



# CHAPTER 2 ALTERNATIVES CONSIDERED

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## 2.0 ALTERNATIVES CONSIDERED

This chapter describes the alternatives that are evaluated in this Final Environmental Impact Statement/Final Environmental Impact Report (FEIS/FEIR) for the Crenshaw/Los Angeles International Airport (LAX) Transit Corridor Project. Two basic alternatives are reviewed: 1) the No-Build Alternative, and 2) the light rail transit (LRT) Build Alternative, selected as the Locally Preferred Alternative (LPA).

### 2.1 Proposed Project

The proposed project is based upon a revised definition of the LPA and the incorporation of a few design options. For purposes of this environmental review, this document presents a complete analysis of a revised LPA, an associated maintenance facility, two potential minimum operable segments (MOs), and five design options.

**LPA.** The LPA that is evaluated in this FEIS/FEIR consists of the following elements:

- **Route.** From a southern terminus at the Metro Green Line, the alignment would follow the Harbor Subdivision Railroad right-of-way, adjacent to Aviation Boulevard/Florence Avenue and continue northeast to Crenshaw Boulevard where it would travel north within the middle of the Crenshaw Boulevard right-of-way to the Exposition/Crenshaw Station, adjacent to the Metro Exposition Line currently under construction.
- **Stations.** Stations are located at: Aviation/Century (aerial), Florence/La Brea (at grade), Florence/West (at grade), Crenshaw/Slauson (at grade), Crenshaw/Martin Luther King Jr. (below grade), and Crenshaw/Exposition (below grade)
- **Grade Separations.** Grade separations include the following:
  - ▶ Adjacent to the LAX south runways (below grade trench of which a 1,600 foot segment is fully-covered)
  - ▶ Aerial across Century Boulevard
  - ▶ Aerial across Manchester Avenue
  - ▶ Aerial across La Cienega Boulevard/I-405
  - ▶ Below grade across La Brea Avenue
  - ▶ Below grade between Victoria Avenue and 60th Street
  - ▶ Below grade between 48th Street and Exposition Boulevard
- **Park and Ride Facilities.** Park-and-ride facilities would be located at the Florence/La Brea, Florence/West, and Crenshaw/Exposition Stations.
- **Maintenance Facility.** A maintenance facility would be located at Arbor Vitae/Bellanca (Site #14). This 17.6-acre site is located in the City of Los Angeles.

In addition to the LPA, the following two shorter segment variations, called Minimum Operable Segments (MOs) and five design options to the LPA are also evaluated in the FEIS/FEIR.

**MOSs.** The following shorter segment variations of the LPA are evaluated:

- **MOS-King** – 8-mile segment extending from the Metro Green Line (as the southern terminus) in the south to the Crenshaw/King Station in the north
- **MOS-Century** - 7.4-mile segment extending from the Aviation/Century Station in the south to the Crenshaw/Exposition Station in the north

**Design Options.** The following design options are evaluated in addition to the LPA:

- Partially-Covered LAX Trench Option - replaces fully covered trench (a 1,600 foot contiguous cover) adjacent to LAX south runways with a temporary solution (two sections each 500 feet long) to address budget constraints. The full build-out is being deferred to a future date when funding is secured to support a fully-covered trench segment.)
- Optional Aviation/Manchester Station -additional aerial or at-grade station
- Cut-and-cover crossing at Centinela - replaces at grade configuration
- Optional Below Grade Crenshaw/Vernon Station - additional station in Leimert Park
- Alternate Southwest Portal at Crenshaw/King Station Option – replaces portal on southeast corner of the Crenshaw/Boulevard/Martin Luther King Jr. Boulevard intersection
  - ▶ At the time of the publication of this FEIS/FEIR, the proposed project is based on the LPA and incorporates the Partially-Covered LAX Trench Design Option as an interim measure. Since several other design options and MOSs are analyzed, the Metro Board has the option to adopt a Project Definition that includes a combination of the revised LPA and any of the other elements (MOSs and design options). For example, the Metro Board has already directed that the Crenshaw/Vernon station option be continued as a design option for purposes of procuring construction bids. The Federal Record of Decision will be based upon the ultimately adopted Project Definition by the Metro Board.

## 2.2 Alternatives Process

This chapter briefly describes the Crenshaw/LAX Transit Corridor Project alternatives that were considered in the Draft Environmental Impact Statement/Draft Environmental Impact Report (DEIS/DEIR). Since the circulation of the DEIS/DEIR (2009), the LRT Alternative was selected as the preferred alternative (2009). For purposes of environmental review, the remaining alternatives have been incorporated by reference with the exception of the No-Build Alternative. The No-Build Alternative establishes a baseline to compare the effects of the preferred alternative.

The No-Build Alternative represents a future condition with the implementation of all planned projects (at the time the document was circulated to the public) until the year 2030 without implementation of the proposed project. The No-Build Alternative for the Crenshaw/LAX Transit Project took into account all existing transit projects or those environmentally cleared and under construction. Measure R, a half percent tax increase passed by two-thirds majority of the voters, was passed in November of 2008 to provide a



projected 40 billion in transit system improvements. The Crenshaw/LAX Transit Corridor project is one of the initial projects to be identified for Measure R funding since the DEIS/DEIR had already been circulated to the public.

After the analysis of the DEIS/DEIR was completed, an update to the Metro Long Range Transportation Plan was adopted in 2009, which included several new Measure R transit projects, that were previously unfunded. These projects include the Exposition Phase II, Westside Subway Extension, Regional Connector, Green Line LAX extension, and South Bay Green Line Extension. Subsequent Measure R transportation projects will include these previously unfunded projects into the No-Build Alternative. From a comparative perspective, the effects of the No-Build Alternative described for the Crenshaw/LAX Transit Project will have lower ridership projections and underestimate the benefits of the transit line when compared to a 2035 condition without the additional transit projects. Higher ridership would result in lower automobile vehicle miles of travel (VMT) which would subsequently reduce traffic congestion and air quality emissions. It is important to note that the planned operating parameters for the project, three-car trains and corresponding station platforms, operating with headways as low as five to six minutes with park-and-ride facilities limited by available land (avoiding impacts associated with expansive land takes) would satisfy the demand for both 2030 and 2035 conditions. This assumption assures that the environmental impacts analyzed for the 2030 condition would also satisfy the 2035 condition.

The Los Angeles County Metropolitan Transportation Authority (Metro) followed a prescribed process to identify the alternatives and issues to be analyzed, including seeking input from the public, corridor stakeholders, and other affected parties. The initial alignment alternatives were presented at the scoping meetings and reviewed with the public and agencies with jurisdiction. The alternatives described provide a reasonable range of possible alternatives, which meet the project goals and objectives described in Chapter 1.0, Purpose and Need. In addition to considering public input, these alignment alternatives were screened using engineering and environmental constraints. Alternatives were evaluated based on their effectiveness, environmental impacts, efficiency, financial feasibility, and equity.

## **2.3 Alternatives Development and Screening**

The initial alignments evaluated are shown in Figure 2-1. From this range of alignments, six full corridor alternatives were identified in the DEIS/DEIR. These six corridor alternatives were screened down to two alignment alternatives that were evaluated in the DEIS/DEIR, one for the Bus Rapid Transit (BRT) Alternative and the other for the Light Rail Transit (LRT) Alternative.

## **2.4 Alternatives Evaluated in the AA/DEIS/DEIR (2009)**

### **2.4.1 No-Build Alternative**

The No-Build Alternative includes: (1) all existing highway and transit services and facilities; (2) the current Metro *2001 Long Range Transportation Plan* committed highway and transit projects that are environmentally cleared or under construction (including Exposition Phase I); and (3) the Southern California Association of Governments' *2008 Regional*

Figure 2-1. Initial Alignment Alternatives Considered



Source: Parsons Brinckerhoff 2008



*Transportation Plan* (RTP) committed highway and transit projects. Also, projects that are unfunded in the Metro *2001 Long Range Transportation Plan* are not included in the No-Build Alternative. There are additional projects which have not yet completed their environmental study or are unfunded as of fall 2008 (e.g., Exposition Phase II, Westside Extension, and the Regional Connector) that are not included in the No-Build Alternative.

#### **2.4.1.1 Highway System**

The only major highway improvement affecting the Crenshaw Transit Corridor Project, between now and 2030 is the Interstate 405 (I-405) high occupancy vehicle (HOV) lane, between State Route 90 (SR 90) and the I-10 that is under construction. HOV are lanes currently on the I-405 Freeway, south of SR 90; on the I-105 and I-110, in the study area vicinity; and, on other freeways throughout the region. The highway system that is assumed under the No-Build Alternative will be used when evaluating the build alternatives.

#### **2.4.1.2 Transit System**

Several transit agencies provide bus and rail transit services within the Crenshaw Transit Corridor Project study area. Metro, the Los Angeles Department of Transportation (LADOT), the Santa Monica Big Blue Bus, Torrance Transit, Beach Cities Transit, and the Culver City Bus provide public transit service. Figure 2-2 identifies the Metro Rapid lines and other transit lines serving the Crenshaw Transit Corridor under the No-Build Alternative.

The Exposition Phase 2 LRT Line fixed guideway was not included in the No-Build Alternative because the project had not obtained environmental clearance at the time this document was circulated to the public.

#### **Metro Rail**

The Metro Purple and Green Lines serve the Crenshaw Transit Corridor. These lines operate along the northern and southern study area boundaries. The No-Build Alternative includes the Exposition Phase I LRT line (under construction). This LRT line is approximately 9 miles long, parallels the congested I-10, and is scheduled to open in 2011. This future line will operate LRT along the Metro-owned Exposition right-of-way, from Downtown Los Angeles to Culver City. As it leaves Downtown Los Angeles, the Expo LRT line will share track and two stations (Metro 7th Street/Metro Center Station and the Metro Pico Station) with the Metro Blue Line. It will operate along the Metro-owned Exposition right-of-way to the current Washington/National Boulevards terminus. Since the No-Build Metro Rail network does not include projects that were not under construction or environmentally cleared at the time of the initiation of the environmental analysis for this study, it does not include several projects which were included in the 2009 update for the Long Range Transportation Plan and funded by Measure R sales tax. Among this set of projects is the Exposition Phase II LRT Line. This extension of the Exposition Phase I LRT Line would continue west from Culver City to Santa Monica. Construction of this line is anticipated to be completed in 2015. Nonetheless, as stated earlier, the design standards, the impacts analyzed, and the mitigation identified are determined to satisfy the requirements of the 2035 expanded transit network.

Eight new stations will be constructed along the Expo LRT line. The line is proposed to operate at five and ten minute headways during the peak and off-peak, respectively, in 2030.

Figure 2-2. No-Build Alternative



Source: Parsons Brinckerhoff 2008

**Los Angeles International Airport Automated People Mover (LAX APM)**

In addition to the Expo Phase 1 LRT Line, the No-Build Alternative includes the proposed LAX APM, which is part of the LAX Master Plan. The proposed APM will operate between the proposed Intermodal Transportation Center, north of the existing Metro Green Line Aviation/LAX Station, and the LAX terminals. This APM may be developed in two phases. The first phase would extend from the terminals to the Manchester Square area, near Century Boulevard/Aviation Boulevard. The second phase would extend from Century Boulevard/Aviation Boulevard to Aviation Boulevard/Imperial Highway. The proposed APM would operate at 2-minute headways during peak and off-peak periods. The Los Angeles World Airports (LAWA) will construct and operate the APM. The final APM route and technology have not yet been finalized.

**Metro Rapid**

The completed Metro Rapid Bus Program is included in the No-Build Alternative. The Metro Rapid Lines 710 and 740, which operate on Crenshaw Boulevard, serve the Crenshaw Transit Corridor. Metro Rapid Line 710 operates from the Metro Purple Line Wilshire/Western Station to the South Bay Galleria in Redondo Beach. Metro Rapid Line 740 operates from Union Station in Downtown Los Angeles, traveling west on Martin Luther King Jr. Boulevard, to Crenshaw Boulevard, and south to the South Bay Galleria. These two lines currently operate at 10-minute frequencies during peak periods and 20-minute frequencies during off-peak periods. Service is provided from approximately 5:00 a.m. to 9:30 p.m., Monday through Saturday. No service is operated on Sunday.

Other Metro Rapid Lines provide east-west services within the corridor. These routes include Metro Rapid Lines 720 and 920 on Wilshire Boulevard, Metro Rapid Line 728 on Olympic Boulevard, Metro Rapid Express, Metro Rapid Line 711 on Florence Avenue, Metro Rapid Line 705 on Vernon Avenue, and Metro Rapid Line 757 on Imperial Highway.

**2.4.2 Transportation System Management (TSM) Alternative**

The TSM Alternative enhances the No-Build Alternative by expanding the Metro Rapid bus services operating in the Crenshaw/LAX Transit Corridor (Figure 2-3). Under the TSM Alternative, a new Metro Rapid line would be added along Crenshaw Boulevard, La Brea Avenue, and Hawthorne Boulevard to complement the existing Metro Rapid Lines 710 and 740. The new Metro Rapid line would operate from the Metro Purple Line Wilshire/Western Station to the Metro Green Line Aviation/LAX Station. It would operate along Wilshire and Crenshaw Boulevards, to Florence Avenue, and then along Florence Avenue and Aviation Boulevard to the Metro Green Line Aviation/LAX Station, located at the Aviation Boulevard/Imperial Highway intersection.

**2.4.3 Bus Rapid Transit Alternative**

The BRT Alternative provides new transit services in the Crenshaw/LAX Transit Corridor, which would travel in mixed-traffic and in exclusive curb lanes. The BRT services would use low-floor, compressed natural gas (CNG) powered (or other clean burning alternative), articulated vehicles, with multi-doors for boarding. Enhanced BRT stops and stations would be constructed for passengers to access the system.

Figure 2-3. TSM Alternative



CRENSHAW/LAX TRANSIT CORRIDOR PROJECT

**2.4.3.1 Alignment – BRT Alternative**

Figure 2-4 shows the proposed BRT Alternative alignment and station locations. The BRT alignment would extend approximately 12 miles from the Metro Purple Line Wilshire/Western Station to the Metro Green Line Aviation/LAX Station. The BRT Alternative includes 12 stations.

**Wilshire Boulevard/Crenshaw Boulevard Mixed-Traffic Lanes**

The proposed new BRT route would begin at the Metro Purple Line Wilshire/Western Station. It would extend west operating in mixed traffic lanes from Wilshire Boulevard to Crenshaw Boulevard with stations located at the Wilshire Boulevard/Western Avenue and the Wilshire/Crenshaw Boulevards intersections and south to Exposition Boulevard.

**Crenshaw Boulevard Exclusive Lanes**

On Crenshaw Boulevard, between Exposition Boulevard and the Harbor Subdivision Railroad right-of-way (Harbor Subdivision), semi-exclusive BRT lanes would be provided in each direction, using the outside curb lane (except where exclusive BRT lanes would be built, as described below). During peak periods, the BRT service would operate in lanes restricted to buses and right-turning vehicles. During off-peak periods, the BRT vehicles would operate in mixed-traffic, in the inside traffic lane in some sections and in exclusive lanes that are restricted to buses and right-turn vehicles, in the remaining sections.

**Harbor Subdivision Busway**

A BRT busway would be provided within the Harbor Subdivision from Crenshaw Boulevard south to the Aviation Boulevard/104th Street intersection, where the busway transitions to mixed traffic operation. The BRT mixed traffic operations would continue from 104th Street and terminate at the Metro Green Line Aviation/LAX Station. The Harbor Subdivision is approximately 50 feet wide within the study area. Although Metro currently owns the right-of-way, the Burlington Northern Santa Fe Railway (BNSF) has an agreement to operate freight trains on the railroad. The railroad is single track throughout most of the study area and is generally located in the center of the right-of-way.

**2.4.3.2 Stations**

BRT stations would be located approximately one mile apart. Stations along mixed-flow sections include Wilshire Boulevard/Western Avenue (Metro Purple Line connection), Wilshire Boulevard/Crenshaw Boulevard, Crenshaw Boulevard/Pico Boulevard, Crenshaw Boulevard/Adams Boulevard, and Crenshaw Boulevard/Exposition Boulevard (Exposition LRT Line connection). Stations along exclusive lane sections include Crenshaw Boulevard/King Boulevard, Crenshaw Boulevard/Vernon Avenue, and Crenshaw Boulevard/Slauson Avenue. The BRT stations along the Harbor Subdivision would be at grade and comprised of two separate platforms, one for each travel direction. The station platforms would accommodate three conventional (40- to 45-foot long) buses or two articulated (60-foot long) buses. The BRT platforms would accommodate low-floor vehicles to improve the boarding and alighting process and help reduce vehicle travel times. Four stations were considered along the Harbor Subdivision (Florence Avenue/West Boulevard, Florence Avenue/La Brea Avenue, Aviation Boulevard/Manchester Avenue, and Aviation Boulevard/Century Boulevard).

Figure 2-4. Bus Rapid Transit Alternative



Source: Parsons Brinckerhoff 2008



**2.4.3.3 Vehicles**

BRT services would be provided by articulated buses similar in design to the existing Metro Orange Line vehicles (Figure 2-5). These vehicles would be powered by low emission propulsion systems consisting of compressed natural gas (CNG) engines.

Due to constraints in the Harbor Subdivision, the vehicles would require an additional feature not present in Metro’s current bus fleet. Vehicles would accommodate up to 100

passengers, have low-floors, and need to be equipped with a guidance system that involves a lateral guide wheel attached to the front wheel assembly

**Figure 2-5. Typical BRT Vehicle**



Source: Metro 2008

**2.4.4 Light Rail Transit Alternative**

The Crenshaw/LAX Transit Corridor LRT Alternative would be operated using high-floor articulated vehicles, electrically powered by an overhead wire, and operating along a new, two-direction fixed guideway, located in both exclusive and semi-exclusive rights-of-way. The alternative would include seven stations, park-and-ride and bus transfer facilities at the stations, a vehicle maintenance and operations facility, and traction power substations. The LRT Alternative is more fully described in Section 2.7 of this Chapter.

**2.4.4.1 Other Design Options**

Six additional LRT Alternative design options were considered as variations of the Base LRT Alternative, as shown in Figure 2-6. These design options include the following:

- LRT Alternative Design Option 1 involves an aerial station at Century Boulevard instead of an at-grade station. An Aviation/Century station option includes an aerial station design option on the north side of Century Boulevard as compared to the Base LRT Alternative at-grade station located approximately 1,500 feet north of Century Boulevard near 96th Street.
- LRT Alternative Design Option 2 involves an aerial crossing instead of an at-grade crossing at Manchester Avenue. An aerial crossing over Manchester would replace the at-grade LRT alignment proposed under the Base LRT Alternative and would extend an aerial alignment approximately 1,300 feet within the Harbor Subdivision. The over crossing would consist of an 800-foot bridge and 250 feet approaches on each bridge. The aerial alignment would return to grade on the north side of Manchester Avenue before the at-grade station proposed on the north side of Hindry Avenue.

Figure 2-6. Additional LRT Alternative Design Options



Source: Parsons Brinckerhoff, 2008.



- LRT Alternative Design Option 3 involves a cut and cover crossing instead of an at-grade crossing at Centinela Avenue. An LRT under crossing at Centinela Avenue would replace the at-grade LRT alignment proposed under the Base LRT Alternative and would extend approximately 2,000 feet within the Harbor Subdivision. The under crossing would consist of a 200-foot bridge with a 700-foot depressed LRT alignment section on the west and a 1,100-foot depressed section on the east side of Centinela Avenue.
- LRT Alternative Design Option 4 involves a cut and cover alignment instead of an aerial alignment between Victoria Avenue and 60th Street. A below-grade alignment between South Victoria Avenue and 60th Street would replace the aerial alignment proposed under the Base LRT Alternative, starting on Crenshaw Boulevard and extending into the Harbor Subdivision. The below-grade alignment would be built as a cut and cover tunnel.
- LRT Alternative Design Option 5 involves a below-grade station at Vernon Avenue in Leimert Park. The Crenshaw/Vernon station is an optional below-grade station.
- LRT Alternative Design Option 6 involves a below-grade alignment between 39th Street and Exposition Boulevard with a below-grade station at Crenshaw and Exposition Boulevards. A below-grade alignment between 39th Street and Exposition Boulevard would replace the at-grade Base LRT Alternative alignment and would extend the below-grade segment north of Martin Luther King Jr. Boulevard to Exposition Boulevard with a below-grade station. The below-grade station would provide street level access for transferring to the Exposition LRT line (under construction).

#### **2.4.4.2 Maintenance Facilities evaluated in the DEIS/DEIR**

A total of four potential maintenance facility sites (A-D) were evaluated in the DEIS/DEIR. These four sites were compared and contrasted using several factors including: size and proximity to the line; land use and zoning; land ownership; buffers; potential expansion; community disruption; and, most valuable and best use. Based on the analysis, the four potential maintenance facility sites were ranked as follows: 1) Site D, 2) Site B, 3) Site C, and, 4) Site A. Site A and Site C were screened out based on the criteria and Site B and Site D were evaluated in the DEIS/DEIR.

- Site B is approximately 16.3 acres and bound by 83rd Street, Harbor Subdivision right-of-way, and Isis Avenue.
- Site D is approximately 14.8 acres and in close proximity to the Metro Green line and bound by the Harbor Subdivision, a Union Pacific Branch Line and Rosecrans Avenue.

## **2.5 Alternatives Evaluated in the SDEIS/RDEIR (2011)**

During circulation of the DEIS/DEIR, Site D and Site B elicited comments from some, including municipal officials, elected representatives, and abutting business and property owners. To try to address and resolve these concerns, the Metro Board directed that Sites D and B be removed from further consideration and that additional alternative maintenance facility sites be evaluated. In the analysis of new alternative sites, a total of

18 sites were identified for consideration. These sites were screened using the same criteria that was used to evaluate the original four sites and was developed from public input at community outreach meetings. This evaluation and screening process resulted in the selection of four sites that were analyzed in this Supplemental Draft Environmental Impact Statement/Recirculated Draft Environmental Impact Report (SDEIS/RDEIR). The following Maintenance Facility Site Alternatives shown in Figure 2-7 were evaluated in the SDEIS/RDEIR:

- Site #14 – Arbor Vitae/Bellanca
- Site #15 – Manchester/Aviation
- Site #17 – Marine/Redondo Beach
- Division 22 Northern Expansion

The SDEIS/RDEIR was circulated to the public for a 45 day review period from February 25 to April 11, 2011. The evaluation led the Metro Board of Directors on April 28, 2011 to selection the Site #14 – Arbor Vitae/Bellanca Alternative as the preferred maintenance site. This alternative is discussed in Chapter 5.0 of the FEIS/FEIR.

## 2.6 Project Definition

The project definition involves refinements to the LPA and the additions of design options during preliminary engineering and development of the FEIS/FEIR. This section describes elements of the project definition, including the process of revisions to the LPA and the design options that are incorporated into the project definition.

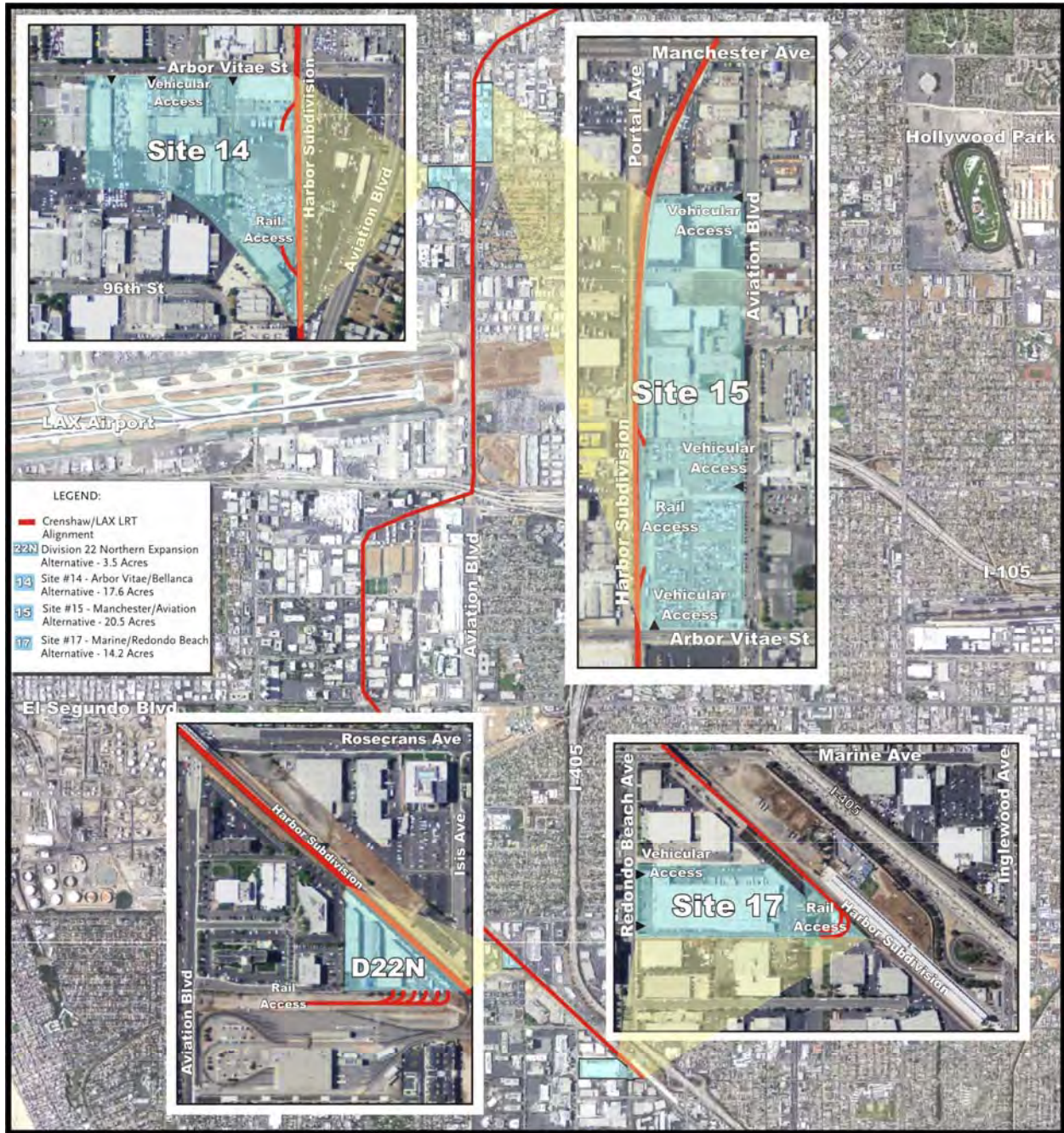
### 2.6.1 Refinements and Additions to the Board-Adopted Locally Preferred Alternative

On December 10, 2009, Metro Board of Directors adopted the LRT Alternative as the LPA for the Crenshaw/LAX Transit Corridor Project. The selection of the LPA provided the starting point for the detailed design of the project. As the project detail increases, the LPA typically evolves based on engineering constraints, potentially significant environmental effects, and financial feasibility. Any changes to the Project Definition are also subject to any actions by Metro's Board. Refinements to the Board-adopted LPA and subsequent additional options are summarized below and described subsequently in further detail.

- **Grade Separations.** Two grade separations initially adopted by the Metro Board that have since been revised:
  - ▶ Below grade between 39th and 48th Streets – This below grade segment has since been lengthened from 48th Street to Exposition Boulevard.
  - ▶ Aerial across La Brea Avenue - This aerial grade separation was changed to a below grade configuration due to seismic considerations



Figure 2-7. Maintenance Facility Site Alternatives Evaluated in the SDEIS/RDEIR



- **Design Options.** One design option initially identified by the Metro Board to be evaluated in the FEIS/FEIR has since been revised:
  - ▶ Exposition/Crenshaw grade separation – This design option was incorporated into the project because of the infeasibility of an at-grade segment along this segment (see grade separation revision above)
- **Maintenance Facility.** After the selection of the LPA, an additional evaluation of maintenance sites occurred in a SDEIS/RDEIR that was circulated to the public for a 45 day review period from February 25 to April 11, 2011. The evaluation led the Metro Board of Directors on April 28, 2011 to selection the Site #14 – Arbor Vitae/Bellanca Alternative as the preferred maintenance site. This alternative is discussed in Chapter 5.0 of the FEIS/FEIR.

Refinements and additional options to the LPA are described below and compared with the Board-adopted LPA in Table 2-1.

### **La Brea Avenue Crossing**

The Board-adopted LPA defined an elevated aerial structure and station on the west side of La Brea Avenue for the Florence/La Brea Station. During ACE, preliminary geotechnical investigations indicated an earthquake fault crossing at this location. To address this seismic condition, a below-grade crossing was recommended and the location of the station was moved approximately 700 feet further east where it could be located at grade. The below-grade crossing would entail construction of a trench under La Brea Avenue. This new trench design is cost neutral with the base design. The location of the Florence/La Brea Station was also required to be relocated at grade, east of Market Street to minimize the impacts of seismic/geotechnical conditions. The station would be located just east of the Market Street/Florence Avenue intersection. These refinements provide for greater safety and an easier recovery in case of an earthquake. In addition, the change from elevated to below grade at La Brea Avenue results in at-grade crossings at Ivy and Eucalyptus Streets. The LPA included grade-separated crossings at Ivy and Eucalyptus Streets required by the transition from the elevated alignment at La Brea Avenue back to grade. Crossings at these two street locations did not require grade separation per the Metro Grade Crossing Policy. This new trench alignment is less expensive than the base design.

### **Segment from Exposition Boulevard to 39th Street**

As defined in the LPA, the ultimate northern terminus (Crenshaw/Exposition Station), had an at-grade configuration as the base condition, as well as a below-grade design option (Design Option 6) which both underwent further analysis during the ACE phase. This design option would extend a tunnel between 39th Street north to Exposition Boulevard with a below-grade station. Extensive evaluations were completed during the ACE phase of the at-grade alignment and station configuration at Exposition Boulevard. All analyzed at-grade configurations were deemed to be infeasible (not likely to gain regulatory approval) due to a combination of physical constraints and significant traffic and land use impacts. In addition, ACE determined that the property acquisitions required along this at-grade segment would increase costs significantly. Consultations with staff from the CPUC (which certifies and approves rail grade crossings), the

**Table 2-1. Evolution of Project Elements from Board-Adopted LPA**

Element	2009 Board-Adopted LPA		2011 Project Elements (Analyzed in FEIS/FEIR)		
	2009 LPA	2009 Design Options	2011 LPA	2011 Design Options	MOSs
<b>Vertical Profile</b>					
Green Line to 111th St	Aerial		Aerial		Bus Connect
111th St to 104th St	Below Grade		Below-Grade (Fully Covered LAX Trench)	<b>Interim Partially-Covered LAX Trench (Below Grade)</b>	
104th St to Century Blvd	Aerial		Aerial		MOS-King Alternative
Century Blvd	Aerial		Aerial		
Century Blvd to Manchester Ave	At Grade		At Grade		
Manchester Ave	Aerial		Aerial		
Manchester Ave to La Cienega	At Grade		At Grade		
La Cienega Blvd and I-405	Aerial		Aerial		
I-405 to Ivy Ave	At Grade		At Grade		
Ivy Ave to La Brea Ave	Aerial		<b>At Grade</b>		
La Brea Ave	Aerial		<b>Below-Grade</b>		
La Brea Ave to Centinela Ave	At Grade		At Grade		
Centinela Ave	At Grade	Below Grade (Design Option 3)	At Grade	Below Grade	
Centinela Ave to Victoria Ave	At Grade		At Grade		
Victoria Ave to 60th St	Below Grade		Below-Grade		
60th St to 48th St	At Grade		At Grade		
Slauson Ave	At Grade		At Grade		
48th Street to 39th St	Below Grade		Below-Grade		
King Blvd	Below Grade		Below-Grade		
39th St to Exposition Blvd	At Grade	Below Grade (Design Option 6)	<b>Below-Grade</b>		Feeder Bus Connection
Exposition Blvd	At Grade	Below Grade (Design Option 6)	<b>Below-Grade</b>		
<b>Stations</b>					
Aviation/Century	Aerial		Aerial		MOS-King Alternative
Aviation/Manchester	None	At Grade	None	At Grade/ <b>Aerial</b>	
Florence/La Brea	Aerial		At Grade		
Florence/West	At Grade		At Grade		
Crenshaw/Slauson	At Grade		At Grade		
Crenshaw/Vernon	None	Below Grade (Design Option 5)	None	Below Grade	
Crenshaw/King	Below Grade		Below Grade	<b>Alternate Southwest Portal Location</b>	
Crenshaw/Exposition	At Grade	Below Grade (Design Option 6)	<b>Below Grade</b>		
MOS-Century Alternative					



Community Redevelopment Agency of Los Angeles (which has an adopted Vision Plan in this segment and which approved a development project in direct conflict with the right-of-way required for the at-grade alignment), and the Los Angeles Department of Transportation (which has jurisdiction over the Crenshaw Boulevard right-of-way and traffic operations) indicate that an at-grade approach would not be acceptable to these agencies. The extent of the impacts for at-grade approach to the Exposition Line also resulted in a higher cost estimate than the available financial plan for the project.

The ACE analysis indicates that Design Option 6 is a technically feasible alternative to an at-grade alignment and is recommended for inclusion into the project definition. However, inclusion of this underground segment will require the project to incorporate cost reductions in order to be consistent with the Metro financial plan for the project. The below-grade Exposition/Crenshaw approach and station costs are approximately \$120 (2010 dollars) million more than the at-grade alternative. The FEIS/FEIR evaluates the LPA with the inclusion Design Option 6 as part of the project definition contingent on financial feasibility.

**Park-and-Ride Facilities.** During the preliminary engineering phase of the project, the project design was refined to include three park-and-ride facilities indicated in Table 2-2. The DEIS/DEIR assumed a maximum of five park-and-ride locations consisting of 100 to 300 spaces at each station. The location and size of the park-and-ride facilities were refined based on updated modeling and transit parking demand.

**Table 2-2. Park and Ride Lots at Station Locations**

Station Locations	Approximate Park-and-Ride (Spaces)
Florence/La Brea	100
Florence/West	120
Crenshaw/Exposition (Design Option 6)	110

**2.6.2 Incorporated Design Options to the Project Definition**

**Partially-Covered LAX Trench Option.** The LPA is located near the eastern limit of LAX Runways 7L/25R and 7R/25L. While the LPA alignment is within Metro-owned right-of-way located to the west of Aviation Boulevard, it is within the designated Runway Protection Zone (RPZ) of LAX. The RPZ’s function is to enhance the protection of people and property on the ground through airport owner control over uses within the RPZ. Such control includes clearing RPZ areas (and maintaining them clear) of incompatible objects and activities. Location within this zone requires coordination with LAWA and the Federal Aviation Administration (FAA). Based on this coordination, the Advanced Conceptual Engineering design that requires maximum investment for the LPA in this area entails that the light rail alignment is depressed in a fully-covered trench. During the preliminary engineering phase of the project, Metro proposed an alternative LPA configuration design of a depressed and partially-covered trench adjacent to the LAX south runways. The design of the partially-covered trench will not preclude future provisions to allow covering of the remaining open section. This option would provide cost savings over the base design which would help the project fit within the available



funding. The FAA requires and Metro concurs that ultimately a 1,600-foot segment covering the rail trench alignment crossing the central portion of the LAX RPZs will be built by Metro in order to meet FAA airport design standards. The FAA has agreed to the transit alignment, but with conditions that the transit corridor must be below grade and covered. The FAA has also agreed to allow a Partially-Covered LAX Trench Option as a temporary initial development option in order to meet Metro budgetary constraints. The environmental analysis in this environmental document evaluated the potential for environmental impacts for the LPA fully-covered below-grade trench and also the Partially-Covered LAX Trench Option, and determined that no environmental impacts would result from either of the designs. Although the Metro Board may initially select the Partially-Covered LAX Trench Option in the Project Definition, Metro has agreed to completely cover a 1,600 foot portion of the trench as required by FAA to meet airport design standards when future Metro funding becomes available. A rendering of this design option and further details are described in Section 2.7.3.

### **2.6.3 Other Design Options Relevant to the Project Definition**

As stated previously, the Partially-Covered LAX Trench Option has been incorporated into the project definition. Two other design options that may be incorporated into the project definition (based on potential for cost savings and reduction in environmental impacts, in one case, and based upon Board action in the other.) These options will further be explored through the preliminary engineering phase and during the procurement of design build contracts.

**Alternate Southwest Portal at Crenshaw/King Station Option.** This option involves an alternate portal at the southwest corner of the Crenshaw Boulevard/Martin Luther King Jr. Boulevard intersection. During the preliminary engineering phase of the project, Metro determined that providing a connection in front of the Broadway building (Walmart) could provide increased access to the regional mall. In addition, potential cost savings and fewer displacements could be achieved through less property acquisition (The portal would be located within the existing landscaped sidewalk adjacent to the Broadway building and would provide vertical circulation to the underground Crenshaw/King Station). The portal could also be located in the basement of the Broadway building to provide a direct connection to the Baldwin Hills Crenshaw Plaza. This alternate portal is not included within the current project financial plan and would only be implemented if the land were privately funded or if easements to privately-owned land are granted. This station is located at the most heavily developed area of the entire line with a major shopping center near the site. A rendering of this design option and further details are described in Section 2.7.3. While this design option is not yet incorporated into the project definition, negotiations with the mall owners may allow it to be adopted as part of the project definition.

**Below-Grade Crenshaw/Vernon Optional Station.** Since the adoption of the LPA, the Metro Board, at its May 2011 meeting, directed the below-grade Crenshaw/Vernon Station to be considered as an option within the procurement of design-build contracts. While this action did not incorporate the optional station into the project definition, it placed an emphasis on carrying the design forward for the design-build procurement

process. It may be implemented if bids for the project including this design option fall within the project funding amount.

## 2.7 Project Elements Evaluated in the FEIS/FEIR

There are a number of project elements evaluated in the FEIS/FEIR which include the revised LPA, two MOSs, and five design options. Final Design and construction of the Crenshaw/LAX Transit Corridor is scheduled to begin in Fiscal Year 2012, with operation commencing in 2018, or earlier, depending on funding availability. The Crenshaw/LAX Transit Corridor Project would operate using high-floor articulated vehicles, electrically powered by an overhead wire, and operating along a new, two direction fixed guideway, located in both exclusive and semi-exclusive rights-of-way. The project elements are described in detail in Sections 2.7.1 through 2.7.3 below:

- 2.7.1 LPA
  - ▶ 2.7.1.1 Route Alignment
  - ▶ 2.7.1.2 Stations
  - ▶ 2.7.1.3 Operating Plan
  - ▶ 2.7.1.4 Ancillary Facilities
  - ▶ 2.7.1.5 Maintenance Facility Site
- 2.7.2. Minimum Operable Segment (MOS) Alternatives
- 2.7.3. Design Options

### 2.7.1 LPA

Figure 2-8 shows the proposed alignment. The project would include six stations, three park-and-ride lots, bus transfer facilities at the stations, a vehicle maintenance and operations facility, and traction power substations.

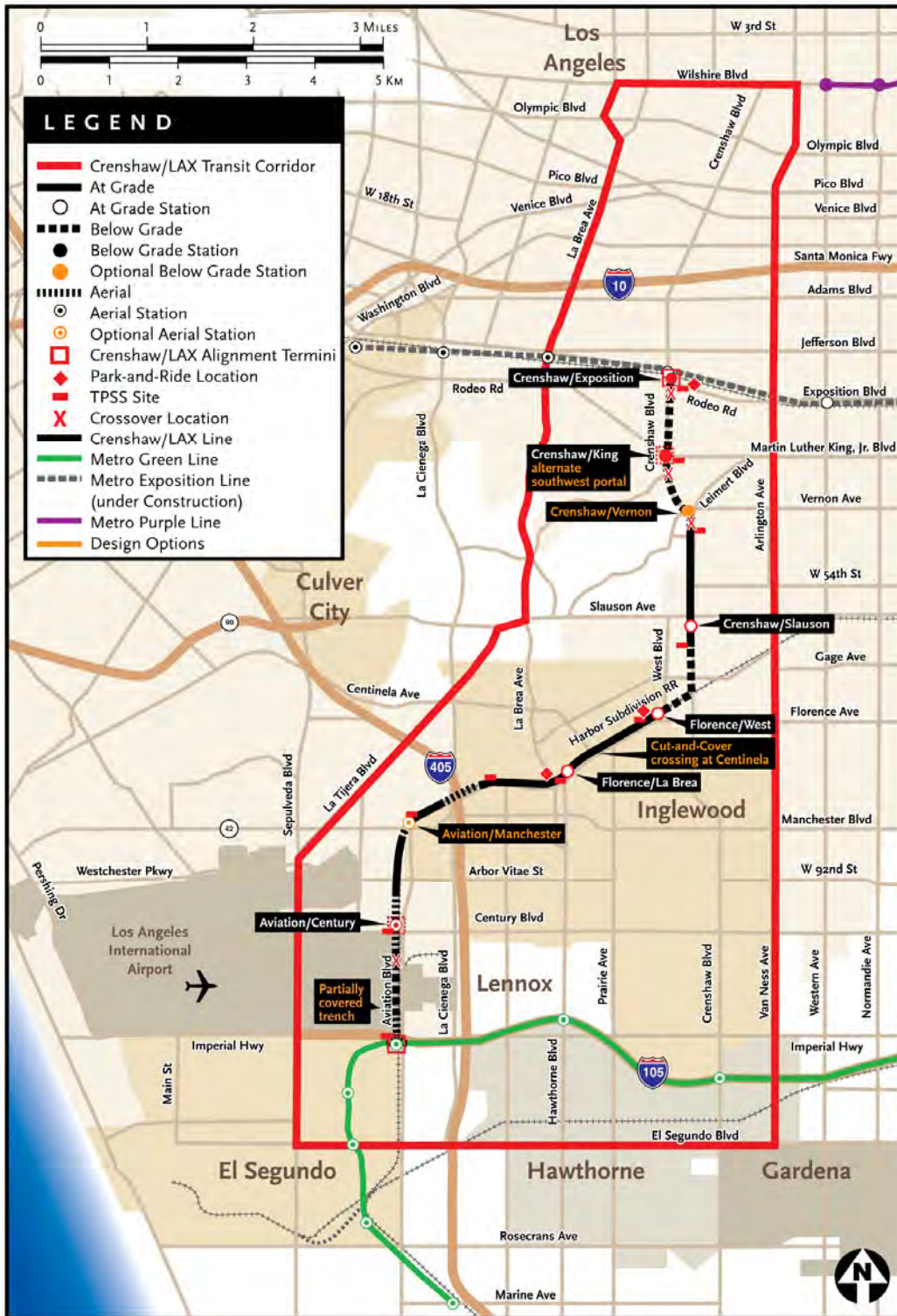
- The Crenshaw/LAX Line and associated facilities will be monitored and controlled from the Rail Operations Control Center (ROC).
- A maintenance facility will be provided near the line where the Crenshaw/LAX or Metro Green Line trains operate.
- Crossovers will be provided at terminal stations and along the line to maintain a minimum of 10 to 12-minute headways during single track operations.
- At maximum, three-car trains will be allowed in the Crenshaw Line and the Metro Green Line.

#### 2.7.1.1 Route Alignment

The project would ultimately extend approximately 8.5 miles from the Metro Green Line Aviation/LAX Station to the Exposition LRT line (under construction) at the Exposition/Crenshaw Boulevards intersection. Two potential Minimum Operable Segment termini are analyzed in this FEIS/FEIR. One MOS for the project would extend from the



Figure 2-8. LRT Alternative (Locally Preferred Alternative)



Note: The Fully-Covered Trench adjacent to the LAX South Runways is part of the LPA. The Partially-Covered Trench is a design option.  
Source Parsons Brinkerhoff, 2011.

Metro Green Line north to the Crenshaw/King Station. The LRT alignment would be double-tracked and would be comprised of at-grade street, at-grade railroad, aerial, and below-grade sections. Operation of the Crenshaw/LAX Line would join the Metro Green line at Mariposa Station and extend to the Exposition Line Crenshaw Station in the north. Metro Green Line service can also be extended north to serve the new Aviation/Century Station for transfers to the LAX. Two potential Minimum Operable Segment termini are analyzed in this FEIS/FEIR. One MOS for the project would extend from the Metro Green Line north to the Crenshaw/King Station. A second MOS could extend between the Crenshaw/Exposition Station south to the Aviation/Century Station. The MOSs are described in more detail in Section 2.7.2, Minimum Operable Segments.

### **Alignment Profile**

Figure 2-9 shows the vertical profile of the project alignment beginning in the south along the Harbor Subdivision and ending in the north along Crenshaw Boulevard.

### **Harbor Subdivision Section**

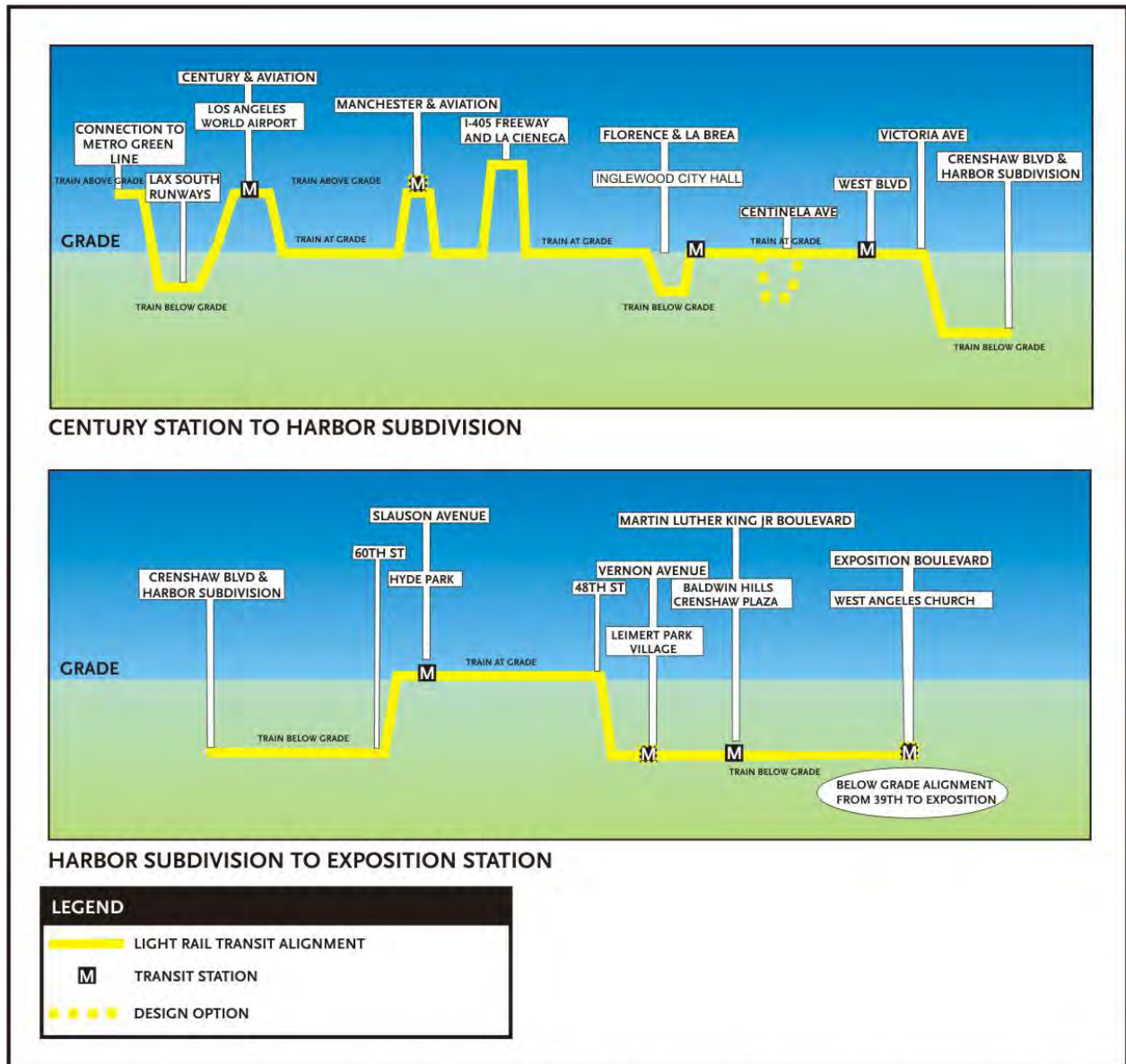
The southern terminus of the alignment would begin near the existing Metro Green Line Aviation/LAX Station which is in an aerial configuration near the intersection of Aviation Boulevard and Imperial Highway. It will follow the Harbor Subdivision right-of-way, which is an existing transportation corridor. Near LAX, the Harbor Subdivision is situated at the end of the LAX South Runway complex. The alignment will transition northerly from an aerial configuration to a fully covered below-grade trench configuration, north of 111th Street, as it passes adjacent to the LAX South Runways (Figure 2-10). This fully covered below-grade trench is designed to address the Federal Aviation Administration's standards related to airspace and obstructions around airport runways. These standards are developed to limit safety hazards and conflicts between potential aircraft operations at the end of the runways and surrounding land uses. Particularly, this addresses the existence of Runway Protection Zones, which were defined by the Federal Aviation Administration, and in this case, include this segment of the railroad right-of-way. For separate consideration, there is an interim design option for a partially-covered trench (Partially Covered LAX Trench Option). A rendering and further description of this option is described in Section 2.7.3.

After clearing the south runways north of 104th Street, the alignment would transition to an aerial configuration across Century Boulevard. At Century Boulevard, the LRT alignment would be located on a new bridge constructed west of, and adjacent to, the existing railroad bridge. The first mile of the alignment between the Metro Green Line and the Aviation/Century Station provides infrastructure for shared operation of two lines – the Crenshaw/LAX Line and the first mile for the extension of the Metro Green Line to LAX (The configuration of the shared operations is explained in more detail in Section 2.7.1.3 Operating Plan.

The alignment would transition to an at-grade configuration north of the Wally Park structure and operate at-grade across Arbor Vitae Street and would transition to an aerial structure across Manchester Avenue (Figure 2-11).



Figure 2-9. Vertical Profile for the Crenshaw/LAX LRT Line



Note - The MOSs, the Partially Covered Trench Option, and the alternate southwest portal at Crenshaw/King would not result in any changes to the vertical alignment and are not depicted.

Source: TAHA, 2011.

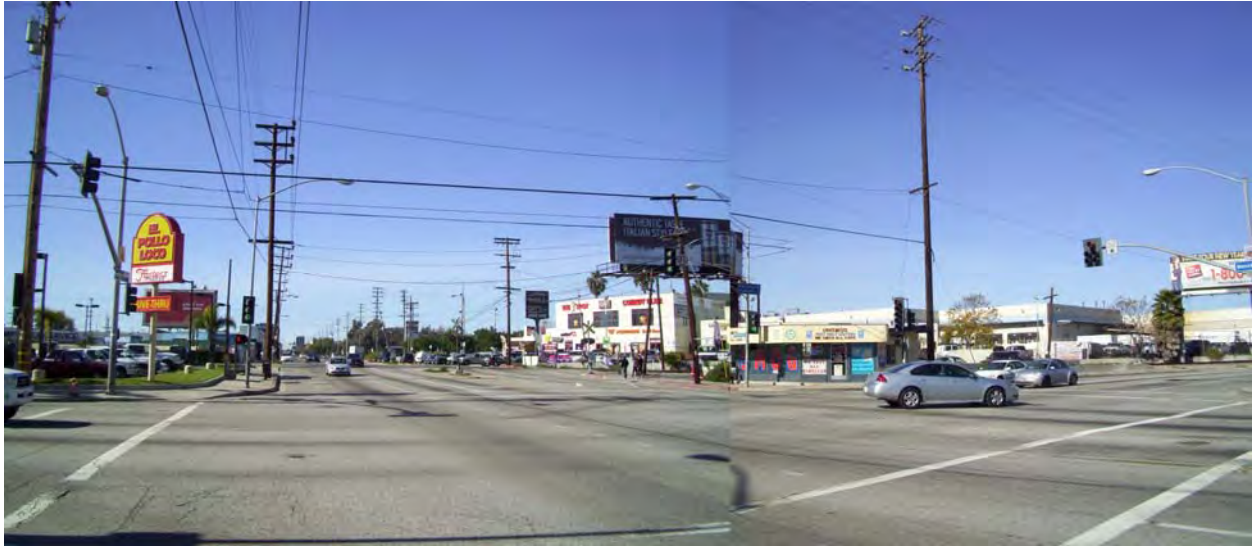
Figure 2-10. LPA in Proximity to LAX



Source: RAW International and Anil Verma Associates, 2011.



**Figure 2-11. Rendering of Aerial Crossing at Manchester**



**Existing Manchester Avenue at Aviation Boulevard**



**Rendering of Manchester Aerial Crossing**

Source: RAW International, 2011.

The alignment would transition back to grade level for at-grade crossings at Isis and Hindry Avenues. The LRT alignment would transition to an aerial configuration across La Cienega Boulevard and the I-405 and would return to grade before Oak Street (Figure 2-12).

The alignment would continue at grade to the east with at-grade crossings at Oak Street, Cedar Street, Ivy Street, and Eucalyptus Avenue. The alignment would descend to a below-grade trench configuration under La Brea Avenue with an open cut station to the east of La Brea Avenue. The alignment would transition back to grade east of La Brea

Figure 2-12. Rendering of Aerial Crossing Over La Cienega and the I-405



Existing I-405



Rendering of I-405 Crossing

Source: RAW International, 2011.



Avenue until Victoria Avenue. At-grade crossings would occur at Centinela Avenue, West Boulevard and Brynhurst Avenue and an at-grade station would be located to the west of West Boulevard. Design Option 3, which is not incorporated into the project definition and which has not been to be required, involves a cut and cover crossing instead of an at-grade crossing at Centinela Avenue. An LRT under crossing at Centinela Avenue would extend approximately 2,000 feet within the Harbor Subdivision. A cut-and-cover trench option would add approximately \$33 million addition to the base project cost.

Along this section between Imperial Highway and Crenshaw Boulevard within the Harbor Subdivision right-of-way, it is assumed that the two light rail tracks will be located to the north and west of a third set of rail tracks, which are proposed to be preserved for the continued operation of trains by the BNSF Railway.

#### **Potential Abandonment by BNSF of the Harbor Subdivision Section**

Metro is currently in discussions with BNSF related to the potential abandonment of the operations between Imperial Highway and Crenshaw Boulevard. In the case of such abandonment, the physical footprint may decrease as a result of removed clearance requirements and the costs may also decrease. If the third track is not preserved, it may require any future project using that track to restore such infrastructure for service.

#### **Crenshaw Boulevard Section**

West of Victoria Avenue, the alignment would transition to a below-grade tunnel and continue along the Harbor Subdivision until Crenshaw Boulevard where it would continue north under Crenshaw Boulevard until north of 59th Place where it would transition to grade level through a portal in the middle of the Crenshaw Boulevard median. The alignment is required to be below grade under this segment of Crenshaw Boulevard because the street right-of-way width is 100 feet, which would be insufficient to accommodate an at-grade LRT without reducing roadway lane capacity.

The alignment would travel at grade in a new median on Crenshaw Boulevard from south of 59th Street to 48th Street. Crenshaw Boulevard would be reconfigured where the alignment is operating at grade. Frontage roads, which contain two rows of parking on each side of the street, and medians would be eliminated. One row of on-street parking would be preserved on both sides of the street. Wider sidewalks, a new bicycle lane, and new sidewalk trees and landscaping would be incorporated. (Figure 2-13)

There would be an at-grade station in the median on Crenshaw Boulevard, south of Slauson Avenue. The alignment would transition to a below-grade configuration north of 48th Street through a portal in the median on Crenshaw Boulevard. The alignment would be below grade to the northern terminus at the Crenshaw/Exposition Station. The below-grade alignment could be built as either a bored or cut and cover tunnel. The choice of tunneling methodology will be based on an analysis of the length and depth of the tunnel section as performed by bidding design/build contractors. Below-grade stations would be located in the median on Crenshaw Boulevard at King and Exposition Boulevards with portal entrances on properties adjacent to Crenshaw Boulevard. Figure 2-14 shows typical cross sections for the alignment in the Harbor Subdivision and Crenshaw Boulevard.

Figure 2-13. At-Grade Alignment between 59th and 48th Streets

**Crenshaw Boulevard Southbound From 54th Street**



**Existing**



**Rendering of LRT Line**

Source: Anil Verma, 2011.



### 2.7.1.2 Stations

The LPA includes two underground stations, three at-grade stations, and one above ground (aerial) station:

- Aviation/Century (aerial)
- Florence/La Brea (at grade)
- Florence/West (at grade)
- Crenshaw/Slauson (at grade)
- Crenshaw/King (underground)
- Crenshaw/Exposition (underground)

#### Optional Stations (described under Design Options)

- Aviation/Manchester (aerial/at grade)
- Crenshaw/Vernon (below grade)

For transit passengers' convenience and to control capital, operating, and maintenance costs, the proposed stations, including signage, maps, fixtures, furnishings, lighting, and communication equipment, would have a consistent design similar to the existing Metro LRT stations.

#### Station Platforms

LRT stations would consist of either center or side platforms, 270 feet long, to accommodate LRT trains with up to three cars. Center platform stations would have a single platform, allowing passengers to access trains from either direction. This configuration would make it easier for passengers to transfer across the platform and to use the system in general. Side platform stations would have platforms on either side of the tracks, with separate entrances to each platform. A side platform configuration would require that patrons transfer to a different platform to access the trains. Platforms would be approximately 18 feet wide for center platform stations and 14 feet wide for side platform stations. The platforms would be 39 inches high to allow level-boarding for full accessibility. Platform widths are determined in accordance with Metro's Design Criteria and Directive Drawings. The existing Metro Green Line Mariposa, Douglas, and Redondo Beach Stations were constructed to accommodate two-car trains. If the Metro Green Line or proposed Crenshaw/LAX Line ridership demand increases, it may warrant that the platforms be extended to accommodate three-car trains.

All platforms would be fully accessible and comply with the Americans with Disabilities Act (ADA). Outdoor platforms would be well-lighted and include amenities, such as canopies that cover a minimum 30 percent of the platform area, seating, bike lockers, bike racks, trash receptacles, and artwork. The LRT stations would also include signage, safety, and security equipment which would provide real-time information. The fare collection area would include ticket vending machine, fare collection equipment, and information cases. The fare collection system would function as fare gates, defining the



“free” and “paid” areas, where patrons would be required to have a ticket. Fare gates would be per Metro Policy and installed at major stations along the line.

**Station Types**

LRT station types would be either at-grade, aerial, or below grade, and are comprised of 270 feet long platforms that accommodate LRT trains with up to three cars.

**At Grade**

At-grade station platforms would be accessed from either a single ramp to a center platform or from separate ramps to each of the side platforms. At-grade stations located in the street median would be accessed from a designated crosswalk. California Public Utilities Commission (CPUC) regulations require that an at-grade station platform boarding area be located at least 180 feet from the nearest street curb to allow adequate safe braking distances for the light rail vehicles (LRVs).

**Elevated or Aerial Stations**

Elevated station structures would be supported by columns spaced approximately 80 to 120 feet apart. The platforms would be accessed either directly from grade or from an intermediate concourse above grade through vertical circulation elements (i.e., stairs, escalators, elevators). Platform widths would be determined by ADA clearances at the stairs, escalators, or elevator structures, and by Metro’s Fire/Life Safety Criteria for exiting requirements, which is based on patronage data.

**Below-Grade Stations**

Below-grade stations would have an off-street entrance comprised of vertical circulation elements that bring patrons to a mezzanine level where the ticketing functions would be located. The platforms would be accessed from the mezzanine level. The platform widths, and the widths of the stairs, escalators, and emergency exits, would be determined by patronage data and ADA required clearances.

**Station Design**

Each of the stations will respond to their unique circumstances of site, surrounding transit relationships, particular uses, and neighborhood character. The design of the station will consider community and agency input to determine what land uses will be around the stations and where the station entrances are to be located. Selection of station options that will be developed for each location will need coordination with the entire team including traffic, tunnel construction, systems, structural engineering, operations, etc.

The station public use and occupancy areas include the free and paid areas of the station with access to a boarding platform through stairs, escalators and elevators, and controlled access to emergency exits. For underground stations and above ground stations that access from street level, the platform can be direct or through an intermediate mezzanine level. Ticketing can be done at the street level or mezzanine level. The non-public areas of the station are the areas used by Metro personnel and the areas designated as ancillary spaces to store mechanical and electrical equipment. These areas are restricted to Metro personnel use only.

The station design will include conceptual level designs for each station with architectural features, fare gate provisions, mechanical, electrical, and fire life safety requirements provided for in appropriately located and sized spaces with consideration for conduits, duct banks, and air ducts. Further development of mechanical and electrical requirements will be completed in subsequent phases of work. Conceptual landscape designs for the stations will also be developed during Final Design.

**Aviation/Century Station**

The Aviation/Century Station will be an aerial station located on Century Boulevard extending between the crossing of Century Boulevard and the northwest corner of the Aviation/Century Boulevards intersection. It is described in greater detail in Section 2.7.1.3 Operating Plan, this station will serve the Metro Green Line to LAX as the mile of new infrastructure between Imperial Highway and Century Boulevard and is designed to accommodate both the Crenshaw/LAX Transit Corridor Project and the first mile of the Metro Green Line to LAX. Design of this station and its associated track alignment will incorporate provisions for service from the Metro Green Line and potential future extensions of the Metro Green Line to the north and west toward LAX or Westchester. These provisions would likely include a single or double track configuration to allow for these future extensions. This station will need to accommodate a potential future connection to the LAX People Mover, which is in the conceptual stage and may not be finalized for some time. Provisions for a bus transfer plaza are being designed on the property just west of Aviation/Century Station and will need to be integrated into the station site design.

**Figure 2-15. Aviation/Century Station Site Layout**

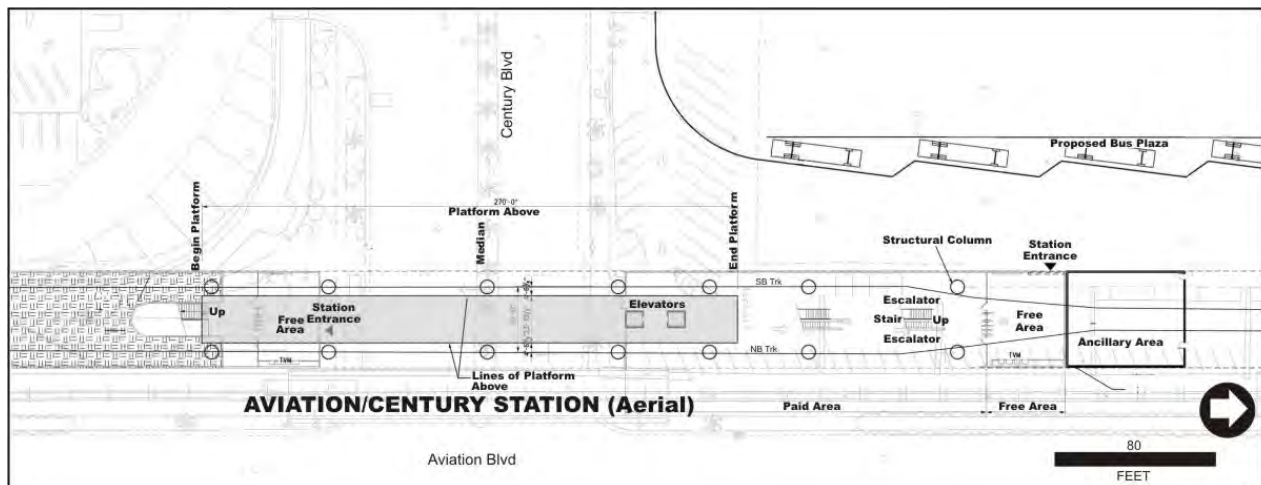




Figure 2-16. Rendering of Aviation/Century Station



Existing Century Boulevard and Harbor Subdivision



Rendering of Aerial Aviation/Century Station

**Florence/La Brea Station**

The Florence/La Brea Station will be located at grade, in a depression just north of Florence Avenue and east of Market Street. This station will provide access to Downtown Inglewood and the City of Inglewood Civic Center. The station would also serve commercial uses along Market Street to the south and residences to the north, east, and west.

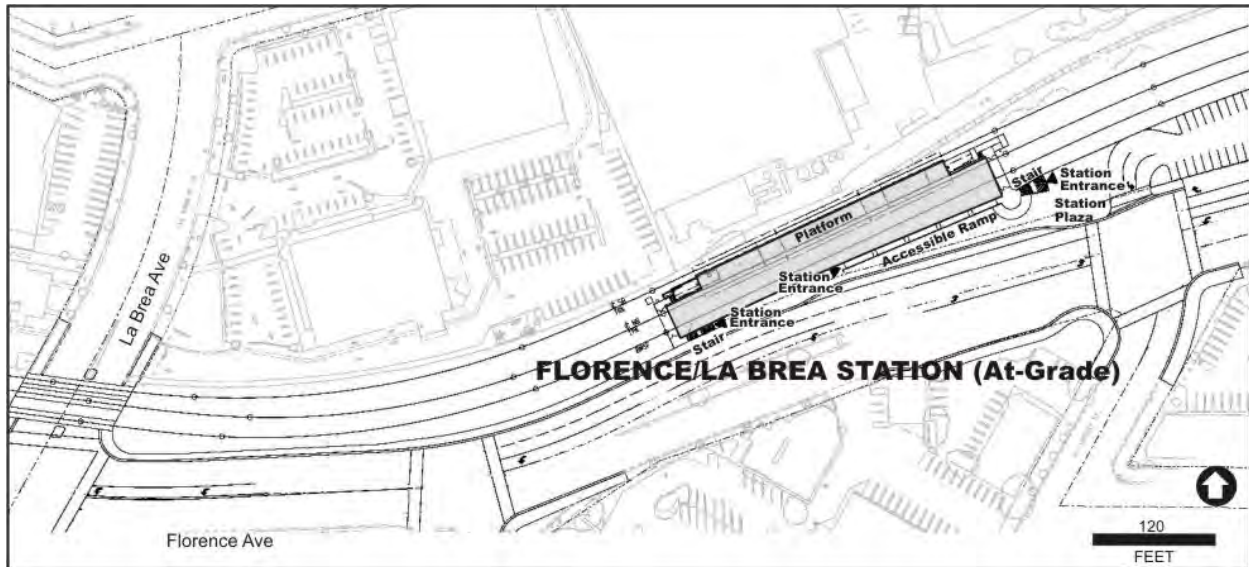
**Figure 2-17. Rendering of Florence/La Brea Station**



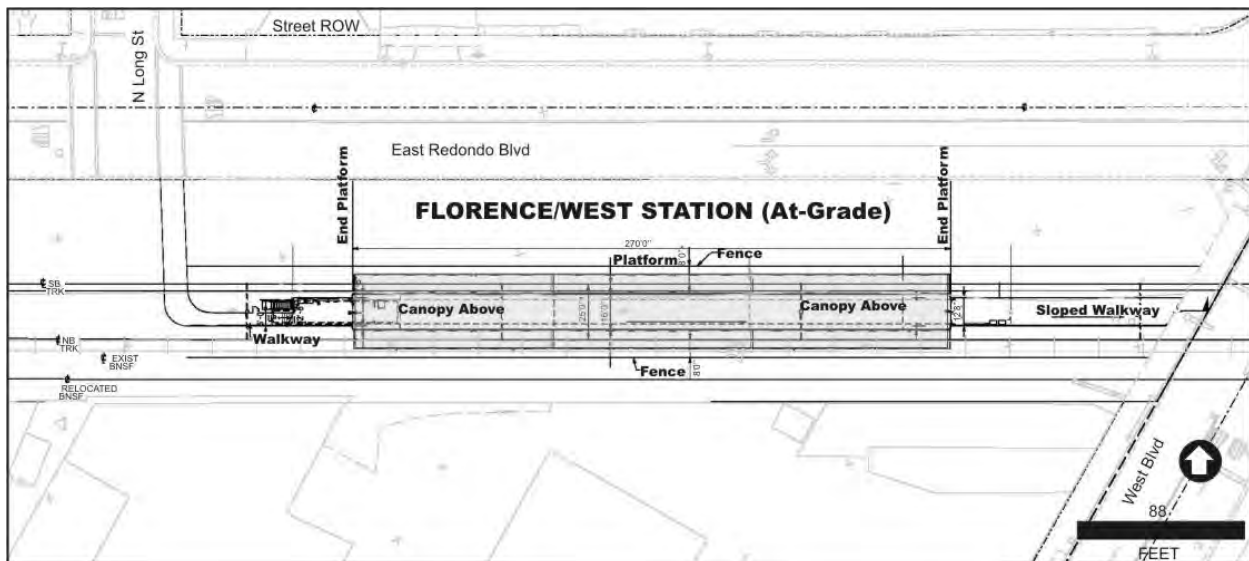
**Existing Harbor Subdivision East of La Brea Avenue**



**Rendering of Florence/La Brea Station**

**Figure 2-18. Florence/La Brea Station Site Layout**

**Florence/West Station**

The Florence/West Station will be designed as an at-grade station. The station will be designed as a center platform station located to the west of West Boulevard. This station will provide access to Edward Vincent Jr. Park, and residences in the Cities of Inglewood and Los Angeles.

**Figure 2-19. Florence/West Station Site Layout**


Source: HatchMott MacDonald and TAHA, 2011.

### Crenshaw/Slauson Station

The Crenshaw/Slauson Station will be an at-grade station. The station will be designed as a center platform station located to the south of Slauson Avenue. This station will serve commercial uses along Slauson Avenue and Crenshaw Boulevards.

Figure 2-20. Rendering of Crenshaw/Slauson Station



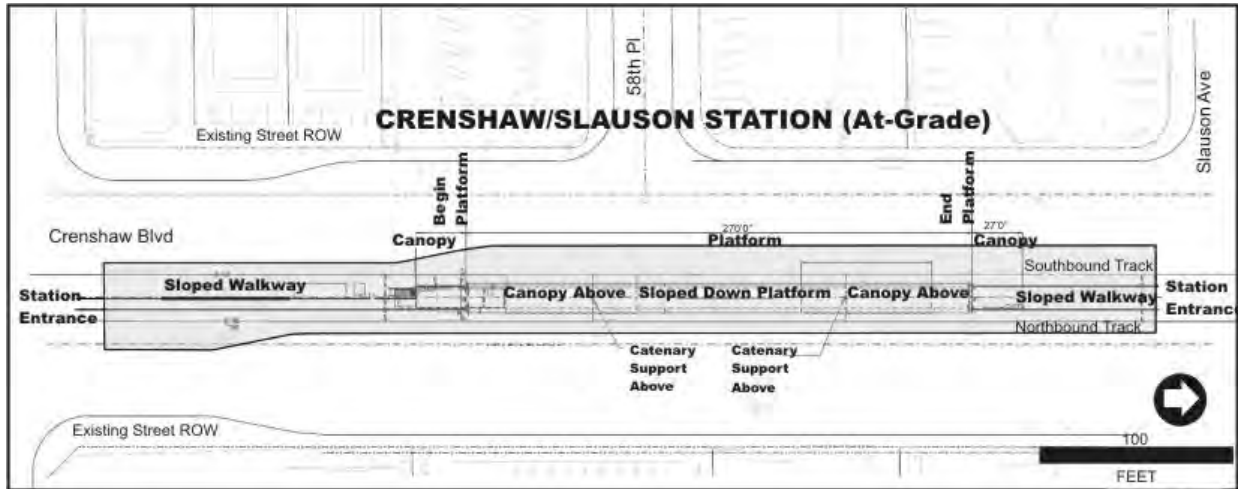
Existing Crenshaw Boulevard/Slauson Avenue Intersection



Rendering of Crenshaw/Slauson Station



Figure 2-21. Crenshaw/Slauson Station Site Layout

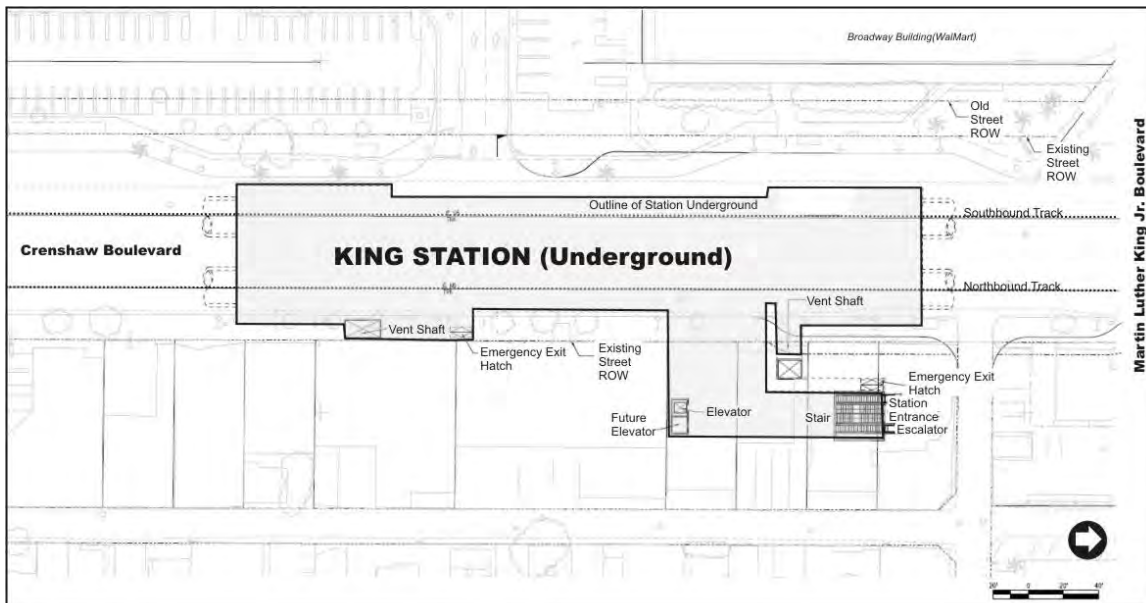


Source: HatchMott MacDonald and TAHA, 2011.

### Crenshaw/King Station

The Crenshaw/King Station is an underground station. The station box would be located under the median on Crenshaw Boulevard, south of King Boulevard. The station portal for this station would be located near the southeast corner of the Crenshaw/King Boulevards intersection. There is an alternate portal location on the southwest corner of Crenshaw/King Boulevards intersection adjacent to the Broadway building. This station is located at the most heavily developed area of the entire line with a major shopping center near the site.

Figure 2-22. Crenshaw/King Station Site Layout

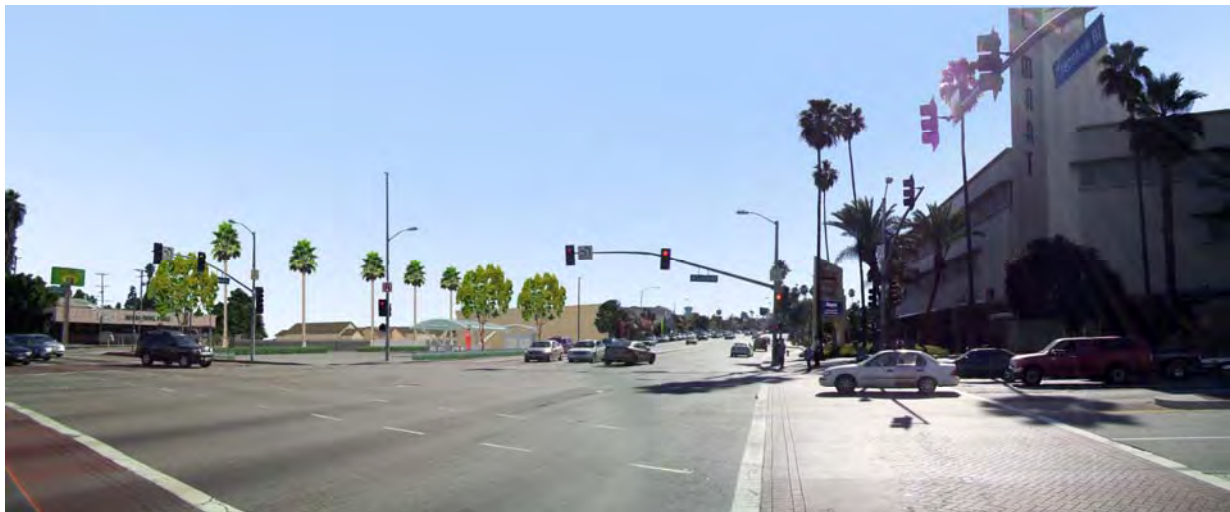


Source: Hatch Mott MacDonald and TAHA, 2011.

Figure 2-23. Rendering of Crenshaw/King Station



Existing Crenshaw Boulevard/King Boulevard Intersection



Rendering of Crenshaw/King Station Portal (Southeast Corner)

### Crenshaw/Exposition Station

The Crenshaw/Exposition Station is the northern terminus of the Crenshaw/LAX line with the incorporation of Design Option 6. The station box would be located under the median on Crenshaw Boulevard, south of Exposition Boulevard. The station portal for this station would be located on the southeast corner of the Crenshaw/Exposition Boulevards intersection. This station will allow a pedestrian connection to the Exposition Line that has a station at Crenshaw and Exposition with the westbound station platform at the northeast corner and the eastbound station platform at the southwest corner. The Crenshaw/Exposition Station will be designed to continue north underground and connect with other Metro lines at some future date.

Figure 2-24. Rendering of Crenshaw/Exposition Station

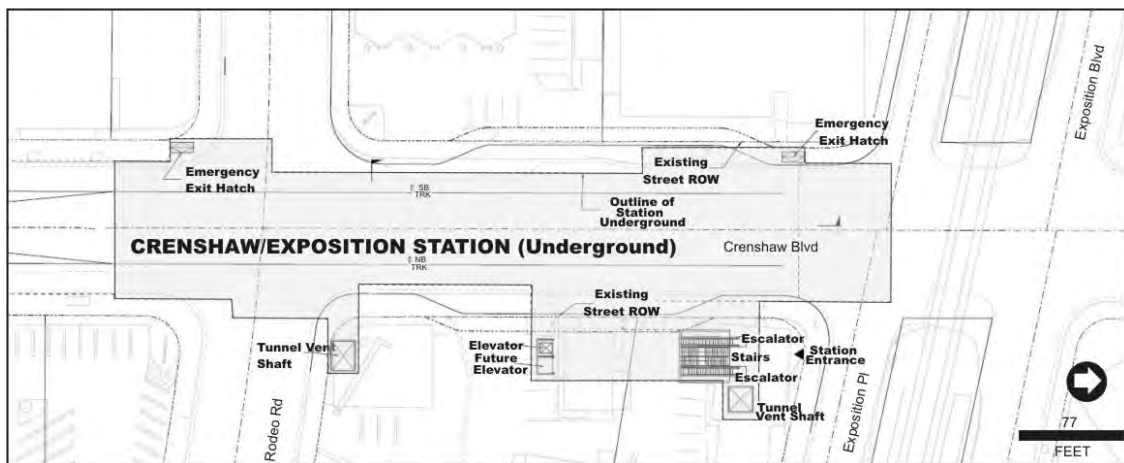


Existing Crenshaw Boulevard and Metro Exposition Line (Under Construction)



Rendering of Crenshaw/Exposition Station Portal (Southeast Corner)

Figure 2-25. Crenshaw/Exposition Station Site Layout



Source: Hatch Mott MacDonald and TAHA, 2011.

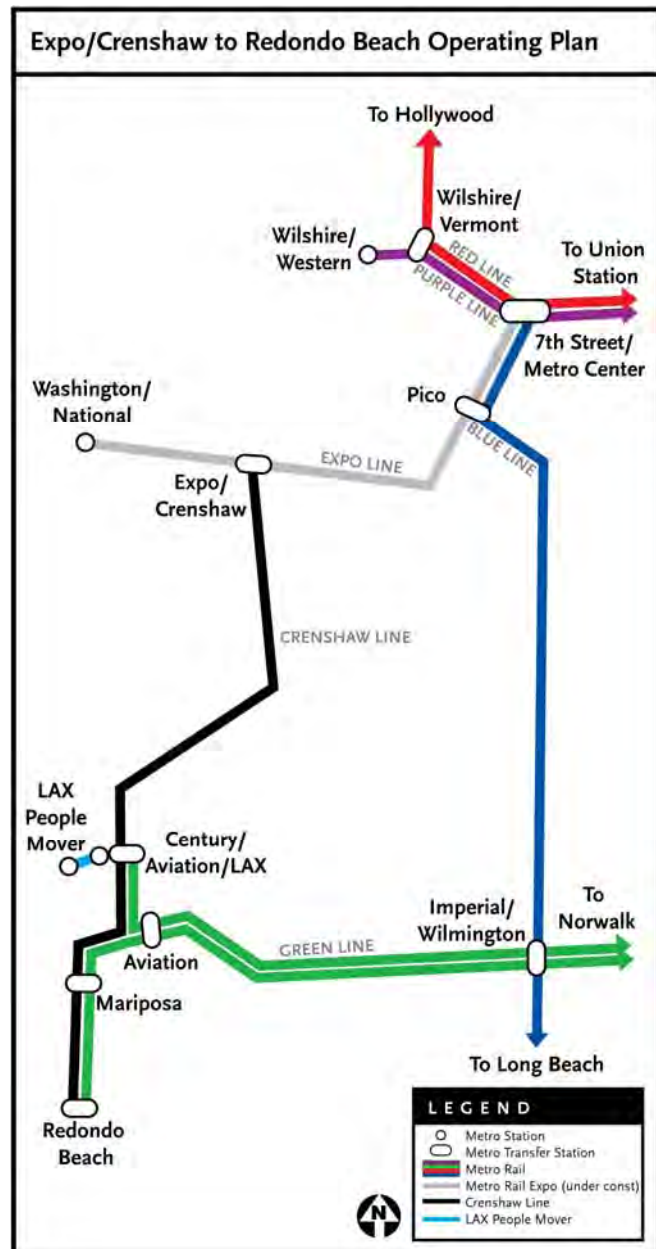
### 2.7.1.3 Operating Plan

A conceptual LRT Alternative operating plan was developed for ridership forecasting and capital and operating cost estimating. The proposed LRT line would operate seven days per week, including holidays. Service hours would be similar to the existing Metro Orange, Purple, Red, Blue, Green, and Gold Lines. Service would be provided from approximately 4:00 a.m. to 1:00 a.m.

Weekday LRT service in 2030 would operate approximately every 5 minutes during peak periods (i.e., 6:00 to 9:00 a.m. and 3:00 to 7:00 p.m.) and every 10 minutes during the off-peak midday period (i.e., 9:00 a.m. to 3:00 p.m.). Service headways would be longer during the early morning and late night periods (i.e., 4:00 to 6:00 a.m. and 7:00 p.m. to 1:00 a.m.). Weekend and holidays would have reduced service hours. With growth of transit demand, the service span could be expanded at some point to 24-hour operation. Service hours and headways for opening day would be operated according to the same operating plan. After commencement of operation, service hours, headways, and train lengths for opening day would be adjusted according to demand.

As shown in Figure 2-26, the LRT Alternative operating plan would provide for running a single LRT line providing service from end-to-end, in both travel directions, stopping at all stations. The line would operate between Metro Green Line Redondo Beach Station and the Crenshaw/Exposition Station termini.

Figure 2-26. LRT Alternative Operating Plan



Source: Parsons Brinckerhoff 2008



This extended operation of the Crenshaw/LAX Transit Project, which includes some operation along a section of the existing Metro Green Line would be approximately 12 miles long and would have an end-to-end travel time of approximately 30 minutes with an average speed of 23 miles per hour.

With the construction of the new infrastructure as part of the Crenshaw/LAX Transit Corridor Project, service on the Metro Green Line would be split equally, with half of the trains routed between the Metro Green Line Norwalk and Aviation/Century Stations and the other half between the Metro Green Line Norwalk and Redondo Beach Stations (See Table 2-3). The Aviation/Century Station, therefore, serves two light rail lines and provides an opportunity to transfer to a potential automated people mover to the airport terminals, which is described in the LAX Master Plan. The operation of the Metro Green Line between the Norwalk and Aviation/Century Stations represents the first operation of the Metro Green Line to LAX, extending between the Metro Green Line at Imperial Highway to a major intermodal terminal at Aviation/Century. A further extension of the Metro Green Line toward the airport terminals is being explored as part of the Metro Green Line to LAX Project which has its own separate project funding and was initiated in Spring 2011. That study is exploring several modes, including light rail, automated people mover, and bus rapid transit.

Operation of the proposed LRT with 6-minute headways and two car trains would require an increment of 20 rail cars, including spares. While opening day ridership forecasts indicate that single-car trains would provide adequate capacity, two-car operation is planned. This is due to the fact that the Crenshaw/LAX Line will operate in an integrated fashion with the Metro Green Line, which currently operates with two-car consists. Two-car operation is planned on the Crenshaw/LAX line to be consistent with the capacity requirement and operation of the Metro Green Line and to support reliability for service on each line. The revised operation on both the Metro Green Line and the Crenshaw/LAX Line will consequently require an increment of 20 rail cars, (16 in-service and 4 spares). In order to allow for future system expansion which could result in higher demand, provisions are made in the alignment design, station design, and in the land area for the maintenance facility for operation of three-car trains.

#### **2.7.1.4 Ancillary Facilities**

The LRT Alternative construction would include installing trackwork, an overhead contact system (OCS) distributing electricity to LRVs, traction power substations (TPSS) located about one mile apart, signaling and communication systems, and a vehicle maintenance and operations facility which would operate 24 hours a day, seven days a week.

The LRT fixed guideway would consist of continuously welded rails. The rails would be embedded in a concrete slab or installed on cross-ties and ballast. The LRT OCS would consist of steel poles installed along the operating right-of-way to support the electrical power line. The poles would be approximately 25 feet tall and would be installed at 90 to 170 feet intervals. The poles would generally be located in the center of the right-of-way, between the two tracks, wherever possible. In some locations, the poles would be located on both sides of the LRT tracks. The overhead electrical power lines are suspended above the LRT tracks.

Table 2-3. LPA Operating Plan

Station	Station Name	Distance (miles)	Cumulative Distance (miles)	Average Speed (mph)	Travel Time (min.)	Cumulative Travel Time (min.)
1.	Metro Green Line Redondo Beach Station					
2.	Metro Green Line Douglas Station	1.1	1.1	22.2	3.0	3.0
3.	Metro Green Line El Segundo Station	0.8	1.9	24.0	2.0	5.0
4.	Metro Green Line Mariposa Station	0.5	2.4	15.3	2.0	7.0
5.	Aviation/Century Station	2.3	4.7	28.6	4.8	11.8
6.	Optional Aviation/Manchester Station	0.9	5.6	30.1	1.8	13.6
7.	Florence/La Brea Station	1.2	6.8	28.2	2.7	16.3
8.	Florence/West Station	1.2	8.0	29.2	2.4	18.7
9.	Crenshaw/Slauson Station	1.1	9.1	22.2	3.1	21.8
10.	Optional Crenshaw/Vernon Station	1.2	10.3	20.7	3.4	25.2
11.	Crenshaw/King Station	0.5	10.8	19.0	1.7	26.9
12.	Crenshaw/Exposition Station	0.9	11.7	15.6	3.5	30.4
Total		11.7		23.1	30.4	

Source: Parsons Brinckerhoff 2008

- Note:
1. Table includes the optional Crenshaw/Vernon Station, near the Leimert/Crenshaw Boulevards intersection. Without this station, the running time would be reduced by 0.6 minutes.
  2. The Metro Green Line Redondo Beach, Douglas, El Segundo, and Mariposa Stations were included in the operating plan for the LRT Alternative.
  3. Note that the length of the Crenshaw LRT service (11.7 miles) is longer than the proposed project length of 8.5 miles. The proposed service operates both over new infrastructure and existing infrastructure (the existing Metro Green Line).
  4. Travel time represents time to travel from station shown in line immediately above. (e.g., Douglas Station to El Segundo requires 2.0 minutes time.)

### Traction Power Substations

Electricity for LRT operations would be supplied to the OCS from ten traction power substations (TPSS), located along the proposed LRT alignment and shown in Figure 2-8. (A more detailed depiction of the initial TPSS sites is located in the Plan and Profile Drawings included in Volume II of this document.) These electrical substations would be enclosed structures located near the LRT alignment. Development of the substations, in some cases, would require an access roadway for maintenance vehicles. Electrical substations would be required for approximately each mile of single or double track.

**Train Control Systems**

Train control includes signal houses, grade crossing, crossovers, wayside equipment, wiring, and vehicle interfaces. Communications and signaling (C&S) buildings house train control and communications for LRT operations in a central facility at each station. Each facility is an enclosure located within the station site area, typically adjacent to a station platform. The positioning of the C&S buildings must be done to provide clearances for maintenance and servicing, and to maintain sight lines for LRT operations. Crossovers are required to maintain flexibility and ensure the operational efficiency of the line. There are three crossovers included in the project. The southern crossover is located in a grade-separated configuration passing 111th Street. There is also a crossover in the median of Crenshaw Boulevard north of Slauson Avenue where the alignment is at grade. The northern crossover would be located south of the Crenshaw/King Station for the MOS and south of Rodeo Road in a below-grade configuration with the incorporation of Design Option 6.

**Vehicles**

The project transit services would use LRVs equivalent to those Metro operates on the existing Metro Blue, Green, or Gold Lines and the Expo LRT line (under construction) with compatible train subsystems. These vehicles are double-ended, articulated, six-axle LRVs capable of multiple unit operation in trains of up to three vehicles.

Based on the existing LRV vehicles Metro uses, each future vehicle would be approximately 90 feet long and would have 55 miles per hour maximum design speed, although capable of achieving 24 miles per hour average speed including normally-spaced stops and anticipated delays in street-running sections. The project would be designed to accommodate up to three-car trains. Each three-car train set could carry up to 500 passengers. Each vehicle would be equipped for independent two-way operation, with a driver's cab at each end and would have equal performance in either direction.

**2.7.1.5 Maintenance Facility Site**

The Crenshaw/LAX Transit Corridor Project would require a new maintenance and operations facility. The facility would provide LRV service and maintenance and storage for vehicles that are not in service. The facility would operate 24 hours a day, seven days a week. The facility would ultimately be large enough to support approximately 70 light rail vehicles. The ultimate facility size would be determined after the project operating plan is finalized.

Four maintenance facility site alternatives were evaluated in a Supplemental Draft Environmental Impact Statement/Recirculated Draft Environmental Impact Report (SDEIS/RDEIR) for the Crenshaw/LAX Transit Corridor Project. The Site #14 – Arbor Vitae/Bellanca Alternative was selected as the preferred maintenance facility site.

**Site #14 – Arbor Vitae/Bellanca Alternative.** This site is approximately 17.6 acres and is located in the City of Los Angeles. The site contains industrial uses, Dollar Car Rental, Avis Car Rental administrative offices, Barthco International, and Gourmet Trading Company. The site is bounded by Arbor Vitae Street to the north, Neutrogena

Corporation to the west, and Bellanca Avenue to the east. The site would be accessed by rail through an at-grade connection at the southeastern end of the site and by vehicles at three entrances along Arbor Vitae Street. This site would service 45 LRVs, contain 40 parking spaces, and have an additional expansion capability of 25 LRVs. Figure 2-27 shows the detailed site layout for the Site #14 - Arbor Vitae/Bellanca Alternative.

## 2.7.2 Minimum Operable Segment (MOS) Alternatives

Although costs are currently being refined and will be further refined during PE, shorter routes should be considered, i.e., either a northern terminus of the Crenshaw/LAX line at the Crenshaw/King Station (MOS-King) or a southern terminus at the Aviation/Century Station (MOS-Century).

FTA requires that an MOS has logical termini and independent utility so that it does not prejudice the consideration of alternatives in subsequent phases or a decision to forego subsequent phases completely. This definition is derived from Federal regulations at 23 CFR Part 771.111(f) which state that projects are evaluated under the following three requirements: (1) connect logical termini and be of sufficient length to address environmental matters on a broad scope; (2) have independent utility or independent significance, i.e., be usable and be a reasonable expenditure even if no additional transportation improvements in the area are made; and (3) not restrict consideration of alternatives for other reasonably foreseeable transportation improvements.

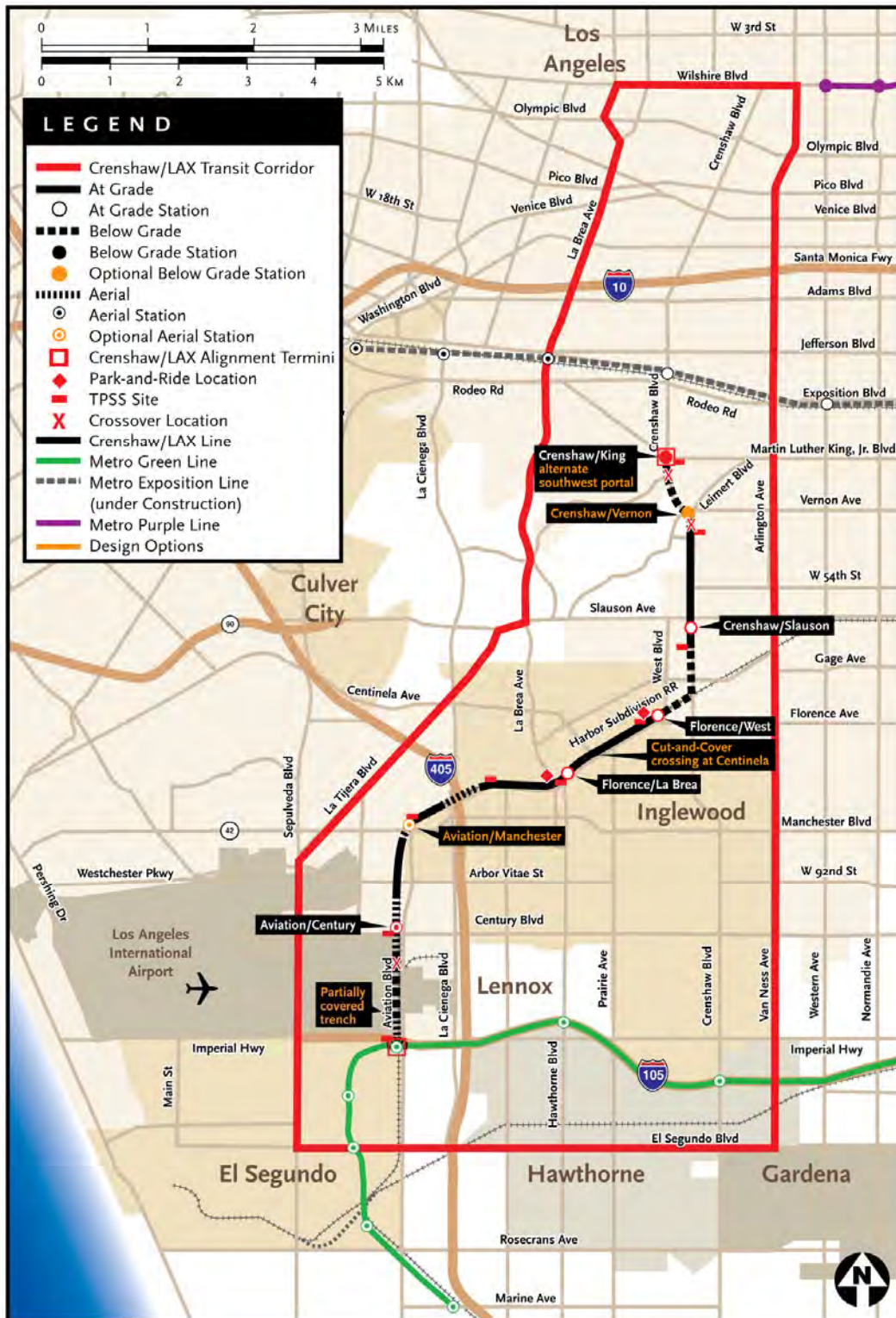
**MOS-King Alternative.** The MOS-King Alternative would extend north from the Metro Green Line to the Crenshaw/King Station at a distance of 8 miles (Figure 2-28). The MOS-King Alternative would omit a below-grade segment of the alignment that would provide enough cost savings to fit within the financial plan for the project. Specifically, the MOS-King Alternative would eliminate the below-grade segment from Exposition Boulevard and Crenshaw Boulevard to 39th Street and Crenshaw Boulevard. MOS-King would connect with the Metro Green Line at the southern end but would require a bus feeder connection to Exposition Line at the northern end between King Boulevard and the Crenshaw/Exposition Station.

**MOS-Century Alternative.** The MOS-Century Alternative would extend south from the Metro Exposition Line to the Aviation/Century Station for a total of 7.4 miles. MOS-Century would include the incorporation of Design Option 6 at a total distance of 7.4 miles (Figure 2-29). The MOS-Century Alternative would omit a below-grade segment of the alignment that would provide enough cost savings to fit within the financial plan for the project. Specifically, the MOS-Century Alternative would eliminate the below-grade segment from Century Boulevard and Aviation Boulevard to Imperial Highway and Aviation Boulevard. MOS-Century would connect with the Metro Exposition Line at the northern end but would but would require a bus feeder connection to the Green Line at the southern end between Century Boulevard and Imperial Highway.

The shorter segments for the MOSs would shift some of the local circulation patterns and parking demand to the new termini at either the Crenshaw/King or Aviation/Century Stations. The implementation of one of the MOSs would result in a



Figure 2-28. MOS-King Alignment

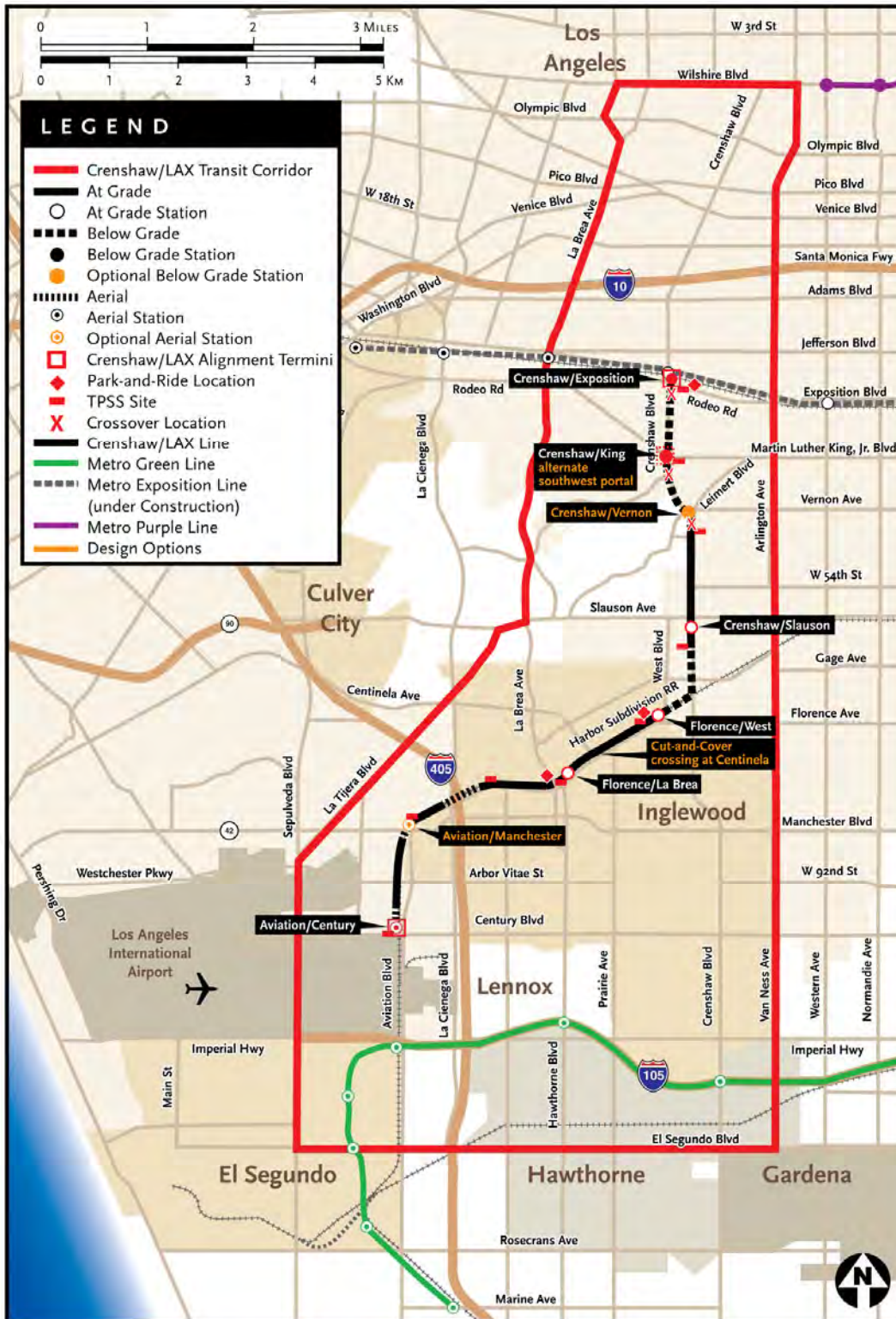


Note: The Fully-Covered Trench adjacent to the LAX South Runways is part of the LPA. The Partially-Covered Trench is a design option.

**CRENSHAW/LAX TRANSIT CORRIDOR PROJECT**



Figure 2-29. MOS-Century Alignment



substantial reduction in regional connectivity compared to the LPA. The bus connection to make the additional connections between the Metro Green and Exposition Lines would substantially increase travel times for both MOSs and ridership projections show a 60 percent decrease in daily boardings. Implementation of either of the MOSs would result in a significant increase in travel times when compared to the LPA. This would result in a significant reduction in the ability to achieve the project goals of regional connectivity and mobility when compared to the LPA.

### 2.7.3 Design Options

The following design options are evaluated in the FEIS/FEIR. Because all of these design options are being evaluated in the FEIS/FEIR, the Metro Board could select any of these options in combination with the LPA when deciding whether to approve the project.

#### Optional Stations

##### *Aviation/Manchester Station*

- The Aviation/Manchester Station could be located either in an aerial configuration over the Manchester aerial crossing or in an at-grade configuration north of Manchester Avenue near the Edison substation. Should this station be implemented, it would provide access to Westchester and serve commercial uses along Manchester Avenue/Boulevard to the east and west. The aerial station option would add more than \$40 million to the base project cost. An at-grade option would be less expensive. A station at this location could be more valuable once the South Bay Metro Green Line Extension, a separate project, is implemented because of higher projected ridership. Later implementation of this station would be more costly.

Figure 2-30. Aviation/Manchester Station Site Layout

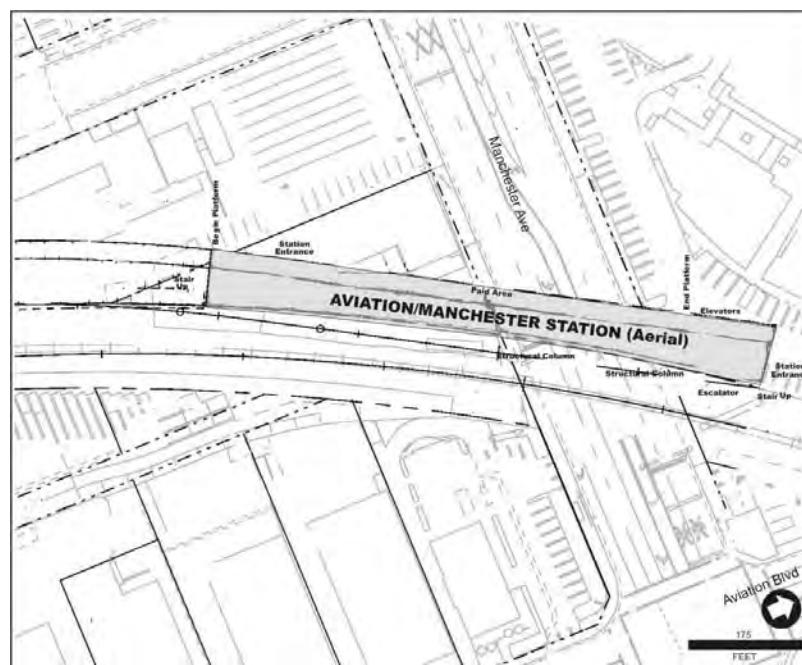




Figure 2-31. Rendering of Optional Aviation/Manchester Station



Existing Aviation/Manchester intersection



Rendering of Optional Aviation/Manchester Station

***Crenshaw/Vernon Station***

The Crenshaw/Vernon Station was designed as a below-grade station, south of Vernon Avenue in the Leimert Triangle. The station will be designed as a center platform station located in a depressed trench on the east side of Crenshaw Boulevard. Should this station be implemented, it would provide access to Leimert Park Village and serve commercial uses along Crenshaw Boulevard and residences to the east and west.

Figure 2-32. Rendering of Optional Crenshaw/Vernon Station



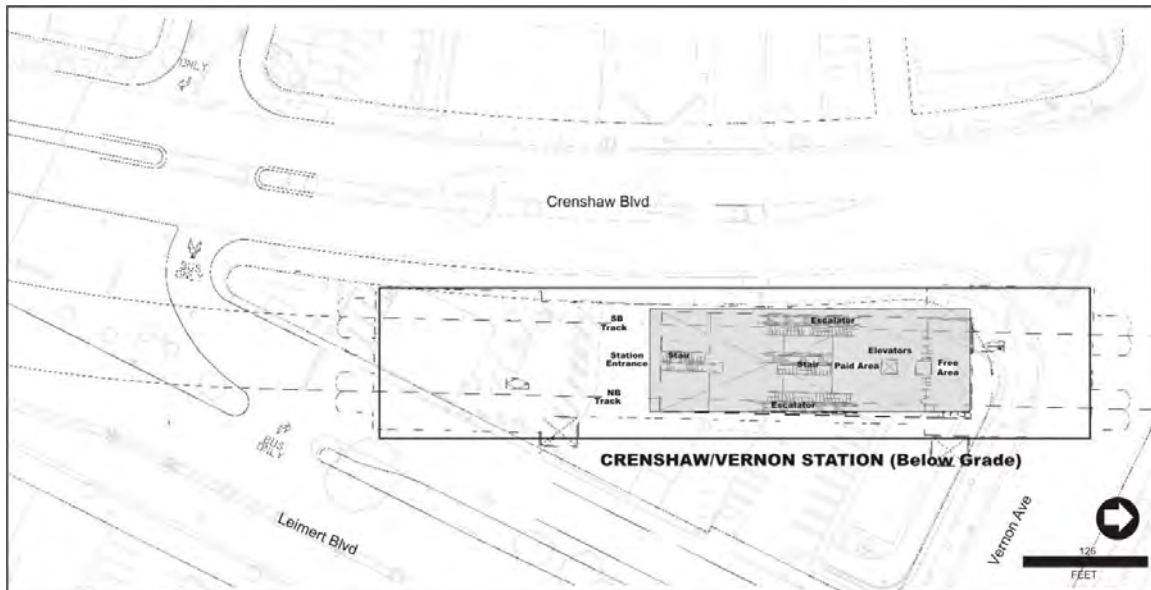
Existing Crenshaw Boulevard at Vernon Avenue (Leimert Park Triangle)



Rendering of Crenshaw/Vernon Station



Figure 2-33. Crenshaw/Vernon Station Site Layout



**Partially-Covered LAX Trench Option.** The LPA is located near the eastern limit of LAX Runways 7L/25R and 7R/25L. The LPA alignment is not located on airport-owned property. The alignment is located in an area currently used as a freight transportation corridor by the Burlington Northern Santa Fe (BNSF) railroad, as well as general traffic of all vehicle types, buses, rental car shuttles, and freight-forwarding trucks and trailers using Aviation Boulevard. These current operations are at-grade adjacent to the airport runways. While the LPA alignment is within Metro-owned right-of-way located to the west of Aviation Boulevard, it is within the designated RPZ zone of LAX. Location within this zone requires coordination between Metro, LAWA and the Federal Aviation Administration (FAA). Based on this coordination, the Advanced Conceptual Engineering design that requires maximum investment for the LPA in this area entails that the light rail alignment is depressed in a fully covered trench. This configuration is designed to address FAA and LAWA concerns regarding both the potential for interference with airport navigational equipment, as well as the for those conditions when planes using these runways would take off or land in an west to east direction (which typically occurs during the late night time hours or during adverse weather conditions) and could potentially overshoot the runway.

Consistent with previous FAA approvals, the FAA requires the Crenshaw/LAX light rail transit line be below grade and covered with a concrete cap through the Runway 25L and Runway 25R RPZs. However, to meet near-term budgetary constraints of Metro, the FAA has agreed to a permanent reduction in the length of the concrete cover over the below grade track from 2,200 feet to 1,600 feet. To achieve this reduced length, the FAA has agreed to allow a 300-foot reduction in the cover on both the north and south ends of the below grade track as it extends through the RPZs. The FAA now requires that Metro coordinate with LAWA to eventually cover a contiguous 1,600-foot portion of the rail line that extends through the central portion of the Runway 25L and Runway 25R RPZs.

Figure 2-34. Rendering of Partially-Covered LAX Trench Option



Existing view of Aviation Boulevard in front of the LAX south runways.



The Partially-Covered LAX Trench Option (interim solution) would be covered directly in front of the runways and have open sections in the middle and on the ends.



To further meet initial budget constraints of Metro, the FAA concurs with the Metro plan to temporarily cover with a concrete cap only 1,000 feet of the below grade track via a design concept called the “Hybrid Option” and discussed under the heading Partially-Covered LAX Trench Option in this environmental document. This option includes two 500-foot long covers over the below grade track centered on the extended centerline of Runway 25L and Runway 25R. The initial construction will include a stressed cable grid over an uncovered 305-foot portion of the below grade track located between the 500-foot covered sections.

The following conditions preserve FAA approval of the design changes mentioned above:

- Approval of the Hybrid Option as presented to the FAA on June 16, 2011 through the local Fire/Life Safety Committee (FLSC). Any significant deviations from this plan (e.g., shortening of the covered trench) will require coordination with the FAA before construction.
- Metro will include in the initial construction any and all provisions necessary to allow for the permanent covering of the 1,600 feet of the track with a concrete lid that extends through the central portion of the Runway 25L and Runway 25R RPZ. This mostly focuses on allowing for the addition of mechanical ventilation in the future when the full 1,600 feet of track is covered with a concrete cap. Metro will provide to the FAA the results of a Computational Fluid Dynamic Simulation (CFD) analysis that demonstrates the design provisions for future mechanical ventilation included in the initial construction will meet local FLSC requirements when constructed.
- Metro will continue to plan and budget through its local capital improvement plan to permanently cover with a concrete cap the 1,600 feet of the track that extends through the central portion of the Runway 25L and Runway 25R approach RPZs. As stated previously, design of the trench with the interim partial-cover condition will allow for the construction of the ultimate build-out condition with minimal impacts to railroad operations.

**Cut-and-Cover Crossing at Centinela.** The LPA has an at-grade configuration across Centinela Avenue. In order to address potential impacts at this intersection, a below-grade trench was analyzed as a design option. During the Advanced Conceptual Engineering Phase, consultation with relevant regulatory agencies suggested that there would be no unmitigable adverse impacts that would require this design option. It is, therefore, not included in the Project Definition. The under-crossing would consist of a 200-foot long bridge with a 700-foot depressed LRT alignment section on the west and a 1,100-foot depressed section on the east side of Centinela Avenue.

Figure 2-35. Rendering of Cut-and-Cover Crossing at Centinela



Existing Centinela Avenue/Florence Avenue intersection

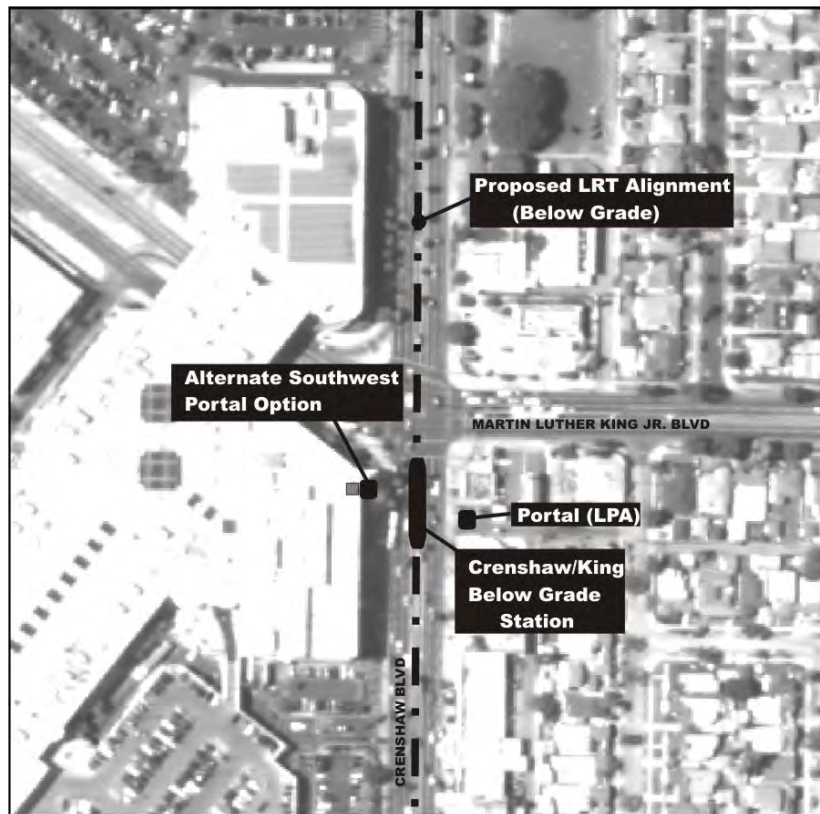


Rendering of Cut-and-Cover Crossing at Centinela Avenue



**Southwest Portal at Crenshaw/King Station Option.** This option involves an alternate portal at the southwest corner of the Crenshaw Boulevard/Martin Luther King Jr. Boulevard intersection (Figure 2-36). The portal would be located within the existing landscaped sidewalk adjacent to the Broadway building and would provide vertical circulation to the underground Crenshaw/King Station. The portal could also be located in the basement of the Broadway building to provide a direct connection to the Baldwin Hills Crenshaw Plaza. This alternate portal is not included within the current project financial plan and would only be implemented if the land were privately funded or if easements to privately-owned land are granted. This station is located at the most heavily developed area of the entire line with a major shopping center near the site.

**Figure 2-36. Alternate Southwest Portal Option at Crenshaw/King Station**



Source: TAHA, 2011

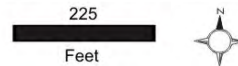


Figure 2-37. Rendering of Alternate Southwest Portal at Crenshaw/King Station



Existing Crenshaw Boulevard/King Boulevard intersection



Rendering of Crenshaw/King Station Portal (Southwest Corner)