miles)	System Boardings	Average per Mile
Alternative 3	4.29	7,780	1,810
Alternative 4	3.78	6,440	1,700
Alternative 7	3.79	6,610	1,740
Orange Line	28	16,360	580
Gold Line	27.4	18,364	670
Gold Line Eastside Extension	12	7,156	600
Green Line	40	15,800	400
Blue Line	44	30,800	700

Source: Metro

Third, a comparison (Table 8) was made to existing (2011 to date) ridership of the five best performing downtown DASH routes. The LA Streetcar outperforms existing ridership of these routes.

TABLE 8. Comparison to Existing DASH Ridership

Alignment Configuration	Length (Miles)	System Boardings	Average per Mile
Alternative 3	4.29	7,780	1,810
Alternative 4	3.78	6,440	1,700
Alternative 7	3.79	6,610	1,740
DASH A	6.1	3,886	640
DASH B	6.7	3,525	530
DASH D	7.5	4,081	540
DASH E	6.3	7,352	1,170
DASH F	7.2	3,306	460

Source: LADOT

Fourth, a comparison (Table 9) was made to existing (July 2011) ridership of the six best performing Metro bus routes on Broadway between Cesar Chavez Ave and Pico Boulevard. The LA Streetcar outperforms existing ridership of four of six of these routes. The high performance of the two routes that outperform the LA Streetcar is likely due to the concentration of boardings along the Broadway corridor and corresponding dispersed alightings along the considerable length of each bus route.

TABLE 9. Comparison to Southbound Broadway Bus Ridership (Cesar Chavez Ave to Pico Boulevard Only)

Alignment Configuration	Length (Miles)	System Boardings	Average per Mile
Alternative 3	1.45	2,480	1,710
Alternative 4	1.24	2,360	1,900
Alternative 7	1.24	2,360	1,900
Metro Line 30	1.37	2,008	1,470
Metro Line 40	1.37	2,985	2,180
Metro Line 45	1.81	4,020	2,220
Metro Line 730	1.45	792	550
Metro Line 740	1.45	1,204	830
Metro Line 745	1.45	1,780	1,230

Source: Metro

5.0 Fare Elasticity

A sensitivity test of a free versus reduced fare versus paid scenarios was completed to better understand the results, differences in alternatives, and how they compare to other system types.

Both the Tacoma streetcar system and significant portions of the Portland streetcar system are fare free. The variable Free/Paid was found to have a statistically significant influence on ridership in the DRF model. To test the impact of applying a fare free system to the LA Streetcar, a comparison of ridership estimates of free versus paid systems was conducted using the Free/Paid variable in the model. The results can be seen in Table 10. Operating the LA Streetcar as a completely fare-free system would increase expected ridership 49 to 57% over a system where a fare is charged.

While the DRF model can distinguish between free and full fare systems, it does not measure changes in the level of fare. Rather than charging the full Metro fare of $1.50 per ride, one consideration is to charge a reduced fare of $0.50 per ride. A widely accepted value for fare to ridership elasticity is -0.42 (although this value is not streetcar-specific). According to this elasticity value, a fare decrease from $1.50 to $0.50 per ride would result in a 27% increase in ridership. The ridership estimates under a $0.50 fare scenario are also summarized in Table 10.

[2] http://onlinepubs.trb.org/onlinepubs/tcrp/tcrp_rpt_95c12.pdf

TABLE 10. Fare Level Sensitivity Testing

		Paid ($1.50 per Ride)		Reduced Fare ($0.50 per Ride)		Free	
Alignment Configuration	**Length (Miles)**	**System Boardings**	**Avg per Mile**	**System Boardings**	**Avg per Mile**	**System Boardings**	**Avg per Mile**
Alternative 1	3.83	7,160	1,870	9,090	2,370	10,670	2,790
Alternative 2	3.32	5,820	1,750	7,390	2,230	8,770	2,640
Alternative 3	4.29	7,780	1,810	9,880	2,300	12,000	2,800
Alternative 4	3.78	6,440	1,700	8,180	2,160	10,100	2,670
Alternative 5	5.16	8,810	1,710	11,190	2,170	13,600	2,630
Alternative 6	4.65	7,480	1,610	9,500	2,040	11,700	2,520
Alternative 7	3.79	6,610	1,740	8,390	2,210	10,120	2,670

6.0 Other Factors with Potential to Positively Influence Ridership of LA Streetcar

6.1 Consideration of Office Employment Density

Another consideration in the ridership forecasting process is that office employment density is much higher in downtown Los Angeles than in the cities included in the model. For example, the office employment density along the Portland streetcar line is 14,000 office jobs per square mile while for the area along the proposed LA streetcar is 40,000 office jobs per square mile.[3] For the existing modern streetcar lines in the U.S., office employment is not a significant predictor of ridership. Retail employment, special generators, connections to high capacity transit lines, and fare structure are key drivers of streetcar ridership. The existing modern streetcar lines in the U.S. primarily serve retail, tourist, and home-based other trips, while home-based work trips (either non-linked or linked) do not have a strong impact on ridership. If commute trips by office workers prove to be a more significant market for the LA Streetcar, the higher density of downtown Los Angeles employment compared to other systems could result in an increase in ridership above current projections.

6.2 Consideration of Special Events

The model results show the ridership estimates for a typical day. However, special events could generate periodic peaks in ridership. For example, if the NFL stadium proposed to be built next to LA Live were to be filled to capacity, this would mean 68,000 people traveling to and from the area within a rather narrow window of time. The Mobility Group estimated that 15 percent of fans will attend weekend games by transit.[4] Since stations for the Metro Blue, Red and Purple lines are located nearby, it is expected that the majority of transit riders would use these lines for a home-based trip. We estimate that 1 – 2 percent of fans would desire to use the streetcar to travel from the stadium on a game day. This would represent 680 – 1,360 additional boardings on a game day, which is an increase in daily ridership of 10 – 20 percent. These fans leaving the stadium after a game would primarily be boarding at the 11th Street & Figueroa Street stop or the Olympic Boulevard & Figueroa Street stop, which already have some of the highest levels of expected ridership of any stop. If each streetcar has a capacity of 100

[3] Source: LEHD, http://lehdmap.did.census.gov/. Office jobs are defined as jobs in the following NAICS industry sectors: information; finance and insurance; real estate and rental and leasing; professional, scientific, and technical services; management of companies and enterprises; public administration.

[4] http://www.dailybreeze.com/latestnews/ci_18980892

riders, it would take 7-14 vehicles to accommodate all of the streetcar riders. Typical peak hour frequency will be one streetcar every 7 minutes. If two spare vehicles are added to serve special events, as is indicated in the Alternatives Analysis, the frequency can be increased to one vehicle every 5 minutes and 40 seconds. This would mean it would take 40 – 80 minutes to serve all of the fans wanting to board the streetcar after a game. It is unlikely that fans will be willing to wait more than 30 minutes for a streetcar, so the actual increase in ridership on a game day would likely be on the lower end of the estimated range given the capacity limits of the streetcar line. Other recurring special events include the Downtown Art Walk and street fairs.

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Appendix B

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						Alternative 1		Alternative 2		Alternative 3		Alternative 4		Alternative 5		Alternative 6		Alternative 7	
SCC	Item	Unit Cost (2011)	Unit	Alloc Conting	Escalation to Const Year	Quantity	Extension	Quantity	Extension	Quantity	Extension	Quantity	Extension	Quantity	Extension	Quantity	Extension	Quantity	Extension
10	**GUIDEWAY & TRACK ELEMENTS**						$ 14,577		$ 12,964		$ 13,693		$ 12,143		$ 17,437		$ 15,824		$ 12,143
10.03	Guideway: at-grade in mixed traffic - excavation and subgrade prep in pavement	$ 260	Per track mile	25%	5%	3.62	$ 1,235	3.11	$ 1,061	4.08	$ 1,392	3.59	$ 1,225	5.16	$ 1,761	4.65	$ 1,587	3.59	$ 1,225
10.04	Guideway: aerial - includes foundation, piers, substructure, deck, railings	$ 9,820	Per track mile	30%	5%	0.09	$ 1,206	0.09	$ 1,206		$ -		$ -		$ -		$ -		$ -
10.05	Guideway: built-up fill	$ 4,500	Per track mile	30%	5%	0.12	$ 737	0.12	$ 737		$ -		$ -		$ -		$ -		$ -
10.10	Track: Embedded using 115RE t-rail in concrete track slab with rubber boot	$ 2,150	Per track mile	25%	5%	3.83	$ 10,808	3.32	$ 9,369	4.08	$ 11,513	3.59	$ 10,131	5.16	$ 14,561	4.65	$ 13,122	3.59	$ 10,131
10.12	Track: Special- 115RE #4 Turnout (powered) - procurement and installation	$ 150	Each turnout	25%	5%	3	$ 591	3	$ 591	4	$ 788	4	$ 788	3	$ 591	3	$ 591	4	$ 788
10.12	Track: Special- Diamond Track Crossing	$ 200	Each diamond	25%	5%	0	$ -	0	$ -	0	$ -	0	$ -	2	$ 525	2	$ 525	0	$ -
20	**STATIONS, STOPS, TERMINALS, INTERMODAL**						$ 2,520		$ 2,117		$ 2,923		$ 2,520		$ 3,326		$ 2,923		$ 2,520
20.01	At-grade station, stop, shelter, mall, terminal, platform	$ 80	Each stop	20%	5%	25	$ 2,520	21	$ 2,117	29	$ 2,923	25	$ 2,520	33	$ 3,326	29	$ 2,923	25	$ 2,520
30	**SUPPORT FACILITIES: YARDS, SHOPS, ADMIN. BLDGS**						$ 11,193		$ 11,193		$ 11,193		$ 11,193		$ 11,193		$ 11,193		$ 11,193
30.01	Administration building	$ 1,500	Lump sum	30%	5%	1	$ 2,048	1	$ 2,048	1	$ 2,048	1	$ 2,048	1	$ 2,048	1	$ 2,048	1	$ 2,048
30.02	Light Maintenance Facility - base facility for 8-10 streetcars	$ 7,000	Lump sum	30%	5%	1	$ 9,555	1	$ 9,555	1	$ 9,555	1	$ 9,555	1	$ 9,555	1	$ 9,555	1	$ 9,555
30.04	Storage building	$ 200	Each building	30%	5%	1	$ 273	1	$ 273	1	$ 273	1	$ 273	1	$ 273	1	$ 273	1	$ 273
30.05	Yard and Yard Track - storage for 8-10 streetcars	$ 1,000	Lump sum	30%	5%	1	$ 1,365	1	$ 1,365	1	$ 1,365	1	$ 1,365	1	$ 1,365	1	$ 1,365	1	$ 1,365
40	**SITEWORK & SPECIAL CONDITIONS**						$ 13,796		$ 11,660		$ 12,334		$ 10,415		$ 16,696		$ 14,724		$ 10,417
40.01	Demolition, Clearing, Earthwork (Excluding water, sewer, other utility relocations)	$ 250	Lump sum	30%	5%	1	$ 341	1	$ 341	1	$ 341	1	$ 341	1	$ 341	1	$ 341	1	$ 341
40.02	Site Utilities, Utility Relocation- Minor Impact Allowance ($200 per track foot)	$ 1,050	Per track mile	30%	5%	0.98	$ 1,405	0.98	$ 1,405	0.98	$ 1,405	0.98	$ 1,405	0.98	$ 1,405	0.98	$ 1,405	0.98	$ 1,405
40.02	Site Utilities, Utility Relocation- Medium Impact Allowance ($400 per track foot)	$ 2,112	Per track mile	30%	5%	2.85	$ 8,216	2.34	$ 6,746	3.10	$ 8,937	2.61	$ 7,524	4.18	$ 12,050	3.67	$ 10,580	2.61	$ 7,524
40.02	Site Utilities, Utility Relocation- Major Impact Allowance ($600 per track foot)	$ 3,168	Per track mile	30%	5%	0.00	$ -	0.00	$ -	0.00	$ -	0.00	$ -	0.00	$ -	0.00	$ -	0.00	$ -
40.07	Civil & roadway improvements (curb, sidewalk reconstruction, minor paving)	$ 1,320	Per track mile	30%	5%	1.07	$ 1,928	0.73	$ 1,315	0.62	$ 1,117	0.37	$ 667	0.50	$ 901	0.25	$ 450	0.37	$ 667
40	Existing bridge strengthening for streetcar tracks	$ 500	Each bridge	30%	5%	2	$ 1,365	2	$ 1,365		$ -		$ -	2	$ 1,365	2	$ 1,365		$ -
40.08	Temporary facilities (1% of construction subtotal)	1%	Lump sum	30%	5%	1	$ 541	1	$ 488	1	$ 534	1	$ 478	1	$ 633	1	$ 582	1	$ 481
50	**SYSTEMS**						$ 12,536		$ 11,366		$ 13,826		$ 11,994		$ 15,327		$ 14,156		$ 12,267
50.01	Train Control and Signals (allowance based on track mileage)	$ 100	Per track mile	30%	5%	3.83	$ 523	3.32	$ 453	4.08	$ 557	3.59	$ 490	5.16	$ 704	4.65	$ 635	3.59	$ 490
50.01	Automatic train protection at freight railroad crossings	$ 500	Each instance	30%	5%	0	$ -	0	$ -	0	$ -	0	$ -	0	$ -	0	$ -	0	$ -
50.01	Automatic train protection on streetcar vehicles	$ 100	Each vehicle	30%	5%	0	$ -	0	$ -	0	$ -	0	$ -	0	$ -	0	$ -	0	$ -
50.02	Minor traffic signal reconstruction	$ 60	Each Intersection	30%	5%	40	$ 3,276	36	$ 2,948	47	$ 3,849	43	$ 3,522	48	$ 3,931	44	$ 3,604	43	$ 3,522
50.02	Major traffic signal reconstruction	$ 200	Each Intersection	30%	5%	4	$ 1,092	3	$ 819	3	$ 819	2	$ 546	4	$ 1,092	3	$ 819	3	$ 819
50.03	Traction power distribution: substations & equipment	$ 500	Each substation	30%	5%	5	$ 3,413	5	$ 3,413	6	$ 4,095	5	$ 3,413	6	$ 4,095	6	$ 4,095	5	$ 3,413
50.04	Traction power distribution (poles, assembly, corrosion control)	$ 640	Per track mile	30%	5%	3.83	$ 3,346	3.32	$ 2,900	4.08	$ 3,564	3.59	$ 3,136	5.16	$ 4,508	4.65	$ 4,062	3.59	$ 3,136
50.05	Communications (allowance)	$ 200	Lump sum	30%	5%	1	$ 273	1	$ 273	1	$ 273	1	$ 273	1	$ 273	1	$ 273	1	$ 273
50.06	Fare Collection - simple device, one per streetcar stop	$ 10	Each device	30%	5%	25	$ 341	21	$ 287	29	$ 396	25	$ 341	33	$ 450	29	$ 396	25	$ 341
50.07	Central control for operations (allowance per alternative)	$ 200	Lump sum	30%	5%	1	$ 273	1	$ 273	1	$ 273	1	$ 273	1	$ 273	1	$ 273	1	$ 273
	CONSTRUCTION SUBTOTAL (10-50)						$ 54,622		$ 49,300		$ 53,970		$ 48,265		$ 63,979		$ 58,821		$ 48,540
60	**RIGHT-OF-WAY, LAND, EXISTING IMPROVEMENTS**						$ 1,809		$ 1,740		$ 1,877		$ 1,775		$ 1,979		$ 1,911		$ 1,775
60.01	Purchase or lease of real estate (calculated by number of corner cuts and TPSS)	$ 25	Each instance	30%	5%	13	$ 444	11	$ 375	15	$ 512	12	$ 410	18	$ 614	16	$ 546	12	$ 410
60.01	Purchase of real estate for maintenance facility	$ 1,000	Lump sum	30%	5%	1	$ 1,365	1	$ 1,365	1	$ 1,365	1	$ 1,365	1	$ 1,365	1	$ 1,365	1	$ 1,365
70	**VEHICLES (INCLUDES SPARE PARTS)**	**$ 3,600**	**EA**	**5%**	**0%**	8	$ 30,240	8	$ 30,240	9	$ 34,020	8	$ 30,240	10	$ 37,800	10	$ 37,800	8	$ 30,240
80	**PROFESSIONAL SERVICES**	**30%**	**LS**				$ 18,328		$ 16,726		$ 18,364		$ 16,418		$ 21,600		$ 20,048		$ 16,501
80.01	Preliminary engineering	3%	Lump sum				$ 1,639		$ 1,479		$ 1,619		$ 1,448		$ 1,919		$ 1,765		$ 1,456
80.02	Final design	8%	Lump sum				$ 4,370		$ 3,944		$ 4,318		$ 3,861		$ 5,118		$ 4,706		$ 3,883
80.03	Program management of design, construction, ROW & vehicles.	6%	Lump sum				$ 5,200		$ 4,877		$ 5,392		$ 4,817		$ 6,226		$ 5,912		$ 4,833
80.04	Construction management	6%	Lump sum				$ 3,277		$ 2,958		$ 3,238		$ 2,896		$ 3,839		$ 3,529		$ 2,912
80.05	Insurance	3%	Lump sum				$ 1,639		$ 1,479		$ 1,619		$ 1,448		$ 1,919		$ 1,765		$ 1,456
80.06	Permits and review fees	1%	Lump sum				$ 564		$ 510		$ 558		$ 500		$ 660		$ 607		$ 503
80.07	Owner provided survey, testing, and inspection	1%	Lump sum				$ 546		$ 493		$ 540		$ 483		$ 640		$ 588		$ 485
80.08	Start-up	2%	Lump sum				$ 1,092		$ 986		$ 1,079		$ 965		$ 1,280		$ 1,176		$ 971
	SUBTOTAL (10-80)						$ 104,999		$ 98,007		$ 108,230		$ 96,697		$ 125,359		$ 118,580		$ 97,055
90	**PROJECT RESERVE (UNALLOCATED CONTINGENCY)**	**10%**	**LS**				$ 10,500		$ 9,801		$ 10,823		$ 9,670		$ 12,536		$ 11,858		$ 9,706
	SUBTOTAL (10-90)						$ 115,499		$ 107,807		$ 119,053		$ 106,367		$ 137,895		$ 130,438		$ 106,761
100	**FINANCE CHARGES**		**LS**																
	SUBTOTAL (10-100)						$ 115,499		$ 107,807		$ 119,053		$ 106,367		$ 137,895		$ 130,438		$ 106,761
	Total Track Miles						3.83		3.32		4.08		3.59		5.16		4.65		3.59
	Per Track Mile						$ 30,156		$ 32,472		$ 29,180		$ 29,629		$ 26,724		$ 28,051		$ 29,738

Note: All costs in thousands and $2011

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Appendix C

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LA Streetcar
Operating and Maintenance Cost Summary

Route	Route Length	Run Time	Peak Vehicles	Fleet Vehicles	Annual Vehicle-Hours	Annual Vehicle-Miles	O&M Cost ($2011)
Route Combination 1 (A4-B2-C1)	3.83	0:34:27	6	8	26,590	145,900	$ 5,318,000
Route Combination 2 (A4-B2-C3)	3.32	0:31:21	6	8	26,590	126,400	$ 5,318,000
Route Combination 3 (A6-B1-C1)	4.29	0:40:21	7	9	30,740	163,400	$ 6,148,000
Route Combination 4 (A6-B1-C3)	3.78	0:35:25	6	8	26,590	143,900	$ 5,318,000
Route Combination 5 (A7-B1-C1)	5.16	0:49:10	8	10	37,210	196,400	$ 7,442,000
Route Combination 6 (A7-B1-C3)	4.65	0:45:04	8	10	34,580	177,000	$ 6,916,000
Route Combination 7 (A6-B1-C4)	3.79	0:35:12	6	8	26,590	144,300	$ 5,318,000

NOTES:
(1) O&M based on streetcar unit cost per hour = $ 200
(2) Assumes 20% spare ratio for fleet requirement

LA Streetcar
Streetcar Run Times
Route Combination 1 (A4-B2-C1)

Station	Speed (mph)	Feet	Distance (miles) Increment	Total	Run Time (hr:min:sec)	Delay Time (hr:min:sec)	Dwell Time (hr:min:sec)	Total Time (hr:min:sec)	Signalized Intersections	Signalized Ped Crossings
2nd and Grand				0.00			00:00:20	00:00:20		
	20	315	0.06		00:00:16	00:00:00				
TS (R=80.00')				0.06			00:00:00	00:00:36		
Curve No. 1 (1st & Grand)	10	100	0.02		00:00:07	00:00:00				
ST				0.08			00:00:00	00:00:43		
	35	1100	0.21		00:00:29	00:01:20			1st, Olive, Hill, Broadway	4
TS (R=80.00')				0.29			00:00:00	00:02:32		
Curve No. 2 (1st & Broadway)	10	100	0.02		00:00:09	00:00:00				
1st and Broadway				0.31			00:00:20	00:03:01		
	30	550	0.10		00:00:25	00:00:20			2nd	1
2nd and Broadway				0.41			00:00:20	00:04:06		
	30	660	0.13		00:00:27	00:00:20			3rd	1
3rd and Broadway				0.54			00:00:20	00:05:13		
	30	660	0.13		00:00:27	00:00:30			Ped Xing, 4th	1 1
4th and Broadway				0.66			00:00:20	00:06:30		
	30	664	0.13		00:00:27	00:00:30			Ped Xing, 5th	1 1
5th and Broadway				0.79			00:00:20	00:07:47		
	30	660	0.13		00:00:27	00:00:30			Ped Xing, 6th	1 1
6th and Broadway				0.91			00:00:20	00:09:04		
	30	670	0.13		00:00:27	00:00:30			Ped Xing, 7th	1 1
7th and Broadway				1.04			00:00:20	00:10:21		
	30	655	0.12		00:00:27	00:00:30			Ped Xing, 8th	1 1
8th and Broadway				1.16			00:00:20	00:11:38		
	30	670	0.13		00:00:27	00:00:30			Ped Xing, 9th	1 1
9th and Broadway				1.29			00:00:20	00:12:55		
	30	660	0.13		00:00:27	00:00:30			Ped Xing, Olympic	1 1
Olympic and Broadway				1.41			00:00:20	00:14:12		
	30	654	0.12		00:00:27	00:00:30			Ped Xing, 11th	1 1
11th and Broadway				1.54			00:00:20	00:15:29		
	35	980	0.19		00:00:34	00:00:30			Ped Xing, 12th	1 1
Pico and Broadway				1.72			00:00:20	00:16:53		
	10	60	0.01		00:00:06	00:00:20			Pico	1
TS (R=80.00')				1.73			00:00:00	00:17:19		
Curve No. 3 (Pico & Broadway)	10	100	0.02		00:00:07	00:00:00				
ST				1.75			00:00:00	00:17:26		
	30	1000	0.19		00:00:31	00:00:40			Hill, Olive	2
Grand and Pico				1.94			00:00:20	00:18:57		
	30	1255	0.24		00:00:41	00:01:00			Grand, Hope, Flower	3
Figueroa and Pico				2.18			00:00:20	00:20:58		
	10	100	0.02		00:00:09	00:00:20			Figueroa	1
TS (R=80.00')				2.20			00:00:00	00:21:27		
Curve No. 4 (Figueroa and Pico)	10	100	0.02		00:00:07	00:00:00				
ST				2.22			00:00:00	00:21:34		
	30	555	0.11		00:00:21	00:00:20			12th	1
12th and Figueroa				2.32			00:00:20	00:22:35		
	35	800	0.15		00:00:30	00:00:20			11th	1
11th and Figueroa				2.48			00:00:20	00:23:45		
	30	610	0.12		00:00:26	00:00:20			Olympic	1
Olympic and Figueroa				2.59			00:00:20	00:24:51		
	30	705	0.13		00:00:25	00:00:20			9th	1
TS (R=80.00')				2.72			00:00:00	00:25:36		
Curve No. 5 (Figueroa and 9th)	10	100	0.02		00:00:09	00:00:00				
Flower and 9th				2.74			00:00:20	00:26:05		
	35	795	0.15		00:00:27	00:00:40			Flower, Hope	2
Grand and 9th				2.89			00:00:20	00:27:32		
	10	60	0.01		00:00:06	00:00:20			Grand	1
TS (R=80.00')				2.90			00:00:00	00:27:58		
Curve No. 6 (Grand and 9th)	10	100	0.02		00:00:07	00:00:00				
ST				2.92			00:00:00	00:28:05		
	30	715	0.14		00:00:25	00:00:20			8th	1
8th and Grand				3.06			00:00:20	00:29:10		
	30	665	0.13		00:00:27	00:00:30			Ped Xing, 7th	1 1
7th and Grand				3.19			00:00:20	00:30:27		
	30	560	0.11		00:00:25	00:00:20			Wilshire	1
6th and Grand				3.29			00:00:20	00:31:32		
	35	1885	0.36		00:00:51	00:00:30			6th, Ped Xing	1 1
3rd and Grand				3.65			00:00:20	00:33:13		
	35	970	0.18		00:00:34	00:00:40			3rd, 2nd	2
2nd and Grand				3.83				00:34:27		
				3.83	**00:12:57**	**00:13:30**	**00:08:00**	**00:34:27**		**35 11**
						Avg. Speed =	6.7 mph			
						Avg. Station Spacing=	0.16 miles			

NOTES:
1. Stationing, distances and horizontal curve radii based on LA Streetcar Routes for Final Screening.pdf
2. Assumed maximum allowable speed on mixed traffic roadways = 35 mph.
3. Average intersection delay = 20 seconds.
4. Average ped. crossing delay = 10 seconds.
5. Acceleration & deceleration rates based on Skoda 10T normal performance (2.5 mphps).
6. Average dwell time = 20 sec. surface stations.

Prepared by HDR Engineering 15-Aug-11

LA Streetcar
Streetcar Run Times
Route Combination 2 (A4-B2-C3)

Station	Speed (mph)	Distance (miles) Feet	Increment	Total	Run Time (hr:min:sec)	Delay Time (hr:min:sec)	Dwell Time (hr:min:sec)	Total Time (hr:min:sec)	Signalized Intersections	Signalized Ped Crossings	
2nd and Grand				0.00			00:00:20	00:00:20			
	20	315	0.06		00:00:16	00:00:00					
TS (R=80.00')				0.06			00:00:00	00:00:36			
Curve No. 1 (1st & Grand)	10	100	0.02		00:00:07	00:00:00					
ST				0.08			00:00:00	00:00:43			
	35	1100	0.21		00:00:29	00:01:20			1st, Olive, Hill, Broadway	4	
TS (R=80.00')				0.29			00:00:00	00:02:32			
Curve No. 2 (1st & Broadway)	10	100	0.02		00:00:09	00:00:00					
1st and Broadway				0.31			00:00:20	00:03:01			
	30	550	0.10		00:00:25	00:00:20			2nd	1	
2nd and Broadway				0.41			00:00:20	00:04:06			
	30	660	0.13		00:00:27	00:00:20			3rd	1	
3rd and Broadway				0.54			00:00:20	00:05:13			
	30	660	0.13		00:00:27	00:00:30			Ped Xing, 4th	1	1
4th and Broadway				0.66			00:00:20	00:06:30			
	30	664	0.13		00:00:27	00:00:30			Ped Xing, 5th	1	1
5th and Broadway				0.79			00:00:20	00:07:47			
	30	660	0.13		00:00:27	00:00:30			Ped Xing, 6th	1	1
6th and Broadway				0.91			00:00:20	00:09:04			
	30	670	0.13		00:00:27	00:00:30			Ped Xing, 7th	1	1
7th and Broadway				1.04			00:00:20	00:10:21			
	30	655	0.12		00:00:27	00:00:30			Ped Xing, 8th	1	1
8th and Broadway				1.16			00:00:20	00:11:38			
	30	670	0.13		00:00:27	00:00:30			Ped Xing, 9th	1	1
9th and Broadway				1.29			00:00:20	00:12:55			
	30	660	0.13		00:00:27	00:00:30			Ped Xing, Olympic	1	1
Olympic and Broadway				1.41			00:00:20	00:14:12			
	25	400	0.08		00:00:18	00:00:30			Ped Xing,11th	1	1
TS (R=80.00')				1.49			00:00:00	00:15:00			
Curve No. 3 (11th & Broadway)	10	100	0.02		00:00:07	00:00:00					
ST				1.51			00:00:00	00:15:07			
	10	140	0.03		00:00:12	00:01:00					
11th and Broadway				1.53			00:00:20	00:16:39			
	30	1150	0.22		00:00:38	00:01:00			Hill, Olive, Grand	3	
Grand and 11th				1.75			00:00:20	00:18:37			
	30	1020	0.19		00:00:35	00:01:00			Hope, Flower, Figueroa	3	
TS (R=80.00')				1.95			00:00:00	00:20:12			
Curve No. 4 (Figueroa and 11th)	10	100	0.02		00:00:07	00:00:00					
11th and Figueroa				1.96			00:00:20	00:20:39			
	30	610	0.12		00:00:26	00:00:20			Olympic	1	
Olympic and Figueroa				2.08			00:00:20	00:21:45			
	30	705	0.13		00:00:25	00:00:20			9th	1	
TS (R=80.00')				2.21			00:00:00	00:22:30			
Curve No. 5 (Figueroa and 9th)	10	100	0.02		00:00:09	00:00:00					
Flower and 9th				2.23			00:00:20	00:22:59			
	35	795	0.15		00:00:27	00:00:40			Flower, Hope	2	
Grand and 9th				2.38			00:00:20	00:24:26			
	10	60	0.01		00:00:06	00:00:20			Grand	1	
TS (R=80.00')				2.39			00:00:00	00:24:52			
Curve No. 6 (Grand and 9th)	10	100	0.02		00:00:07	00:00:00					
ST				2.41			00:00:00	00:24:59			
	30	715	0.14		00:00:25	00:00:20			8th	1	
8th and Grand				2.55			00:00:20	00:26:04			
	30	665	0.13		00:00:27	00:00:30			Ped Xing, 7th	1	1
7th and Grand				2.68			00:00:20	00:27:21			
	30	560	0.11		00:00:25	00:00:20			Wilshire	1	
6th and Grand				2.78			00:00:20	00:28:26			
	35	1885	0.36		00:00:51	00:00:30			6th, Ped Xing	1	1
3rd and Grand				3.14			00:00:20	00:30:07			
	35	970	0.18		00:00:34	00:00:40			3rd, 2nd	2	
2nd and Grand				3.32				00:31:21			
				3.32	**00:11:21**	**00:13:00**	**00:07:00**	**00:31:21**		**31**	**10**
					Avg. Speed =	6.4 mph					
					Avg. Station Spacing=	0.16 miles					

NOTES:
1. Stationing, distances and horizontal curve radii based on LA Streetcar Routes for Final Screening.pdf
2. Assumed maximum allowable speed on mixed traffic roadways = 35 mph.
3. Average intersection delay = 20 seconds.
4. Average ped. crossing delay = 10 seconds.
5. Acceleration & deceleration rates based on Skoda 10T normal performance (2.5 mphps).
6. Average dwell time = 20 sec. surface stations.

Prepared by HDR Engineering 15-Aug-11

LA Streetcar
Streetcar Run Times
Route Combination 3 (A6-B1-C1)

Station	Speed (mph)	Distance (miles) Feet	Increment	Total	Run Time (hr:min:sec)	Delay Time (hr:min:sec)	Dwell Time (hr:min:sec)	Total Time (hr:min:sec)	Signalized Intersections	Signalized Ped Crossings
2nd and Grand				0.00			00:00:20	00:00:20		
	20	315	0.06		00:00:16	00:00:00				
TS (R=80.00')				0.06			00:00:00	00:00:36		
Curve No. 1 (1st & Grand)	10	100	0.02		00:00:07	00:00:00				
ST				0.08			00:00:00	00:00:43		
	35	1100	0.21		00:00:29	00:01:20			1st, Olive, Hill, Broadway	4
TS (R=80.00')				0.29			00:00:00	00:02:32		
Curve No. 2 (1st & Broadway)	10	100	0.02		00:00:09	00:00:00				
1st and Broadway				0.31			00:00:20	00:03:01		
	30	550	0.10		00:00:25	00:00:20			2nd	1
2nd and Broadway				0.41			00:00:20	00:04:06		
	30	660	0.13		00:00:27	00:00:20			3rd	1
3rd and Broadway				0.54			00:00:20	00:05:13		
	30	660	0.13		00:00:27	00:00:30			Ped Xing, 4th	1 1
4th and Broadway				0.66			00:00:20	00:06:30		
	30	664	0.13		00:00:27	00:00:30			Ped Xing, 5th	1 1
5th and Broadway				0.79			00:00:20	00:07:47		
	30	660	0.13		00:00:27	00:00:30			Ped Xing, 6th	1 1
6th and Broadway				0.91			00:00:20	00:09:04		
	30	670	0.13		00:00:27	00:00:30			Ped Xing, 7th	1 1
7th and Broadway				1.04			00:00:20	00:10:21		
	30	655	0.12		00:00:27	00:00:30			Ped Xing, 8th	1 1
8th and Broadway				1.16			00:00:20	00:11:38		
	30	670	0.13		00:00:27	00:00:30			Ped Xing, 9th	1 1
9th and Broadway				1.29			00:00:20	00:12:55		
	30	660	0.13		00:00:27	00:00:30			Ped Xing, Olympic	1 1
Olympic and Broadway				1.41			00:00:20	00:14:12		
	30	654	0.12		00:00:27	00:00:30			Ped Xing, 11th	1 1
11th and Broadway				1.54			00:00:20	00:15:29		
	35	980	0.19		00:00:34	00:00:30			Ped Xing, 12th	1 1
Pico and Broadway				1.72			00:00:20	00:16:53		
	10	60	0.01		00:00:06	00:00:20			Pico	1
TS (R=80.00')				1.73			00:00:00	00:17:19		
Curve No. 3 (Pico & Broadway)	10	100	0.02		00:00:07	00:00:00				
ST				1.75			00:00:00	00:17:26		
	30	1000	0.19		00:00:31	00:00:40			Hill, Olive	2
Grand and Pico				1.94			00:00:20	00:18:57		
	30	1255	0.24		00:00:41	00:01:00			Grand, Hope, Flower	3
Figueroa and Pico				2.18			00:00:20	00:20:58		
	10	100	0.02		00:00:09	00:00:20			Figueroa	1
TS (R=80.00')				2.20			00:00:00	00:21:27		
Curve No. 4 (Figueroa and Pico)	10	100	0.02		00:00:07	00:00:00				
ST				2.22			00:00:00	00:21:34		
	30	555	0.11		00:00:21	00:00:20			12th	1
12th and Figueroa				2.32			00:00:20	00:22:35		
	35	800	0.15		00:00:30	00:00:20			11th	1
11th and Figueroa				2.48			00:00:20	00:23:45		
	30	610	0.12		00:00:26	00:00:20			Olympic	1
Olympic and Figueroa				2.59			00:00:20	00:24:51		
	30	705	0.13		00:00:25	00:00:20			9th	1
TS (R=80.00')				2.72			00:00:00	00:25:36		
Curve No. 5 (Figueroa and 9th)	10	100	0.02		00:00:07	00:00:00				
Flower and 9th				2.74			00:00:20	00:26:03		
	35	795	0.15		00:00:27	00:00:40			Flower, Hope	2
Grand and 9th				2.89			00:00:20	00:27:30		
	35	955	0.18		00:00:30	00:01:00			Grand, Olive, Hill	3
TS (R=80.00')				3.07			00:00:00	00:29:00		
Curve No. 6 (Hill and 9th)	10	100	0.02		00:00:09	00:00:00				
9th and Hill				3.09			00:00:20	00:29:29		
	30	660	0.13		00:00:27	00:00:30			Ped Xing, 8th	1 1
8th and Hill				3.22			00:00:20	00:30:46		
	30	665	0.13		00:00:27	00:00:30			Ped Xing, 7th	1 1
7th and Hill				3.34			00:00:20	00:32:03		
	30	670	0.13		00:00:27	00:00:30			Ped Xing, 6th	1 1
6th and Hill				3.47			00:00:20	00:33:20		
	30	645	0.12		00:00:27	00:00:30			Ped Xing, 5th	1 1
5th and Hill				3.59			00:00:20	00:34:37		
	35	980	0.19		00:00:34	00:00:30			Ped Xing, 4th	1 1
4th and Hill				3.78			00:00:20	00:36:01		
	35	920	0.17		00:00:33	00:00:30			Ped Xing, 3rd	1 1
2nd and Hill				3.95			00:00:20	00:37:24		
	30	555	0.11		00:00:25	00:00:20			2nd	1
1st and Hill				4.06			00:00:20	00:38:29		
	10	50	0.01		00:00:05	00:00:20			1st	1
TS (R=80.00')				4.07			00:00:00	00:38:54		
Curve No. 7 (1st & Hill)	10	100	0.02		00:00:07	00:00:00				
ST				4.09			00:00:00	00:39:01		
	30	650	0.12		00:00:20	00:00:40			Hill, Grand	2
TS (R=80.00')				4.21			00:00:00	00:40:01		
Curve No. 1 (1st & Grand)	10	100	0.02		00:00:07	00:00:00				
ST				4.23			00:00:00	00:40:08		
	20	315	0.06		00:00:13	00:00:00				
2nd and Grand				4.29				00:40:21		
				4.29	**00:14:51**	**00:16:10**	**00:09:20**	**00:40:21**		**41 15**
						Avg. Speed =	6.4 mph			
						Avg. Station Spacing=	0.16 miles			

NOTES:
1. Stationing, distances and horizontal curve radii based on LA Streetcar Routes for Final Screening.pdf
2. Assumed maximum allowable speed on mixed traffic roadways = 35 mph.
3. Average intersection delay = 20 seconds.
4. Average ped. crossing delay = 10 seconds.
5. Acceleration & deceleration rates based on Skoda 10T normal performance (2.5 mphps).
6. Average dwell time = 20 sec. surface stations.

Prepared by HDR Engineering 15-Aug-11

LA Streetcar
Streetcar Run Times
Route Combination 4 (A6-B1-C3)

Station	Speed (mph)	Distance (miles) Feet	Increment	Total	Run Time (hr:min:sec)	Delay Time (hr:min:sec)	Dwell Time (hr:min:sec)	Total Time (hr:min:sec)	Signalized Intersections	Signalized Ped Crossings
2nd and Grand				0.00			00:00:20	00:00:20		
	20	315	0.06		00:00:16	00:00:00				
TS (R=80.00')				0.06			00:00:00	00:00:36		
Curve No. 1 (1st & Grand)	10	100	0.02		00:00:07	00:00:00				
ST				0.08			00:00:00	00:00:43		
	35	1100	0.21		00:00:29	00:01:20			1st, Olive, Hill, Broadway	4
TS (R=80.00')				0.29			00:00:00	00:02:32		
Curve No. 2 (1st & Broadway)	10	100	0.02		00:00:09	00:00:00				
1st and Broadway				0.31			00:00:20	00:03:01		
	30	550	0.10		00:00:25	00:00:20			2nd	1
2nd and Broadway				0.41			00:00:20	00:04:06		
	30	660	0.13		00:00:27	00:00:20			3rd	1
3rd and Broadway				0.54			00:00:20	00:05:13		
	30	660	0.13		00:00:27	00:00:30			Ped Xing, 4th	1 1
4th and Broadway				0.66			00:00:20	00:06:30		
	30	664	0.13		00:00:27	00:00:30			Ped Xing, 5th	1 1
5th and Broadway				0.79			00:00:20	00:07:47		
	30	660	0.13		00:00:27	00:00:30			Ped Xing, 6th	1 1
6th and Broadway				0.91			00:00:20	00:09:04		
	30	670	0.13		00:00:27	00:00:30			Ped Xing, 7th	1 1
7th and Broadway				1.04			00:00:20	00:10:21		
	30	655	0.12		00:00:27	00:00:30			Ped Xing, 8th	1 1
8th and Broadway				1.16			00:00:20	00:11:38		
	30	670	0.13		00:00:27	00:00:30			Ped Xing, 9th	1 1
9th and Broadway				1.29			00:00:20	00:12:55		
	30	660	0.13		00:00:27	00:00:30			Ped Xing, Olympic	1 1
Olympic and Broadway				1.41			00:00:20	00:14:12		
	25	400	0.08		00:00:18	00:00:10			Ped Xing,11th	1 1
TS (R=80.00')				1.49			00:00:00	00:14:40		
Curve No. 3 (11th & Broadway)	10	100	0.02		00:00:07	00:00:00				
ST				1.51			00:00:00	00:14:47		
	10	140	0.03		00:00:12	00:00:30				
11th and Broadway				1.53			00:00:20	00:15:49		
	30	1150	0.22		00:00:38	00:00:30			Hill, Olive, Grand	3
Grand and 11th				1.75			00:00:20	00:17:17		
	30	1020	0.19		00:00:35	00:00:30			Hope, Flower, Figueroa	3
TS (R=80.00')				1.95			00:00:00	00:18:22		
Curve No. 4 (Figueroa and 11th)	10	100	0.02		00:00:07	00:00:00				
11th and Figueroa				1.96			00:00:20	00:18:49		
	30	610	0.12		00:00:26	00:00:20			Olympic	1
Olympic and Figueroa				2.08			00:00:20	00:19:55		
	30	705	0.13		00:00:25	00:00:20			9th	1
TS (R=80.00')				2.21			00:00:00	00:20:40		
Curve No. 5 (Figueroa and 9th)	10	100	0.02		00:00:07	00:00:00				
Flower and 9th				2.23			00:00:20	00:21:07		
	35	795	0.15		00:00:27	00:00:40			Flower, Hope	2
Grand and 9th				2.38			00:00:20	00:22:34		
	35	955	0.18		00:00:30	00:01:00			Grand, Olive Hill	3
TS (R=80.00')				2.56			00:00:00	00:24:04		
Curve No. 6 (Hill and 9th)	10	100	0.02		00:00:09	00:00:00				
9th and Hill				2.58			00:00:20	00:24:33		
	30	660	0.13		00:00:27	00:00:30			Ped Xing, 8th	1 1
8th and Hill				2.71			00:00:20	00:25:50		
	30	665	0.13		00:00:27	00:00:30			Ped Xing, 7th	1 1
7th and Hill				2.83			00:00:20	00:27:07		
	30	670	0.13		00:00:27	00:00:30			Ped Xing, 6th	1 1
6th and Hill				2.96			00:00:20	00:28:24		
	30	645	0.12		00:00:27	00:00:30			Ped Xing, 5th	1 1
5th and Hill				3.08			00:00:20	00:29:41		
	35	980	0.19		00:00:34	00:00:30			Ped Xing, 4th	1 1
4th and Hill				3.27			00:00:20	00:31:05		
	35	920	0.17		00:00:33	00:00:30			Ped Xing, 3rd	1 1
2nd and Hill				3.44			00:00:20	00:32:28		
	30	555	0.11		00:00:25	00:00:20			2nd	1
1st and Hill				3.55			00:00:20	00:33:33		
	10	50	0.01		00:00:05	00:00:20			1st	1
TS (R=80.00')				3.56			00:00:00	00:33:58		
Curve No. 7 (1st & Hill)	10	100	0.02		00:00:07	00:00:00				
ST				3.58			00:00:00	00:34:05		
	30	650	0.12		00:00:20	00:00:40			Hill, Grand	2
TS (R=80.00')				3.70			00:00:00	00:35:05		
Curve No. 1 (1st & Grand)	10	100	0.02		00:00:07	00:00:00				
ST				3.72			00:00:00	00:35:12		
	20	315	0.06		00:00:13	00:00:00				
2nd and Grand				3.78				00:35:25		
				3.78	**00:13:15**	**00:13:50**	**00:08:20**	**00:35:25**		**37 14**
						Avg. Speed =	6.4	mph		
						Avg. Stat	0.16	miles		

NOTES:
1. Stationing, distances and horizontal curve radii based on LA Streetcar Routes for Final Screening.pdf
2. Assumed maximum allowable speed on mixed traffic roadways = 35 mph.
3. Average intersection delay = 20 seconds.
4. Average ped. crossing delay = 10 seconds.
5. Acceleration & deceleration rates based on Skoda 10T normal performance (2.5 mphps).
6. Average dwell time = 20 sec. surface stations.

Prepared by HDR Engineering 15-Aug-11

LA Streetcar
Streetcar Run Times
Route Combination 5 (A7-B1-C1)

Station	Speed (mph)	Distance (miles) Feet	Distance (miles) Increment	Distance (miles) Total	Run Time (hr:min:sec)	Delay Time (hr:min:sec)	Dwell Time (hr:min:sec)	Total Time (hr:min:sec)	Signalized Intersections	Signalized Ped Crossings	
Olvera and Los Angeles				0.00			00:00:20	00:00:20			
	10	80	0.02		00:00:07	00:00:00					
TS (R=80.00')				0.02			00:00:00	00:00:27			
Curve No. 1 (Olvera & Los Angeles)	10	100	0.02		00:00:07	00:00:00					
ST				0.03			00:00:00	00:00:34			
	35	1300	0.25		00:00:37	00:00:50			Arcadia, Aliso, Ped Xing	2	1
Temple and Los Angeles				0.28			00:00:20	00:02:21			
	35	820	0.16		00:00:31	00:00:30			Temple, Ped Xing	1	1
1st and Los Angeles				0.44			00:00:20	00:03:42			
	10	30	0.01		00:00:04	00:01:20			1st, Main, Spring, Broadway	4	
TS (R=80.00')				0.44			00:00:00	00:05:06			
Curve No. 2 (1st & Grand)	10	100	0.02		00:00:07	00:00:00					
ST				0.46			00:00:00	00:05:13			
	35	1200	0.23		00:00:31	00:01:20			1st, Olive, Hill, Broadway	4	
TS (R=80.00')				0.69			00:00:00	00:07:04			
Curve No. 3 (1st & Broadway)	10	100	0.02		00:00:09	00:00:00					
1st and Broadway				0.71			00:00:20	00:07:33			
	30	550	0.10		00:00:25	00:00:20			2nd	1	
2nd and Broadway				0.81			00:00:20	00:08:38			
	30	660	0.13		00:00:27	00:00:20			3rd	1	
3rd and Broadway				0.94			00:00:20	00:09:45			
	30	660	0.13		00:00:27	00:00:30			Ped Xing, 4th	1	1
4th and Broadway				1.06			00:00:20	00:11:02			
	30	664	0.13		00:00:27	00:00:30			Ped Xing, 5th	1	1
5th and Broadway				1.19			00:00:20	00:12:19			
	30	660	0.13		00:00:27	00:00:30			Ped Xing, 6th	1	1
6th and Broadway				1.31			00:00:20	00:13:36			
	30	670	0.13		00:00:27	00:00:30			Ped Xing, 7th	1	1
7th and Broadway				1.44			00:00:20	00:14:53			
	30	655	0.12		00:00:27	00:00:30			Ped Xing, 8th	1	1
8th and Broadway				1.56			00:00:20	00:16:10			
	30	670	0.13		00:00:27	00:00:30			Ped Xing, 9th	1	1
9th and Broadway				1.69			00:00:20	00:17:27			
	30	660	0.13		00:00:27	00:00:30			Ped Xing, Olympic	1	1
Olympic and Broadway				1.81			00:00:20	00:18:44			
	30	654	0.12		00:00:27	00:00:30			Ped Xing, 11th	1	1
11th and Broadway				1.94			00:00:20	00:20:01			
	35	980	0.19		00:00:34	00:00:30			Ped Xing, 12th	1	1
Pico and Broadway				2.12			00:00:20	00:21:25			
	10	60	0.01		00:00:06	00:00:20			Pico	1	
TS (R=80.00')				2.14			00:00:00	00:21:51			
Curve No. 4 (Pico & Broadway)	10	100	0.02		00:00:07	00:00:00					
ST				2.15			00:00:00	00:21:58			
	30	1000	0.19		00:00:31	00:00:40			Hill, Olive	2	
Grand and Pico				2.34			00:00:20	00:23:29			
	30	1255	0.24		00:00:41	00:01:00			Grand, Hope, Flower	3	
Figueroa and Pico				2.58			00:00:20	00:25:30			
	10	100	0.02		00:00:09	00:00:20			Figueroa	1	
TS (R=80.00')				2.60			00:00:00	00:25:59			
Curve No. 5 (Figueroa and Pico)	10	100	0.02		00:00:07	00:00:00					
ST				2.62			00:00:00	00:26:06			
	30	555	0.11		00:00:21	00:00:20			12th	1	
12th and Figueroa				2.72			00:00:20	00:27:07			
	35	800	0.15		00:00:30	00:00:20			11th	1	
11th and Figueroa				2.88			00:00:20	00:28:17			
	30	610	0.12		00:00:26	00:00:20			Olympic	1	
Olympic and Figueroa				2.99			00:00:20	00:29:23			
	30	705	0.13		00:00:25	00:00:20			9th	1	
TS (R=80.00')				3.12			00:00:00	00:30:08			
Curve No. 6 (Figueroa and 9th)	10	100	0.02		00:00:07	00:00:00					
Flower and 9th				3.14			00:00:20	00:30:35			
	35	795	0.15		00:00:27	00:00:40			Flower, Hope	2	
Grand and 9th				3.29			00:00:20	00:32:02			
	35	955	0.18		00:00:30	00:01:00			Grand, Olive Hill	3	
TS (R=80.00')				3.48			00:00:00	00:33:32			
Curve No. 7 (Hill and 9th)	10	100	0.02		00:00:09	00:00:00					
9th and Hill				3.49			00:00:20	00:34:01			
	30	660	0.13		00:00:27	00:00:30			Ped Xing, 8th	1	1
8th and Hill				3.62			00:00:20	00:35:18			
	30	665	0.13		00:00:27	00:00:30			Ped Xing, 7th	1	1
7th and Hill				3.74			00:00:20	00:36:35			
	30	670	0.13		00:00:27	00:00:30			Ped Xing, 6th	1	1
6th and Hill				3.87			00:00:20	00:37:52			
	30	645	0.12		00:00:27	00:00:30			Ped Xing, 5th	1	1
5th and Hill				3.99			00:00:20	00:39:09			
	35	980	0.19		00:00:34	00:00:30			Ped Xing, 4th	1	1
4th and Hill				4.18			00:00:20	00:40:33			
	35	920	0.17		00:00:33	00:00:30			Ped Xing, 3rd	1	1
2nd and Hill				4.35			00:00:20	00:41:56			
	30	555	0.11		00:00:25	00:00:20			2nd	1	
1st and Hill				4.46			00:00:20	00:43:01			
	10	60	0.01		00:00:06	00:00:20			1st	1	
TS (R=80.00')				4.47			00:00:00	00:43:27			
Curve No. 8 (1st & Hill)	10	100	0.02		00:00:07	00:00:00					
ST				4.49			00:00:00	00:43:34			
	35	1000	0.19		00:00:27	00:01:00			Broadway, Spring, Main	3	
TS (R=80.00')				4.68			00:00:00	00:45:01			
Curve No. 9 (1st & Main)	10	100	0.02		00:00:07	00:00:00					
ST				4.70			00:00:00	00:45:08			
	30	600	0.11		00:00:19	00:00:10			Ped Xing		1
City Hall and Main				4.81			00:00:20	00:45:57			
	30	590	0.11		00:00:25	00:00:30			Temple, Ped Xing	1	1
LA Mall and Main				4.92			00:00:20	00:47:12			
	10	800	0.15		00:00:57	00:00:40			Aliso, Arcadia	2	
TS (R=80.00')				5.07			00:00:00	00:48:49			
Curve No. 10 (Main & Olvera)	10	100	0.02		00:00:07	00:00:00					
ST				5.09			00:00:00	00:48:56			
	20	360	0.07		00:00:14	00:00:00					
Olvera and Los Angeles				5.16				00:49:10			
				5.16	**00:18:00**	**00:20:30**	**00:10:40**	**00:49:10**		**52**	**19**
						Avg. Speed =	6.3	mph			
						Avg. Station Spacing=	0.17	miles			

NOTES:
1. Stationing, distances and horizontal curve radii based on LA Streetcar Routes for Final Screening.pdf
2. Assumed maximum allowable speed on mixed traffic roadways = 35 mph.
3. Average intersection delay = 20 seconds.
4. Average ped. crossing delay = 10 seconds.
5. Acceleration & deceleration rates based on Skoda 10T normal performance (2.5 mphps).
6. Average dwell time = 20 sec. surface stations.

Prepared by HDR Engineering 15-Aug-11

LA Streetcar
Streetcar Run Times
Route Combination 6 (A7-B1-C3)

Station	Speed (mph)	Distance (miles) Feet	Increment	Total	Run Time (hr:min:sec)	Delay Time (hr:min:sec)	Dwell Time (hr:min:sec)	Total Time (hr:min:sec)	Signalized Intersections	Signalized Ped Crossings
Olvera and Los Angeles				0.00			00:00:20	00:00:20		
	10	80	0.02		00:00:07	00:00:00				
TS (R=80.00')				0.02			00:00:00	00:00:27		
Curve No. 1 (Olvera & Los Angeles)	10	100	0.02		00:00:07	00:00:00				
ST				0.03			00:00:00	00:00:34		
	35	1300	0.25		00:00:37	00:00:50			Arcadia, Aliso, Ped Xing	2 1
Temple and Los Angeles				0.28			00:00:20	00:02:21		
	35	820	0.16		00:00:31	00:00:30			Temple, Ped Xing	1 1
1st and Los Angeles				0.44			00:00:20	00:03:42		
	10	30	0.01		00:00:04	00:01:20			1st, Main, Spring, Broadway	4
TS (R=80.00')				0.44			00:00:00	00:05:06		
Curve No. 2 (1st & Grand)	10	100	0.02		00:00:07	00:00:00				
ST				0.46			00:00:00	00:05:13		
	35	1200	0.23		00:00:31	00:01:20			1st, Olive, Hill, Broadway	4
TS (R=80.00')				0.69			00:00:00	00:07:04		
Curve No. 3 (1st & Broadway)	10	100	0.02		00:00:09	00:00:00				
1st and Broadway				0.71			00:00:20	00:07:33		
	30	550	0.10		00:00:25	00:00:20			2nd	1
2nd and Broadway				0.81			00:00:20	00:08:38		
	30	660	0.13		00:00:27	00:00:20			3rd	1
3rd and Broadway				0.94			00:00:20	00:09:45		
	30	660	0.13		00:00:27	00:00:30			Ped Xing, 4th	1 1
4th and Broadway				1.06			00:00:20	00:11:02		
	30	664	0.13		00:00:27	00:00:30			Ped Xing, 5th	1 1
5th and Broadway				1.19			00:00:20	00:12:19		
	30	660	0.13		00:00:27	00:00:30			Ped Xing, 6th	1 1
6th and Broadway				1.31			00:00:20	00:13:36		
	30	670	0.13		00:00:27	00:00:30			Ped Xing, 7th	1 1
7th and Broadway				1.44			00:00:20	00:14:53		
	30	655	0.12		00:00:27	00:00:30			Ped Xing, 8th	1 1
8th and Broadway				1.56			00:00:20	00:16:10		
	30	670	0.13		00:00:27	00:00:30			Ped Xing, 9th	1 1
9th and Broadway				1.69			00:00:20	00:17:27		
	30	660	0.13		00:00:27	00:00:30			Ped Xing, Olympic	1 1
Olympic and Broadway				1.81			00:00:20	00:18:44		
	25	400	0.08		00:00:18	00:00:30			Ped Xing,11th	1 1
TS (R=80.00')				1.89			00:00:00	00:19:32		
Curve No. 4 (11th & Broadway)	10	100	0.02		00:00:07	00:00:00				
ST				1.91			00:00:00	00:19:39		
	10	140	0.03		00:00:12	00:00:00				
11th and Broadway				1.94			00:00:20	00:20:11		
	30	1150	0.22		00:00:38	00:01:00			Hill, Olive, Grand	3
Grand and 11th				2.15			00:00:20	00:22:09		
	30	1020	0.19		00:00:35	00:01:00			Hope, Flower, Figueroa	3
TS (R=80.00')				2.35			00:00:00	00:23:44		
Curve No. 5 (Figueroa and 11th)	10	100	0.02		00:00:07	00:00:00				
11th and Figueroa				2.37			00:00:20	00:24:11		
	30	610	0.12		00:00:26	00:00:20			Olympic	1
Olympic and Figueroa				2.48			00:00:20	00:25:17		
	30	705	0.13		00:00:25	00:00:20			9th	1
TS (R=80.00')				2.61			00:00:00	00:26:02		
Curve No. 8 (Figueroa and 9th)	10	100	0.02		00:00:07	00:00:00				
Flower and 9th				2.63			00:00:20	00:26:29		
	35	795	0.15		00:00:27	00:00:40			Flower, Hope	2
Grand and 9th				2.78			00:00:20	00:27:56		
	35	955	0.18		00:00:30	00:01:00			Grand, Olive Hill	3
TS (R=80.00')				2.96			00:00:00	00:29:26		
Curve No. 9 (Hill and 9th)	10	100	0.02		00:00:09	00:00:00				
9th and Hill				2.98			00:00:20	00:29:55		
	30	660	0.13		00:00:27	00:00:30			Ped Xing, 8th	1 1
8th and Hill				3.11			00:00:20	00:31:12		
	30	665	0.13		00:00:27	00:00:30			Ped Xing, 7th	1 1
7th and Hill				3.23			00:00:20	00:32:29		
	30	670	0.13		00:00:27	00:00:30			Ped Xing, 6th	1 1
6th and Hill				3.36			00:00:20	00:33:46		
	30	645	0.12		00:00:27	00:00:30			Ped Xing, 5th	1 1
5th and Hill				3.48			00:00:20	00:35:03		
	35	980	0.19		00:00:34	00:00:30			Ped Xing, 4th	1 1
4th and Hill				3.67			00:00:20	00:36:27		
	35	920	0.17		00:00:33	00:00:30			Ped Xing, 3rd	1 1
2nd and Hill				3.84			00:00:20	00:37:50		
	30	555	0.11		00:00:25	00:00:20			2nd	1
1st and Hill				3.95			00:00:20	00:38:55		
	10	60	0.01		00:00:06	00:00:20			1st	1
TS (R=80.00')				3.96			00:00:00	00:39:21		
Curve No. 10 (1st & Hill)	10	100	0.02		00:00:07	00:00:00				
ST				3.98			00:00:00	00:39:28		
	35	1000	0.19		00:00:27	00:01:00			Broadway, Spring, Main	3
TS (R=80.00')				4.17			00:00:00	00:40:55		
Curve No. 11 (1st & Main)	10	100	0.02		00:00:07	00:00:00				
ST				4.19			00:00:00	00:41:02		
	30	600	0.11		00:00:19	00:00:10			Ped Xing	1
City Hall and Main				4.30			00:00:20	00:41:51		
	30	590	0.11		00:00:25	00:00:30			Temple, Ped Xing	1 1
LA Mall and Main				4.41			00:00:20	00:43:06		
	10	800	0.15		00:00:57	00:00:40			Aliso, Arcadia	2
TS (R=80.00')				4.56			00:00:00	00:44:43		
Curve No. 12 (Main & Olvera)	10	100	0.02		00:00:07	00:00:00				
ST				4.58			00:00:00	00:44:50		
	20	360	0.07		00:00:14	00:00:00				
Olvera and Los Angeles				4.65				00:45:04		
				4.65	**00:16:24**	**00:19:00**	**00:09:40**	**00:45:04**		**48 18**
						Avg. Speed =	6.2	mph		
						Avg. Station Spacing=	0.16	miles		

NOTES:
1. Stationing, distances and horizontal curve radii based on LA Streetcar Routes for Final Screening.pdf
2. Assumed maximum allowable speed on mixed traffic roadways = 35 mph.
3. Average intersection delay = 20 seconds.
4. Average ped. crossing delay = 10 seconds.
5. Acceleration & deceleration rates based on Skoda 10T normal performance (2.5 mphps).
6. Average dwell time = 20 sec. surface stations.

Prepared by HDR Engineering 15-Aug-11

LA Streetcar
Streetcar Run Times
Route Combination 7 (A6-B1-C4)

Station	Speed (mph)	Distance (miles) Feet	Increment	Total	Run Time (hr:min:sec)	Delay Time (hr:min:sec)	Dwell Time (hr:min:sec)	Total Time (hr:min:sec)	Signalized Intersections	Signalized Ped Crossings
2nd and Grand				0.00			00:00:20	00:00:20		
	20	315	0.06		00:00:16	00:00:00				
TS (R=80.00')				0.06			00:00:00	00:00:36		
Curve No. 1 (1st & Grand)	10	100	0.02		00:00:07	00:00:00				
ST				0.08			00:00:00	00:00:43		
	35	1100	0.21		00:00:29	00:01:20			1st, Olive, Hill, Broadway	4
TS (R=80.00')				0.29			00:00:00	00:02:32		
Curve No. 2 (1st & Broadway)	10	100	0.02		00:00:09	00:00:00				
1st and Broadway				0.31			00:00:20	00:03:01		
	30	550	0.10		00:00:25	00:00:20			2nd	1
2nd and Broadway				0.41			00:00:20	00:04:06		
	30	660	0.13		00:00:27	00:00:20			3rd	1
3rd and Broadway				0.54			00:00:20	00:05:13		
	30	660	0.13		00:00:27	00:00:30			Ped Xing, 4th	1 1
4th and Broadway				0.66			00:00:20	00:06:30		
	30	664	0.13		00:00:27	00:00:30			Ped Xing, 5th	1 1
5th and Broadway				0.79			00:00:20	00:07:47		
	30	660	0.13		00:00:27	00:00:30			Ped Xing, 6th	1 1
6th and Broadway				0.91			00:00:20	00:09:04		
	30	670	0.13		00:00:27	00:00:30			Ped Xing, 7th	1 1
7th and Broadway				1.04			00:00:20	00:10:21		
	30	655	0.12		00:00:27	00:00:30			Ped Xing, 8th	1 1
8th and Broadway				1.16			00:00:20	00:11:38		
	30	670	0.13		00:00:27	00:00:30			Ped Xing, 9th	1 1
9th and Broadway				1.29			00:00:20	00:12:55		
	30	660	0.13		00:00:27	00:00:30			Ped Xing, Olympic	1 1
Olympic and Broadway				1.41			00:00:20	00:14:12		
	25	400	0.08		00:00:18	00:00:10			Ped Xing,11th	1 1
TS (R=80.00')				1.49			00:00:00	00:14:40		
Curve No. 3 (11th & Broadway)	10	100	0.02		00:00:07	00:00:00				
ST				1.51			00:00:00	00:14:47		
	10	140	0.03		00:00:12	00:00:30				
11th and Broadway				1.53			00:00:20	00:15:49		
	30	1150	0.22		00:00:38	00:00:30			Hill, Olive, Grand	3
Grand and 11th				1.75			00:00:20	00:17:17		
	30	1020	0.19		00:00:35	00:00:30			Hope, Flower, Figueroa	3
TS (R=80.00')				1.95			00:00:00	00:18:22		
Curve No. 4 (Figueroa and 11th)	10	100	0.02		00:00:07	00:00:00				
11th and Figueroa				1.96			00:00:20	00:18:49		
	30	610	0.12		00:00:26	00:00:20			Olympic	1
Olympic and Figueroa				2.08			00:00:20	00:19:55		
	30	550	0.10		00:00:25	00:00:20			9th	1
9th and Figueroa				2.18			00:00:20	00:21:00		
	30	775	0.15		00:00:30	00:00:20			8th	1
8th and Figueroa				2.33			00:00:20	00:22:10		
	30	545	0.10		00:00:21	00:00:20			7th	1
TS (R=80.00')				2.43			00:00:00	00:22:51		
Curve No. 5 (Figueroa and 7th)	10	100	0.02		00:00:09	00:00:00				
Figueroa and 7th				2.45			00:00:20	00:23:20		
	30	825	0.16		00:00:31	00:00:40			Flower, Hope	2
Hope and 7th				2.61			00:00:20	00:24:51		
	35	1160	0.22		00:00:34	00:01:00			Grand, Olive, Hill	3
TS (R=80.00')				2.83			00:00:00	00:26:25		
Curve No. 6 (7th and Hill)	10	100	0.02		00:00:09	00:00:00				
7th and Hill				2.85			00:00:20	00:26:54		
	30	670	0.13		00:00:27	00:00:30			Ped Xing, 6th	1 1
6th and Hill				2.98			00:00:20	00:28:11		
	30	645	0.12		00:00:27	00:00:30			Ped Xing, 5th	1 1
5th and Hill				3.10			00:00:20	00:29:28		
	35	980	0.19		00:00:34	00:00:30			Ped Xing, 4th	1 1
4th and Hill				3.28			00:00:20	00:30:52		
	35	920	0.17		00:00:33	00:00:30			Ped Xing, 3rd	1 1
2nd and Hill				3.46			00:00:20	00:32:15		
	30	555	0.11		00:00:25	00:00:20			2nd	1
1st and Hill				3.56			00:00:20	00:33:20		
	10	50	0.01		00:00:05	00:00:20			1st	1
TS (R=80.00')				3.57			00:00:00	00:33:45		
Curve No. 7 (1st & Hill)	10	100	0.02		00:00:07	00:00:00				
ST				3.59			00:00:00	00:33:52		
	30	650	0.12		00:00:20	00:00:40			Hill, Grand	2
TS (R=80.00')				3.71			00:00:00	00:34:52		
Curve No. 1 (1st & Grand)	10	100	0.02		00:00:07	00:00:00				
ST				3.73			00:00:00	00:34:59		
	20	315	0.06		00:00:13	00:00:00				
2nd and Grand				3.79				00:35:12		
				3.79	**00:13:22**	**00:13:30**	**00:08:20**	**00:35:12**		**37 12**
						Avg. Speed =	6.5 mph			
						Avg. Station Spacing=	0.16			

NOTES:
1. Stationing, distances and horizontal curve radii based on LA Streetcar Routes for Final Screening.pdf
2. Assumed maximum allowable speed on mixed traffic roadways = 35 mph.
3. Average intersection delay = 20 seconds.
4. Average ped. crossing delay = 10 seconds.
5. Acceleration & deceleration rates based on Skoda 10T normal performance (2.5 mphps).
6. Average dwell time = 20 sec. surface stations.

Prepared by HDR Engineering 21-Sep-11