Final Report

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Background

The Crenshaw Northern Extension is a Measure M project that would extend the under-construction Metro Crenshaw Line from its current terminus at the Metro Expo Line north to the Metro Purple and Red Lines. The purpose of this study is to define and evaluate project alignments and alternatives in support of future screening and public outreach efforts that will inform the recommendation of alternative(s) to be carried forward for environmental review.

The study evaluates several alignment corridors that would provide a critical north-south regional transit link through Central Los Angeles, connecting the South Bay, South LA, and Metro Green and Expo Lines, with Mid-City, West Hollywood, Hollywood, and the Metro Red and Purple Lines, while serving major activity centers and areas of high population and employment density. In order to maximize cost-effectiveness, the study identifies and evaluates opportunities for above-grade and at-grade profiles wherever feasible, based on existing and planned physical conditions, including roadway width, traffic volumes, land use, and engineering feasibility. All five study corridors demonstrate high ridership potential, particularly at major connection points with the Metro rail system, underscoring the regional benefits of the project. The capital cost of each alternative is largely a function of vertical profile, length, and number of stations. Future studies will be needed to screen the five alternatives down to a Locally Preferred Alternative that can be environmentally cleared for construction.

Study Area

The Crenshaw Northern Extension Feasibility/Alternatives Analysis Study Area (Study Area) (Figure ES - 1) is 17 square miles and includes portions of the City of Los Angeles, the City of West Hollywood, and the City of Beverly Hills.
The Study Area is characterized by neighborhoods originally built-out in the first half of the 20th century, containing a mix of high-density residential communities and employment clusters shaped largely by the extensive streetcar and interurban rail network that existed at the time. The extensive arterial street network and proximity to major regional centers such as Hollywood, Downtown LA and the Wilshire corridor supported the continued densification of the Study Area following the streetcar era. The dense, mixed-use character of the Study Area (Figure ES - 2) would benefit from enhancements to the transit network to support existing densities and future population and employment growth.

The Study Area itself is similar in size, in terms of population and jobs, to many major U.S. cities (Figure ES - 3), and its influence on regional travel demand is comparable to downtown Los Angeles, with significant regional activity centers including major retail and commercial centers, employment centers, medical facilities, and cultural sites (Figure ES-5).

Today, with approximately 19,800 residents and 10,900 jobs per square mile, the Study Area population and employment densities are more than twice the City of LA average, and almost ten times the LA County average. In 2040, the Study Area is projected to have a total population of about 397,000, or 27,629 people per square mile, which is similar to the population density of New York City1.

![Population per Square Mile](Figure ES - 2 Urban Character of the Study Area)

![Comparison of Population Density of the Study Area and Major Cities](Figure ES - 3 Comparison of Population Density of the Study Area and Major Cities)

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1 http://www1.nyc.gov/site/planning/data-maps/nyc-population/population-facts.page
The number of jobs within the Study Area is a major driver of regional travel demand, acting as a Central Business District (CBD). In fact, the employment contained within the Study Area is comparable to the combined employment of the CBDs of San Jose, San Diego, and Sacramento, as well as the other major cities shown in Figure ES-4.

Figure ES - 4 Comparison of Employment in the Study Area and Major Cities' Central Business Districts

Figure ES - 5 Regional Activity Centers in the Study Area

1. West Adams Retail Corridor
2. Midtown Crossing Shopping Center
3. Midtown Shopping Center
4. Olympia Medical Center
5. Beverly Connection
6. West Hollywood Library
7. West Hollywood Park
8. Santa Monica Blvd Shops & Restaurants
9. Fairfax Ave Shops & Restaurants
10. Pan Pacific Park
11. Los Angeles Holocaust Museum
12. Peterson Automotive Museum
13. Melrose Ave Retail Corridor
14. WeHo Gateway Center
15. Sunset Blvd Commercial Corridor
16. Hollywood/Highland Station
17. Pico Blvd Retail Corridor
18. Wilshire Theater
19. Olympic Blvd Retail Corridor
Existing and Planned Metro Network

Metro’s extensive bus and rail network provides interurban high-capacity transit across the region. The Study Area is served from east to west by the Expo light rail line, and Purple Line subway, and Metro Local and Rapid bus routes provide service on most arterial roadways. The Study Area lacks a reliable, high-capacity transit service for trips moving north and south through the Study Area and connecting to Metro’s regional rail lines. The existing Metro rail and bus rapid transit (BRT) network began with the opening of the Blue Line in 1990 and currently supports 384,604 daily boardings at 110 stations along 123 route-miles (Figure ES - 6). In addition, there are two rail lines under construction in or adjacent to the Study Area: the Purple Line subway extension to Westwood is scheduled for completion by 2026; and the Crenshaw Line, from the Expo Line south to the Los Angeles International Airport (LAX) and the South Bay, will open in 2019.

Therefore, by 2026, the Metro system will include five primarily east-west fixed-guideway transit lines west of Downtown Los Angeles (the Green, Expo, Purple, Red, and Orange Lines), with only a single north-south link providing service between the Expo Line and points south. Due to the lack of a high-capacity north-south transit line, trips between the San Fernando Valley, Central LA, Mid-City, South LA, the Westside, LAX, and the South Bay experience significant travel time delays due to slow and unreliable bus service or the need for significant out-of-the-way travel via Downtown LA.

Over the coming decades, Metro will greatly expand the fixed-guideway rail and bus network throughout Los Angeles County due to the passage of the Measure M ballot initiative in November, 2016. The ½-cent sales tax increase is expected to provide upwards of $130 billion for the development of new transit lines and other transportation capital investments throughout Los Angeles County (Figure ES - 7). The Measure M expenditure plan identifies $2.24 billion (2015 $) for the Crenshaw Northern Extension project beginning in 2040.
Previous Studies
The Crenshaw Northern Extension Feasibility/Alternatives Analysis Study (Study) builds mainly upon portions of alignments previously identified in the Wilshire/La Brea LRT Extension Feasibility (Figure ES-8) and Westside Subway Extension studies.

Figure ES - 8 Potential Crenshaw North Extension Alignments Studied in Wilshire/La Brea LRT Extension Feasibility Study (2009)
Purpose and Need

Existing travel conditions, transportation infrastructure performance, and demand demonstrate the challenges associated with the lack of high-capacity north-south transportation infrastructure in the Study Area.

The Study Area is characterized by high-density residential and commercial uses that draw tourism, shopping and employment. The roadway network is made of a grid of narrow arterials that date to the early twentieth century. The resulting demand on the existing transportation network results in some of the region’s highest local surface street congestion. These conditions will intensify as population and employment within the Study Area continue to grow, posing risks to economic development, quality of life, and the environment.

Five mobility problems identified in this Study demonstrate the overall need for the project:

- **Transit Network:** Transit options within the Study Area are limited to east-west rail services and buses that operate on congested roadways. North-south travel on the rail network requires transferring through downtown Los Angeles, thus decreasing network efficiency.
- **Congestion & Transit Reliability:** Commuters’ willingness to use transit is negatively impacted by long and unpredictable travel times due to traffic congestion.
- **Travel Demand:** High demand exists for trips within the Study Area as well as trips between the Study Area and surrounding region. Projected increased travel demand will place additional strain on an already overburdened system and further increase travel times.
- **Demand for High-Quality (Fast and Reliable) Transit Service:** The Study Area consists largely of transit supportive land uses that attract a high volume of transit trips from both within the Study Area and the entire region. Despite existing high levels of transit use, transit ridership is constrained by slow speeds, circuitous travel routes, high travel times, and unreliability due to congestion.
- **Transit Dependency:** The Study Area has a significant proportion of transit-dependent residents. Transit-dependent residents are disproportionately impacted by long travel times and crowding on the existing transit system. The Crenshaw Northern Extension Project has the potential to address these mobility challenges by providing reliable, high-speed and high-capacity transit service that serves as a critical link in the regional transit network, enhancing mobility both within the Study Area and the broader region, particularly to the north (San Fernando Valley/North County) and south (South LA, LAX, and South Bay).
Transit options within the Study Area are limited to east-west rail service and buses that operate on congested roadways. This leaves the Study Area with a network deficiency that impacts regional mobility and local access by creating unnecessarily long and circuitous trips caused by the need to transfer in Downtown Los Angeles to travel to, through, and within the Study Area. The addition of a north-south transit line in the Study Area has the potential to (1) effectively serve local population, employment, and activity centers within the Study Area, and (2) form part of a well-connected transit system for regional transit users travelling to or through the Study Area.

The Study Area is located on a major east-west, employment-rich axis (the Wilshire Corridor), which connects Downtown LA and the Westside. This jobs-rich corridor attracts hundreds of thousands of daily trips from the Study Area and the entire region. A connection is needed through the Study Area to link transit trips from the north and south conveniently to the Wilshire corridor without detouring through Downtown LA.

The project would close a gap in the regional network by linking the Metro Red, Purple and Expo Lines, and leveraging the high-volume east-west network to facilitate new north-south connections, including higher demand for the under construction Crenshaw line (Figure ES - 9).
Mobility Problem: Travel Demand

Travel demand is projected to increase for trips within, to and from the Study Area, which will be inhibited by continually increasing congestion.

The high population and employment densities result in high demand for travel within, to, and from the Study Area. On an average weekday, roughly 64,000 round-trips occur within the Study Area, but the 209,000 round-trips that leave and nearly 261,000 round-trips that enter the Study Area show the significantly greater regional demand (Figure ES - 10). Heavy north-south travel demand to the Study Area is indicated by the more than 80,000 weekday round-trips that are made from the South Bay and over 110,000 weekday round-trips from the San Fernando Valley to the Study Area.

Seven out of the ten highest-ridership Metro bus routes travel through the Study Area (Figure ES - 11), indicating high existing transit demand. The highest bus-stop activity occurs at major transfer points between east-west and north-south services. Significant transit capacity for east-west routes will be added with the Purple Line extension which is expected to increase transit ridership in the Study Area and facilitate east-west travel along the Wilshire Boulevard corridor, resulting in an even greater need for north-south connections.

The Crenshaw Northern Extension project would provide a high-capacity, grade-separated transit service to meet growing travel demand.
Mobility Problem: Congestion & Transit Reliability

Travel times within the Study Area are high, negatively influencing commuters’ willingness to use transit and disproportionately impacting those dependent on transit service.

Arterial bus service throughout the Study Area is generally frequent, with good geographic coverage. However, this service is increasingly slow and unpredictable: bus travel speeds average below 10 miles per hour throughout the day on major arterials within the Study Area, with the lowest average speed at around 7 miles per hour during PM peak hours. The resulting decreased transit level of service is primarily due to the high roadway congestion in the Study Area.

According to the Westside Cities and Central Los Angeles Arterial Performance Baseline Conditions Analysis (2017) conducted by Metro, many of the above mentioned key arterials in the Study Area are on the list of the 10 worst-performing corridors in jurisdictions within Central L.A. and Westside Cities Sub-regions(Figure ES - 12). For example, the average travel speeds on Santa Monica Boulevard, La Brea Avenue and Melrose Avenue are all less than 15 miles per hour during PM peak hour, the result of intense delays. Sunset Boulevard within the City of West Hollywood, as well as Santa Monica Boulevard and La Cienega Boulevard within the City of Los Angeles are among the 10 least reliable segments due to their severe congestion during the PM peak hour. This is another indicator that surface streets in the Study Area experience poor travel time reliability, suggesting a need for transportation improvements that offer an alternative to congestion.

The project must increase the efficiency and convenience of transit trips by providing faster, more reliable service in an exclusive guideway that is not affected by local roadway congestion.

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2 Westside Cities and Central LA Arterial Performance Baseline Conditions Analysis Reports, Exhibit 3.8
3 Westside Cities and Central LA Arterial Performance Baseline Conditions Analysis Reports, Exhibit 3.17
Mobility Problem: Demand for High-Quality Transit and Transit Dependency

The Study Area’s urban character and land use densities lead to both high transit ridership and a much higher percentage of people riding transit as compared to the rest of the region. This creates two conditions:

- **Demand for High-Quality (Fast and Reliable) Service**: The Study Area consists largely of transit-supportive land uses that are conducive to both local trip generation and regional attraction, yielding high transit use relative to the region.
- **Transit Dependency**: The Study Area has a significant level of transit-dependent residents, who are the most impacted by decreasing transit levels of service.

In 2012, about 16% of the commuting trips to/from the Study Area were transit trips, more than twice the L.A. County average. This trend is projected to continue in the future, with over 21% of Study Area commute trips using transit (Figure ES - 13). Also, the Study Area consists largely of dense, transit-supportive land uses (approximately 80% of the Study Area based on the exclusion of single-family residential, industrial, and other low-density land uses, Figure ES - 14) that generate and attract a high number of both local and regional trips. Transit supportive land uses are associated with a mix of land uses, including high residential, retail and commercial/office uses.

Previously stated deficiencies in the transportation network result in decreased transit reliability and efficiency that disproportionately impact transit dependent populations. Metro defines transit-dependent areas with high percentages of zero-car, low-income, and/or low-income senior citizen households. Transit dependent census tracts within the Study Area are illustrated below (Figure ES - 15). It is worth noting that the Study Area has high zero-car ownership household rates (Figure ES - 16), which presents extensive opportunities and needs for robust transit options.

The factors above indicate ideal conditions for the continued development and strengthening of transit-oriented communities in the project area. The project will cultivate the transit-friendly environment by encouraging denser, walkable land use patterns near proposed and existing transit stations. This enables users of the transit system to take advantage of the housing and employment opportunities in the Study Area while reducing regional auto dependency, urban sprawl, and other environmental impacts.
**Figure ES - 15 Crenshaw Northern Extension Study Area Transit Dependency by Census Tract**

**Transit Dependent Census Tract Definition:**
1. Zero-car ownership - 10 percent or more of the households do not own a car;
2. Low-income - 26.7 percent or more of the households have income of $25,000 or less (in 2010 dollars); or
3. Senior citizens with medium-low-income - 11 percent or more of the households include individuals aged 65 or older and median household income for those ages 65 or older is less than $33,762.

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**Figure ES - 16 Crenshaw Northern Extension Study Area Percentage of Zero-Car Ownership Households by Census Tract**

**% of Zero-car Ownership Households in the Study Area by Census Tract**
- <10%
- 10% - 25%
- 25% - 50%
- 50% - 75%
As previously mentioned, this Study builds upon alignments studied in the Wilshire/La Brea LRT Extension Feasibility Study (2009) with the following four route alternatives that extend from Expo/Crenshaw to Hollywood/Highland (Figure ES-17):

**San Vicente Boulevard:** Mid-City to Hollywood/Highland via San Vicente Blvd. and Santa Monica Blvd.

**La Cienega Boulevard:** Mid-City to Hollywood/Highland via San Vicente Blvd., La Cienega Blvd., and Santa Monica Blvd.

**Fairfax Avenue:** Mid-City to Hollywood/Highland via San Vicente Blvd., Fairfax Ave., and Santa Monica Blvd.

**La Brea Avenue:** Mid-City to Hollywood/Highland via La Brea Avenue.

A fifth route, the **Vermont Avenue** alternative, from Crenshaw Boulevard to Wilshire/Vermont via Olympic Boulevard and Vermont Avenue, was added to the study because it offers the shortest connection to both the Red and Purple Lines at the Wilshire/Vermont station. All other alternatives connect to the Metro Purple Line along Wilshire Boulevard and the Metro Red Line at the Hollywood/Highland Station.

With the alternative routes established, cost-effective alignment configurations were developed that would accommodate reliable transit service while maximizing use of at- or above-ground guideway. This was accomplished by exploring opportunities where, based on existing physical conditions, the guideway could fit within existing roadways without major impacts. Guideway alignment options were created based on existing street right-of-way, traffic conditions, track geometry, and other engineering criteria (Figure ES-17), then further refined considering operations, environmental impacts, urban design issues, and stakeholder feedback.

The first step was to determine whether an existing corridor could physically support an aerial or at-grade guideway (Figure ES-18, ES-19). At-grade or aerial guideway is preferable where possible because the capital cost for constructing an underground alignment can be 2.5 to over 3 times greater. Then, track geometry concepts were developed for transitions between vertical profiles to create complete alignment alternatives (Figure ES-20). While the alternatives defined reflect the guideway configurations that the project team determined to be the most feasible options, additional study is still required to further define the feasibility of at-grade operation based on Metro’s Grade Crossing and Safety Policy.
80+ ft. curb-curb: At-grade and aerial profiles may be feasible within right-of-way and/or street section

60 - 75 ft. curb-curb: Aerial profile may be feasible with minor impacts to existing right-of-way, street section, and/or adjacent properties

< 60 ft. curb-curb: Tunnel alignment: at-grade or aerial infeasible without major impacts to existing right-of-way, street section, and/or adjacent properties

Figure ES - 19 Right-of-Way and Vertical Profile Configurations
Alternatives Analyzed in this Study

The five alternatives with stations and guideway profile configurations are summarized on the following pages:

- **San Vicente Alternative**: Crenshaw Blvd-Venice Blvd.-San Vicente Blvd.-Santa Monica Blvd.-Highland Ave. (*Figure ES - 21*).
- **La Cienega Alternative**: Crenshaw Blvd.-Venice Blvd.-San Vicente Blvd.-La Cienega Blvd.-Santa Monica Blvd.-Highland Ave. (*Figure ES - 22*).
- **Fairfax Alternative**: Crenshaw Blvd.-Venice Blvd.-San Vicente Blvd.-Fairfax Ave.-Santa Monica Blvd.-Highland Ave. (*Figure ES - 23*).
- **La Brea Alternative**: Crenshaw Blvd.-Venice Blvd.-San Vicente Blvd.-La Brea Ave.-Highland Ave. (*Figure ES - 24*).
- **Vermont Alternative**: Crenshaw Blvd.-Olympic Blvd.-Vermont Ave. (*Figure ES - 25*).
Station Locations & Adjacent Land Uses/Destinations

- **Crenshaw/Adams** – Neighborhood retail, commercial, and residential
- **San Vicente/Venice/Pico** - Midtown Crossing retail/commercial and Pico-Rimpau Transit Center
- **San Vicente/Fairfax** - Neighborhood retail, commercial and residential; Little Ethiopia
- **San Vicente/Wilshire** - High-rise office and medical commercial and strip retail and connection to Metro Purple Line La Cienega station
- **San Vicente/3rd Street** - Beverly Center, Cedars Sinai Medical Center, office and commercial
- **San Vicente/Santa Monica** - West Hollywood Park and Library, Pacific Design Center, Santa Monica Boulevard retail and entertainment district, Melrose Avenue retail district
- **Santa Monica/Fairfax** - Neighborhood commercial/retail
- **Santa Monica/La Brea** - West Hollywood Gateway retail/commercial, large multifamily residential complexes, The Lot Studios
- **Hollywood/Highland** - Regional retail and entertainment district and connection to Metro Red Line

**Key Alignment Features**

- From existing Crenshaw/Expo station in subway under Crenshaw Blvd., transitioning to aerial guideway in Venice Blvd.
- Opportunity for mixed-use redevelopment of strip retail center(s) with aerial station at Midtown Crossing
- Potential “complete street” reconfiguration of San Vicente Boulevard along median-running alignment through residential neighborhoods to Wilshire Boulevard
- Aerial guideway over Wilshire Boulevard along San Vicente Boulevard through Cedars Sinai and Beverly Center regional medical, office, professional, and retail center into West Hollywood Design District
- Opportunity for redevelopment of Metro Division 7 yard where alignment transitions from aerial guideway to subway adjacent to West Hollywood “Westside” entertainment and retail district
- Subway under Santa Monica Boulevard and Highland Avenue through neighborhood retail, entertainment, and commercial areas in West Hollywood and Hollywood
- Underground terminus at Metro Red Line Hollywood/Highland Station
Station Locations & Adjacent Land Uses/Destinations

- **Crenshaw/Adams** – Neighborhood retail, commercial, and residential
- **San Vicente/Venice/Pico** - Midtown Crossing retail/commercial and Pico-Rimpau bus transfer center
- **San Vicente/Fairfax** - Neighborhood retail, commercial and residential; Little Ethiopia
- **San Vicente/Wilshire** - High-rise office and medical commercial and strip retail and connection to Metro Purple Line La Cienega station
- **La Cienega/3rd Street** - Beverly Center, Cedars Sinai Medical Center, office and commercial
- **La Cienega/Santa Monica** - Santa Monica Boulevard neighborhood retail and entertainment district, Sunset Strip
- **Santa Monica/Fairfax** - neighborhood commercial/retail
- **Santa Monica/La Brea** - West Hollywood Gateway retail/commercial, large multifamily residential complexes, The Lot Studios
- **Hollywood/Highland** - Regional retail and entertainment district and connection to Metro Red Line

**Key Alignment Features**

- From existing Crenshaw/Expo station in subway under Crenshaw Blvd., transitioning to aerial guideway in Venice Blvd.
- Opportunity for mixed-use redevelopment of strip retail center(s) with aerial station at Midtown Crossing
- Potential “complete street” reconfiguration of San Vicente Boulevard along median-running alignment through residential neighborhoods to Wilshire Boulevard
- Aerial guideway from Wilshire Boulevard along San Vicente and La Cienega Boulevards through Cedars Sinai and Beverly Center regional medical, office, professional, and retail center
- Transition from aerial to subway on La Cienega Boulevard just south of Santa Monica Boulevard
- Subway under Santa Monica Boulevard and Highland Avenue through neighborhood retail and commercial areas in West Hollywood and Hollywood
- Underground terminus at Metro Red Line Hollywood/Highland Station
Station Locations & Adjacent Land Uses/Destinations

- **Crenshaw/Adams** – Neighborhood retail, commercial, and residential
- **San Vicente/Venice/Pico** - Midtown Crossing retail/commercial and Pico-Rimpau bus transfer center
- **Fairfax/Wilshire** - Miracle Mile high-rise office commercial, strip retail, LACMA and Petersen Automotive Museum, Park La Brea multifamily complex, and connection to Metro Purple Line
- **Fairfax/Beverly** - The Grove, Original Farmers Market, and neighborhood retail, CBS Television City
- **Santa Monica/Fairfax** - Neighborhood commercial/retail
- **Santa Monica/La Brea** - West Hollywood Gateway retail/commercial, large multifamily residential complexes, The Lot Studios
- **Hollywood/Highland** - Regional retail and entertainment district and connection to Metro Red Line

**Key Alignment Features**
- From existing Crenshaw/Expo station in subway under Crenshaw Blvd., transitioning to aerial guideway in Venice Blvd.
- Opportunity for mixed-use redevelopment of strip retail center(s) with aerial station at Midtown Crossing
- Potential “complete street” reconfiguration of San Vicente Boulevard along median-running alignment through residential neighborhoods to underground transition just east of Fairfax Avenue
- Subway under Fairfax Avenue through major regional cultural and retail districts and Park La Brea multifamily residential complex
- Subway under Santa Monica Boulevard and Highland Avenue through neighborhood retail and commercial areas in West Hollywood and Hollywood
- Underground terminus at Metro Red Line Hollywood/Highland Station
Station Locations & Adjacent Land Uses/Destinations

- **Crenshaw/Adams** – Neighborhood retail, commercial, and residential
- **San Vicente/Venice/Pico** - Midtown Crossing retail/commercial and Pico-Rimpau bus transfer center
- **La Brea/Wilshire** - Miracle Mile mixed office, multifamily residential, commercial, strip retail, and connection to Metro Purple Line
- **La Brea/Beverly** - Low-rise neighborhood retail, multifamily residential, commercial, strip retail
- **Santa Monica/La Brea** - West Hollywood Gateway retail/commercial, large multifamily residential complexes, The Lot Studios
- **Hollywood/Highland** - Regional retail and entertainment district and connection to Metro Red Line

Key Alignment Features

- From existing Crenshaw/Expo station in subway under Crenshaw Blvd., transitioning to aerial guideway in Venice Blvd.
- Opportunity for mixed-use redevelopment of strip retail center(s) with aerial station at Midtown Crossing
- Continue aerial guideway from San Vicente Boulevard over La Brea Avenue
- Aerial guideway along La Brea through neighborhood commercial/residential area adjacent to Miracle Mile, Park La Brea, and Hancock Park
- Opportunity for mixed-use redevelopment of strip retail or light industrial properties to accommodate a station at Santa Monica Boulevard and potential transition from aerial to subway
- Options for underground, aerial, or at-grade terminus at Metro Red Line Hollywood/Highland Station approached from Highland Avenue or Hollywood Boulevard
Station Locations & Adjacent Land Uses/Destinations

- **Crenshaw/Adams** – Neighborhood retail, commercial, and residential
- **Crenshaw/Venice** – Mid-City neighborhood retail, commercial, and residential
- **Olympic/Western** – Galleria Market, medium-density residential, commercial, and retail, Koreatown
- **Olympic/Normandie** – Medium-density residential, commercial, and retail, Koreatown
- **Vermont/Wilshire** – Connection to Metro Purple and Red Lines

Key Alignment Features

- From existing Crenshaw/Expo station in subway under Crenshaw Blvd. low/medium-density residential neighborhoods to Olympic Boulevard
- Subway along Olympic Boulevard under increasing commercial and residential density into Koreatown district
- Terminus on Vermont Avenue in the heart of Koreatown with deep station and tail-tracks required under existing Metro Purple/Red Line station box
Performance of Alternatives

The alternatives definition effort results in five representative alignments which were evaluated against the following criteria:

- Ridership
- User Benefit/Travel Time Savings
- Vehicle Miles Traveled (VMT) Reduction
- Cost Effectiveness
- Environmental Impact

The five alternatives as defined are summarized below (Figure ES-26).

![Summary of Alternatives Definition](image)

*To Wilshire/Vermont Station only

**Figure ES - 26 Summary of Alternatives Definition**

Ridership

The Crenshaw Northern Extension Alternatives are projected to have ridership ranging from 77,700 to 90,800 daily project boardings. 16% to 21% of those trips are taken by “new riders”, or trips that would not have used transit without the project (Figure ES - 27).

Alternatives with longer alignments and more stations generate a greater proportion of trips that begin and end within the project (local trips), while shorter alternatives with fewer stations generate a greater proportion of end-to-end “through” trips (Figure ES - 28). The Vermont Alternative produces the least ridership and fewest new riders, in addition to generating notably fewer trips to and from destinations along the route compared to the other alternatives.
The strong transit demand in the Study Area is further demonstrated by the high projected ridership relative to current Metro ridership on a per-mile basis, higher even than Red and Purple Line heavy-rail (Figure ES - 29).
The forecasted ridership decreases among the alternatives from west to east. The longer, western alternatives have more stations and provide access to more activity centers than the eastern alternatives, resulting in higher ridership. This is reinforced by population and employment data collected within a ½-mile radius of proposed stations and compared only for the unique stations along the four western alternatives between San Vicente/Pico and Santa Monica/La Brea (Figure ES-30). Even when compared on a per-mile basis, the longer western alignments provide much greater access to jobs and housing. The San Vicente and La Cienega alignments provide access to nearly 70,000 jobs within ½ mile of the proposed stations, or over 11,000 jobs per mile. These alignments provide access to over four times as many total jobs as the La Brea alignment which provides access to nearly 16,500 jobs, or about 5,100 jobs per mile. The Fairfax alignment provides access to over twice as many jobs as the La Brea alignment, nearly 40,000 jobs or about 8,300 per mile.

Figure ES - 30 Western Alternatives Access to Housing & Jobs
User Benefit (Time Savings)
All Crenshaw Northern Extension Alternatives analyzed in this Study would result in reduced transit travel times and improved transit service compared with existing conditions. Existing transit travel times between the Metro Expo/Crenshaw Station and Hollywood/Highland Station are approximately 45 minutes and include at least one transfer. Estimated end-to-end travel times on the alternatives range from 12 to 27 minutes (Figure ES-26). The average travel time savings experienced for each rider on the project alternatives ranges from 17 minutes to 20 minutes (Figure ES-31). The greater time savings for the western alternatives is a direct function of their higher ridership, and thus higher benefit.

Vehicle-Miles Reduction
All Crenshaw Northern Extension Alternatives analyzed in this Study would contribute to a substantial reduction in regional vehicle-miles travelled (VMT) by encouraging greater transit use. Among the five alternatives, La Brea Alternative will see the largest reduction of 383,930 VMT per year, followed by Fairfax Alternative with 358,888 miles of VMT reduction (Figure ES-32).

The Vermont Alternative is the lowest performing of the project alternatives for several reasons:
- 70% of its ridership consists of through trips, which don’t serve origins and destinations within the Study Area that aren’t already served by the existing Metro Rail network
- The alignment is largely redundant with the existing rail system and all the western alignments, which connect riders to the Purple Line and Wilshire Blvd. corridor faster than via Vermont
- While this alternative shaves 1-2 minutes from existing travel times to points east (including Downtown LA, etc.), it imposes an over 8-minute penalty for trips between the Study Area and the Westside, as well as the San Fernando Valley (versus all other alternatives)
- This alignment does not serve any new neighborhoods or any areas that would not be served with any of the other alternatives and/or are already served by Metro Rail
Capital & Operating Costs & Cost Effectiveness

This study prepared rough-order-of-magnitude (ROM) estimates for capital costs, annual operations and maintenance (O&M) costs, and annualized replacement costs for each alternative. Capital Cost estimates include project components per the FTA Standard Cost Category (SCC) workbook, including construction costs for new rail infrastructure, maintenance facilities, vehicles, ROW acquisition, and professional services. O&M costs include vehicle operations, vehicle maintenance, non-vehicle maintenance, and general administration. Annualized replacement costs represent the average cost over the life of the project for replacing the infrastructure as it wears down. The results include cost effectiveness metrics for comparing the performance of each alternative based on project length, ridership, and travel time savings.

Table ES - 1 shows capital cost metrics for the alternatives. Capital costs range from $3 to $4.7 billion. The La Brea Alternative has the lowest capital cost at $3.0 billion (as low as $2.4 billion with an at-grade option in Hollywood), with a higher cost per mile than the San Vicente and La Cienega Alternatives. The San Vicente/La Cienega Alternatives cost $4.4 billion and have the lowest costs per mile. The Fairfax Alternative has the highest cost at $4.7 billion with the second-highest cost-per-mile. The Vermont Alternative has the highest cost per mile. The La Brea alternative has the lowest capital cost per annual project trip at $34,000/trip. The San Vicente/La Cienega and Vermont Alternatives have similar capital costs per annual trip between $46,000 and $48,000/trip, and the Fairfax Alternative is the most expensive at $52,000 per annual trip.

Table ES - 2 shows annualized costs and cost effective metrics for the alternatives. The annualized O&M and replacement costs range from $260 to $370 million per year. La Brea has the lowest annualized cost at $260 million, with a similar cost per mile as the San Vicente and La Cienega Alternatives. The San Vicente/La Cienega Alternatives have costs of $374 and $379 million per year, respectively, and the lowest costs per mile. The Fairfax Alternative has the highest cost at $386 million with the second highest cost-per-mile. The Vermont Alternative has the highest cost per mile. The La Brea alternative is the most cost effective with a capital cost per annual project trip at $2.9/trip. The Vermont Alternative is the second most cost effective at $3.7/trip. The San Vicente, La Cienega, and Fairfax Alternatives have similar cost effectiveness with annual costs per trip between $4.1-$4.3/trip.

These findings are valid for the alignment and guideway configuration assumptions as defined for this study only and could vary significantly if the guideway configuration is modified in later planning efforts. In particular, additional underground stations or guideway length would result in higher costs and lower cost effectiveness rankings.

---

4 Capital costs are based on Metro’s design criteria and represent existing infrastructure in the current Metro rail system. Elements beyond Metro’s standard kit-of-parts could result in higher project costs.

5 Costs are in 2017 base year dollar value and do not include escalation to the year of construction. Costs will increase 2 to 4% per year to the mid-point of construction.

6 O&M and Replacement Costs are in 2017 base year dollar value and do not include escalation to year of construction. Costs will increase 2 to 4% per year to the mid-point of construction.
Phasing

The timing and amount of available funding could result in the need to separate the project into multiple phases. None of the alternatives fall within the Measure M budget, so the alternatives were analyzed for their ability to be delivered in a first phase as a “minimum operable segment” between the Metro Expo Line and the Metro Purple Line. The Vermont Alternative could not be phased due to the fact that the full-length alternative terminates at the Purple Line.

Figure ES - 33 presents the total estimated ROM capital cost for the phased project to Purple Line scenario of each alternative. All Phased options, except for the Vermont alignment, fall within the Measure M funding allotment.

Total Trips on the project for the phased to Purple Line alternatives are higher on the eastern alignments than the western alignments (Figure ES - 34), reverse of the results from the full alternatives, which project Vermont to have the lowest ridership. The phased alternatives are more regional-serving, thus alignments with the faster travel times connecting the Expo and Purple lines is expected to have higher ridership. However, it is important to take into account the ridership results of the full alternatives since the ultimate goal of the project is to provide service to the Red Line in Hollywood, completing a regional north-south high-capacity corridor.

The breakdown of “Phase 1” within-corridor (local), through, and on/off corridor trips (region to Study Area) is presented in Figure ES - 35. The vast majority of trips on all of the phased alternatives are through trips from origins and/or destinations outside the Study Area. The western alignments serve more Local and On/Off Corridor Trips, but the main travel demand is for the connection between the Expo and Purple Lines.
Findings and Next Steps

Below is a summary of key performance statistics of the five alternatives (Figure ES - 36) and vertical profile configurations (Figure ES - 37).

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</tr>
</tbody>
</table>

* Travel Time is from Expo/Crenshaw to Hollywood/Hollywood

Figure ES - 36 Comparative Summary of Alternatives

While all of the alternatives are forecast to serve high ridership comparable to Metro’s highest-performing rail lines, the western alternatives demonstrate higher total ridership and user benefits. The La Brea Alternative has the lowest capital cost and is the most cost effective, but does not serve many of the major regional job centers and activity centers. Alternatives to the west have dramatically higher access to jobs and housing in the vicinity of proposed station locations.

The shorter, eastern alternatives do a better job at serving more regional, longer distance trips, but do not serve the denser concentration of jobs and major activity centers along the western alignments, while the longer western alignments do a better job at serving these areas but due to their added length and travel time, don’t serve as many regional trips. As transit improves around the region, though, the western alignments may prove to increase in ridership potential with their access to high concentrations of existing, growing job centers, whereas the La Brea Avenue corridor is unlikely to experience major increases in jobs or housing in the future.

Even though not an original alignment from the previous Wilshire/La Brea LRT Extension Study, the Vermont Alternative was added to this Study as an alternative that would reach the Metro Purple and Red Line with the shortest distance, and thus potentially the fastest travel time, lower costs, and fewer impacts. However, the Vermont Alternative has the lowest-ranking performance among all of the alternatives analyzed, and therefore is not recommended for further analysis.
The alternatives analyzed in this study represent a preliminary assessment of alternatives for the northern extension of the Crenshaw Line. Conceptual assumptions made were sufficient for the purposes of this Study, but further analysis is required in order to better inform planning and system design decisions. The findings of this study should be carried forward to further refine the alternatives by conducting additional stakeholder and public outreach in addition to engineering refinement and advanced environmental analysis. This effort would result in a screening of the five alternatives to a single Locally Preferred Alternative (LPA) that can be environmentally cleared for future funding opportunities and construction.
Introduction
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1 Introduction

In 2016, the Metro (Metro) initiated the Crenshaw Northern Extension Feasibility/Alternatives Analysis Study to analyze a northern extension of the Metro Crenshaw/Los Angeles International Airport (LAX) Light Rail Transit (LRT) Line from the Metro Expo Line to the Metro Purple and Red heavy rail lines. The study builds upon alignments previously identified in the Wilshire/La Brea LRT Extension Feasibility Study (2009) (Figure 1-1).

This study explores the feasibility of extending the under-construction Crenshaw Light Rail Line, scheduled to open in 2019, from its terminus at Exposition/Crenshaw (Metro Exposition Line) to the Metro Purple and Red Lines via Mid-City Los Angeles, West Hollywood and Hollywood. The study defines and analyzes five alignment corridors that would provide a critical north-south regional transit link through Central Los Angeles, connecting the South Bay, South LA, and Metro Green and Expo Lines, with Mid-City, West Hollywood, Hollywood, and the Metro Red and Purple Lines, while serving major activity centers and areas of high population and employment density.

Figure 1-1 Potential Alignments for Extension of Crenshaw Line from the 2009 Wilshire/La Brea LRT Extension Feasibility Study

Source: Metro
1.1 Study Area
The 17-square-mile Crenshaw Northern Extension Feasibility/Alternatives Analysis Study Area (Study Area) encompasses the entire City of West Hollywood, a portion of eastern Beverly Hills, and the following City of Los Angeles neighborhoods (Figure 1-2):

- West Adams
- Jefferson Park
- Mid-City
- Miracle Mile/Mid-Wilshire
- Carthay
- Mid-City West/Fairfax District
- Koreatown
- Olympic Park
- Hollywood

This study assesses the preliminary feasibility of five alignment alternatives in the Study Area (Figure 1-2):

- San Vicente Alternative (Crenshaw-San Vicente-Santa Monica Blvd.-Highland)
- La Cienega Alternative (Crenshaw-San Vicente-La Cienega-Santa Monica Blvd.-Highland)
- Fairfax Alternative (Crenshaw-San Vicente-Fairfax-Santa Monica Blvd.-Highland)
- La Brea Alternative (Crenshaw-La Brea-Santa Monica Blvd.-Highland)
- Vermont Alternative (Crenshaw-Olympic-Vermont)

Figure 1-2: Crenshaw Northern Extension Feasibility/Alternatives Analysis Study Area
Source: AECOM
The Study Area itself is similar in size, in terms of population and jobs, to many major U.S. cities (Figure 1-3), and its influence on regional travel demand is comparable to downtown Los Angeles, with significant regional activity centers including major retail and commercial centers, employment centers, medical facilities, and cultural sites.

The current and projected population density in the Study Area is among the highest in the Los Angeles Region, with a density of approximately 2.5-times the average density of the City of Los Angeles and ten times the average density of the County of Los Angeles. In 2040, the Study Area is projected to have a total population of about 397,000, or 27,629 people per square mile, which is similar to the population density of New York City1.

The number of jobs within the study area is a major driver of regional travel demand, characteristic of a Central Business District (CBD). In fact, the employment contained within the Study Area is comparable to the combined employment of the CBDs of San Jose, San Diego, and Sacramento, as well as the other cities shown in Figure 1-4.

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1 http://www1.nyc.gov/site/planning/data-maps/nyc-population/population-facts.page
The Study Area includes a variety of land uses, such as single- and multi-family residential neighborhoods and dense commercial and retail corridors (Figure 1-5). From the Metro Expo Line in the south to Hollywood in the north, the character of the communities changes dramatically. The southern portion of the Study Area consists of low-rise but fairly dense housing with small-scale commercial uses, while the northern portion of the Study Area is characterized by regional activity centers, dense retail development, and significant employment centers and tourist attractions, as well as high-density, multi-family residential development.

Figure 1-5: Study Area Land Uses

Source: Southern California Association of Governments (SCAG) General Plan Land Use, 2012

SCAG 2012 General Plan dataset is the most up-to-date parcel-based dataset for the region.
The Study Area has many activity centers and corridors (Figure 1-6). These centers consist of areas or points that generate and attract many trips, locally and regionally. Activity centers are shown as circles and corridors in orange. Several of Southern California’s busiest activity centers are located in the Study Area.

Figure 1-6 Regional Activity Centers in the Study Area

Source: AECOM
1.2 Study Background

The Crenshaw Northern Extension Feasibility/Alternatives Analysis Study represents the next step in a series of Metro studies that address regional and local transit system connectivity in Central Los Angeles and the Westside, including:

- The Crenshaw-Prairie Corridor Major Investment Study (MIS), completed in 2003.
- The Draft Environmental Impact Statement/Report (EIS/EIR) for Crenshaw Transit Project, completed in 2009, which included a Bus Rapid Transit (BRT) alternative north to Wilshire Boulevard.
- The Draft EIS/EIR for Purple Line Extension (2010), which included the West Hollywood line: an alignment extending north from Wilshire Boulevard on San Vicente Boulevard to connect with the Hollywood/Highland station via Santa Monica Boulevard.

Recent transit planning in the area dates back to the original 1984 EIS/EIR for the Metro Red Line, which envisioned a rail line extending west along Wilshire Boulevard, north along Fairfax Avenue to West Hollywood, and east to Hollywood on Sunset Boulevard.

Many of the improvements studied over the past decades are either now in place or currently under construction. These projects include:

- The Red Line subway, completed from Union Station to North Hollywood in 2000.
- The Purple Line subway, completed from Union Station to Wilshire/Western in 1996. An extension now under construction under Wilshire Boulevard will extend to the Veterans’ Administration Hospital west of I-405 as early as 2026 (Figure 1-7).
- The Expo Line light rail, completed from Downtown Los Angeles to Santa Monica in 2016 (Figure 1-7).
- The Crenshaw Line light rail, from the Expo Line to Green Line, scheduled to open for service in 2019.

![Figure 1-7: Westside Metro Rail Map](Source: Metro (2016))
This Study provides the opportunity to develop a project that will serve as a critical north-south link between east-west rail lines. Preliminary ridership estimates performed in 2009 for the Wilshire/La Brea LRT study estimated that simply extending the Crenshaw Line by three miles from the Expo Line to the Purple Line at Wilshire/La Brea could increase the ridership on the Crenshaw Line by up to 150 percent. This suggests latent demand for additional transit connectivity through and within the Study Area, and provides a strong case for further refinement and study of the alignment alternatives.

In summary, this Study makes a compelling case for developing rail alternatives that can provide significant local and regional benefits, including:

- A north-south crosstown connection to facilitate local and regional trips and to eliminate the need for out-of-direction travel through Downtown Los Angeles,
- Improved transit efficiency through enhanced connectivity between the Metro Red, Purple and Expo lines,
- Leveraging investment in the original Crenshaw Line, and
- Completing a regional rail network from the San Fernando Valley to southern Los Angeles County.

1.2.1 Regional Context and Future Transit Network

Figure 1-8 Existing Metro Rail & BRT Network

Source: Metro (2016)

---

The existing Metro rail and BRT network (exclusive of Metrolink regional rail) began with the opening of the Blue Line in 1990 and now supports 385,000 daily boardings at 110 stations along 123 route-miles⁴ (Figure 1-8). In addition, the separately-operated Metrolink commuter rail has more than 500 route-miles, making it the nation’s largest. Over the coming decades, Metro will greatly expand the fixed-guideway rail and bus network throughout Los Angeles County due to the passage of the Measure M ballot initiative in November, 2016. The ½-cent sales tax increase is expected to provide upwards of $130 billion for the development of new transit lines and other transportation capital investments throughout Los Angeles County. Measure M identifies funding for a variety of transit capital construction projects, including the Crenshaw Northern Extension as well as a variety of programs such as bus and rail operation and local street improvements. A total of $2.33 billion (in 2017 dollars) is identified for the Crenshaw Northern Extension Project, with funds expected to become available in 2040 for project completion by 2047.

The Measure M expenditure plan outlines a sequence of project funding derived from the sales tax, organized by expected groundbreaking and opening dates. Pertinent major transit projects which set the stage for the Crenshaw Northern Extension and will contribute to the regional network are presented on the following page by decade (Figure 1-9, Figure 1-10, and Figure 1-11).
First Decade of Expansion

- 2019: Crenshaw (Expo to Green Line)
- 2021: Regional Connector
- 2024: Airport Metro Connector and Purple Line Extension (Section 1)

Figure 1-11 Measure M: First Decade of Expansion

Second Decade of Expansion

- 2026: Sepulveda Transit Corridor BRT
- 2027: East San Fernando Valley LRT
- 2028: West Santa Ana LRT (south of Green Line)
- 2030: Green Line Extension to Torrance
- 2033: Sepulveda Transit Corridor Rail (Orange to Expo Line)

Figure 1-10 Measure M: Second Decade of Expansion

Third Decade of Expansion

- 2041: West Santa Ana LRT extended to Union Station
- 2047: Crenshaw Northern Extension

Figure 1-9 Measure M: Third Decade of Expansion

Source: Metro Measure M Expenditure Plan
1.2.2 Existing Transit Network

Metro’s extensive bus and rail network provides interurban high-capacity transit across the region. The Study Area is served from east to west by the Expo Line light rail, Purple Line subway, and Metro Local and Rapid bus routes provide service on most arterial roadways (Figure 1-12). The Study Area lacks a reliable, high-capacity transit service for trips moving north and south through the study area and connecting to Metro’s regional rail lines. The existing Metro rail and bus rapid transit (BRT) network began with the opening of the Blue Line in 1990 and currently supports 384,604 daily boardings at 110 stations along 123 route-miles. In addition, there are two rail lines under construction in or adjacent to the Study Area: the Purple Line subway extension to Westwood is scheduled for completion by 2026; and the Crenshaw Line, from the Expo Line south to the Los Angeles International Airport (LAX) and the South Bay, will open in 2019.

The existing and committed fixed-guideway system, listed in order of opening date, currently includes:

- The **Metro Blue Line** - Opened for service in 1990, the 22-mile Metro Blue Line LRT operates between downtown Los Angeles and Long Beach.

- The **Metro Red/Purple Lines** - Opened in phases between 1993 and 2000, the 17.4-mile Metro Red/Purple Line heavy rail subway extends west and north from Union Station. Both lines run together and share six stations between Union Station and the Wilshire/Vermont Station. The Purple Line then extends west along Wilshire Boulevard with two more stations, while the Red Line continues to eight more stations through Hollywood, Universal City, and North Hollywood. The Red/Purple Line is the only urban heavy rail system in the nation that operates entirely underground.

- The **Metro Green Line** - Opened in 1995, the 20-mile Metro Green LRT operates between Redondo Beach and Norwalk, primarily in the median of the elevated Glen Anderson Century Freeway (I-105).

- The **Metro Gold Line** - Opened in phases between 2003 and 2016, the 31-mile Metro Gold Line LRT operates between East Los Angeles and Azusa via Downtown Los Angeles and Pasadena.

- The **Metro Orange Line** - Opened in 2005 and expanded in 2012, the 18.0-mile Metro Orange Line is an urban BRT route (busway) extending west and north across the San Fernando Valley from the North Hollywood terminus of the Metro Red Line.

- The **Metro Expo Line** - Opened in phases in 2012 and 2016, the 15.3-mile Metro Expo LRT operates from the 7th Street/Metro Center Station in Downtown Los Angeles to Downtown Santa Monica.

Other significant regional services include:

- **Metro Rapid Bus Routes** - Metro has developed a predominantly non-fixed-guideway rapid bus system in Los Angeles County that uses signal priority and additional features of BRT to create an arterial-based, limited-stop transit network.

- **Metrolink** - Opened in phases beginning in 1992, Metrolink provides seven routes that connect Los Angeles, Orange, Riverside, San Bernardino, San Diego, and Ventura counties using existing rail rights-of-way shared with freight operators.
1.3 Purpose & Need

The urban character and high density of the Study Area, in combination with the existing transportation infrastructure, create a unique set of mobility problems. High-density residential uses and regional destinations for tourism, shopping, and employment contend with a grid of narrow arterials that experience some of the worse street congestion in the region. These conditions are likely to worsen as population and employment in the Study Area continue to grow, having negative impacts on economic development, quality of life, and the environment.

The addition of a high-capacity, north-south transit line in the Study Area can improve connections and access across the Los Angeles region. The purpose of the project is (1) to serve local population, employment, and activity centers within the Study Area, and (2) to become part of a larger regional transit system that serves travel to, from, and through the Study Area. The remainder of this section demonstrates the need for the project due to the following mobility issues:

- **Transit Network:** Transit options within the Study Area are limited to east-west rail services and buses that operate on congested roadways. North-south travel on the rail network requires transferring through downtown Los Angeles, increasing travel times.
- **Congestion & Transit Reliability:** Commuters’ willingness to use existing transit services is negatively impacted by long and unpredictable travel times due to traffic congestion.
- **Travel Demand:** High demand exists for trips within the Study Area as well as trips between the Study Area and surrounding region. Projected increased travel demand will place additional strain on an already overburdened system and further increase travel times.
- **Demand for High-Quality (Fast and Reliable) Transit Service:** The Study Area consists largely of transit-supportive land uses that attract a high volume of transit trips from both within the Study Area and the entire region. Despite existing high levels of transit use, additional ridership is discouraged by slow speeds, circuitous travel routes, high travel times, and unreliability due to congestion.
- **Transit Dependency:** The Study Area has a significant proportion of transit-dependent residents. Transit-dependent residents are disproportionately impacted by long travel times and crowding on the existing transit system.

The Crenshaw Northern Extension Project has the potential to address these mobility challenges by providing reliable, high-speed and high-capacity transit service that serves as a critical link in the regional transit network, enhancing mobility both within the Study Area and the broader region, particularly to the north (San Fernando Valley/North County) and south (South LA, LAX, and South Bay).
1.3.1 Transit Network

Transit options within the Study Area are limited to east-west rail services and buses that operate on congested roadways. North-south travel on the rail network requires transferring through downtown Los Angeles, increasing travel times.

At the regional level, the Crenshaw Northern Extension has the potential to create a 40+ mile north/south corridor connecting the Orange, Red, Purple, Expo, and Green Lines, as well as the Hollywood Burbank Airport, Metrolink, future California High Speed Rail, LAX, and the South Bay (Figure 1-13).

Figure 1-12 Potential Crenshaw Corridor North-South Connectivity

Source: AECOM

The Crenshaw Northern Extension completes a 40-mile north-south “crosstown” corridor through the region via Mid-City Los Angeles and Hollywood.
The Study Area is at the core of the major east-west employment axis between the Westside and Downtown Los Angeles that generates tremendous trip attraction from the Valley and South Bay. However, the existing and planned Metro network facilitates direct trips to only limited portions of the Westside, Mid-City and Hollywood without leveraging the full east-west transit network. While there is a strong commuting demand between the Valley and South Bay to points along the east-west axis, forced transfers and circuitous routes add extra travel time, thus decreasing the competitiveness of transit options compared to driving. A summary of typical transit travel times of origins and destinations with and without a Crenshaw Northern Extension is shown below (Table 1-1).

**Table 1-1 Typical PM Peak Transit Travel Time between Major Destinations With and Without Crenshaw Northern Extension**

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<tr>
<th>Origin</th>
<th>Destination</th>
<th>Transit Travel Time</th>
<th>Travel Time Savings</th>
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<td></td>
<td></td>
<td>Current Conditions</td>
<td>With Crenshaw</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Northern Extension</td>
</tr>
<tr>
<td>Expo/Crenshaw</td>
<td>Cedars Sinai/Beverly Center</td>
<td>44 Minutes</td>
<td>11 Minutes</td>
</tr>
<tr>
<td>Hollywood</td>
<td>Cedars Sinai/Beverly Center</td>
<td>44 Minutes</td>
<td>8 Minutes**</td>
</tr>
<tr>
<td>Leimert Park</td>
<td>CBS Studios/The Grove</td>
<td>47 Minutes</td>
<td>17 Minutes***</td>
</tr>
<tr>
<td>Hollywood</td>
<td>CBS Studios/The Grove</td>
<td>24 Minutes</td>
<td>5 Minutes***</td>
</tr>
<tr>
<td>AMC</td>
<td>WeHo Park/PDC</td>
<td>71 Minutes</td>
<td>33 Minutes</td>
</tr>
<tr>
<td>Expo/Crenshaw</td>
<td>WeHo Park/PDC</td>
<td>52 Minutes</td>
<td>13 Minutes**</td>
</tr>
<tr>
<td>Hollywood</td>
<td>WeHo Park/PDC</td>
<td>34 Minutes</td>
<td>6 Minutes**</td>
</tr>
<tr>
<td>Leimert Park</td>
<td>Midtown Shopping Center</td>
<td>35 Minutes</td>
<td>10 Minutes</td>
</tr>
<tr>
<td>Inglewood</td>
<td>Miracle Mile</td>
<td>49 Minutes</td>
<td>22-24Minutes</td>
</tr>
<tr>
<td>Hollywood</td>
<td>Miracle Mile</td>
<td>34 Minutes</td>
<td>5-7 Minutes</td>
</tr>
<tr>
<td>AMC</td>
<td>Downtown Beverly Hills</td>
<td>74 Minutes</td>
<td>35-36 Minutes</td>
</tr>
<tr>
<td>Leimert Park</td>
<td>Downtown Beverly Hills</td>
<td>61 Minutes</td>
<td>21-22 Minutes</td>
</tr>
<tr>
<td>Hollywood</td>
<td>Downtown Beverly Hills</td>
<td>59 Minutes</td>
<td>13-17 Minutes</td>
</tr>
<tr>
<td>Leimert Park</td>
<td>Westwood</td>
<td>44 Minutes</td>
<td>25-26 Minutes</td>
</tr>
<tr>
<td>Hollywood</td>
<td>Westwood</td>
<td>35 Minutes</td>
<td>17-21Minutes</td>
</tr>
<tr>
<td>Inglewood</td>
<td>Hollywood</td>
<td>60 Minutes</td>
<td>27-34 Minutes</td>
</tr>
<tr>
<td>Expo/Crenshaw</td>
<td>Hollywood</td>
<td>45 Minutes</td>
<td>12-19 Minutes</td>
</tr>
<tr>
<td>Culver City</td>
<td>Hollywood</td>
<td>52 Minutes</td>
<td>24-31 Minutes</td>
</tr>
<tr>
<td>Inglewood</td>
<td>Universal City</td>
<td>61 Minutes</td>
<td>33-40 Minutes</td>
</tr>
<tr>
<td>Expo/Crenshaw</td>
<td>North Hollywood</td>
<td>50 Minutes</td>
<td>22-29 Minutes</td>
</tr>
<tr>
<td>Culver City</td>
<td>North Hollywood</td>
<td>58 Minutes</td>
<td>34-41 Minutes</td>
</tr>
<tr>
<td>Expo/Crenshaw</td>
<td>Burbank Airport (RITC)</td>
<td>69 Minutes</td>
<td>44-51 Minutes</td>
</tr>
<tr>
<td>Culver City</td>
<td>Burbank Airport (RITC)</td>
<td>84 Minutes</td>
<td>56-63 Minutes</td>
</tr>
</tbody>
</table>

Note: ** Based on transit travel times for the La Brea, Fairfax, San Vicente, and La Cienega alignments, unless noted otherwise
*** Based on San Vicente/La Cienega alignments
**** Based on Fairfax alignment

**Source: Metro Google Maps, Metro Trip Planner Tool**

In summary, the existing transit network generates extra travel time for trips to or through the Study Area and Westside-Downtown axis. The Crenshaw Northern Extension project, combined with other projects, completes a “grid” of high-capacity fixed-guideway service across the heart of the region. Thus, a purpose of this project is to leverage the high-volume east-west network to provide new north-south connections, closing a “gap” in the regional network.
1.3.2 Congestion & Transit Reliability

Commuters’ willingness to use existing transit services is negatively impacted by long and unpredictable travel times due to traffic congestion.

The Study Area is served primarily by an extensive arterial network, with limited access to the I-10 and US 101 freeways to the south and north. The Study Area is well served by numerous Metro Local, Rapid, and other bus services that operate on arterials that are currently congested during the afternoon peak hour as measured by Volume to Capacity (V/C) ratio (Table 1-2).

The project team selected several arterials as examples of traffic conditions and roadway performance. Traffic count data in this area was collected from various sources, such as NavigateLA, the City of Los Angeles, and the City of West Hollywood, representing conditions between 1999 and 2016. The V/C ratio describes the congestion of a roadway segment or other facility, in terms of demand versus supply. The capacity is defined as the maximum number of vehicles that the facility can carry under prevailing conditions of geometric, the vehicle mix, and location. The V/C ratio may vary from 0.0 (no usage or demand) to values greater than 1.0 (breakdown). A V/C ratio greater than 1.0 indicates that the roadway is over its capacity, resulting in severe congestion. A V/C ratio of 0.9 roughly equates to Level of Service (LOS) E (Table 1-3). As Table 1-4 shows, during the weekday PM peak hour on weekdays, most of the sample arterials in the Study Area operate at congested (V/C > 0.9) or severely congested levels.

**Table 1-2 Volume to Capacity Thresholds for the Quick Estimation Method**

<table>
<thead>
<tr>
<th>Critical Volume to Capacity Ratio</th>
<th>Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 0.85</td>
<td>Intersection is operating under capacity. Excessive delays are not experienced.</td>
</tr>
<tr>
<td>0.85-0.95</td>
<td>Intersection is operating near its capacity. Higher delays may be expected, but continuously increasing queues should not occur.</td>
</tr>
<tr>
<td>0.95-1.0</td>
<td>Unstable flow results in a wide range of delay. Intersection improvements will be required soon to avoid excessive delays.</td>
</tr>
<tr>
<td>&gt; 1.0</td>
<td>The demand exceeds the available capacity of the intersection. Excessive delays and queueing are anticipated.</td>
</tr>
</tbody>
</table>

*Source: FHWA Signalized Intersections: Informational Guide, 2004*

**Table 1-3 Level of Service Criteria for Signalized Intersections**

<table>
<thead>
<tr>
<th>Level of Service</th>
<th>Average Control Delay (sec/veh)</th>
<th>General Description (Signalized Intersections)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>≤10</td>
<td>Free Flow</td>
</tr>
<tr>
<td>B</td>
<td>&gt;10 - 20</td>
<td>Stable Flow (slight delays)</td>
</tr>
<tr>
<td>C</td>
<td>&gt;20 - 35</td>
<td>Stable flow (acceptable delays)</td>
</tr>
<tr>
<td>D</td>
<td>&gt;35 - 55</td>
<td>Approaching unstable flow (tolerable delay, occasionally wait through more than one signal cycle before proceeding)</td>
</tr>
<tr>
<td>E</td>
<td>&gt;55 - 80</td>
<td>Unstable flow (intolerable delay)</td>
</tr>
<tr>
<td>F</td>
<td>&gt;80</td>
<td>Forced flow (jammed)</td>
</tr>
</tbody>
</table>

*Source: Highway Capacity Manual, 2000*
Table 1-4 Average Weekday PM Peak Hour Intersection V/C Ratio of Sample Arterials

<table>
<thead>
<tr>
<th>Major Arterial</th>
<th>Average V/C</th>
<th>Major Arterial</th>
<th>Average V/C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beverly Blvd</td>
<td>0.69</td>
<td>Santa Monica Blvd</td>
<td>0.98</td>
</tr>
<tr>
<td>Olympic Blvd</td>
<td>0.79</td>
<td>Fountain Ave</td>
<td>1.01</td>
</tr>
<tr>
<td>La Brea Ave</td>
<td>0.88</td>
<td>La Cienega Blvd</td>
<td>1.15</td>
</tr>
<tr>
<td>Fairfax Ave</td>
<td>0.90</td>
<td>Sunset Blvd</td>
<td>1.12</td>
</tr>
<tr>
<td>San Vicente Blvd</td>
<td>0.92</td>
<td>Melrose Ave</td>
<td>1.15</td>
</tr>
</tbody>
</table>

Sources: NavigateLA, City of West Hollywood, City of Los Angeles

Actual bus travel speeds were compiled to assess system performance. Variable bus speeds in the study area reduce schedule adherence and service reliability. Figure 1-13 shows the average weekday bus travel speed of routes operating on selected major arterials in the Study Area, including Fairfax Avenue, La Brea Avenue, Olympic Boulevard, and San Vicente Boulevard. The data indicate that the average bus speed in the Study Area during the AM peak period is below 10 miles per hour and decreases throughout the day until after the PM peak period, reflecting the diminishing performance of the bus network as roadway congestion increases.

![Figure 1-13 Average Weekday Metro Local Bus Speed (miles/hour) on Selected Major Arterials](source: Metro)

According to the Westside Cities and Central Los Angeles Arterial Performance Baseline Conditions Analysis (2017) conducted by Metro, many of the above mentioned key arterials in the Study Area are on the list of the 10 worst-performing corridors in jurisdictions within the Central L.A. and Westside Cities Sub-regions (Figure 1-14). For example, the average travel speeds on Santa Monica Boulevard, La Brea Avenue, and Melrose Avenue are all less than 15 miles per hour during PM peak hour⁵, the result of intense delays. Sunset Boulevard within the City of West Hollywood, as well as Santa Monica Boulevard and La Cienega Boulevard within the City of Los Angeles are among the 10 least reliable segments in the region due to their severe congestion during PM peak hour⁶. This is another indicator that surface streets in the Study Area experience poor travel time reliability, suggesting a need for transportation improvements that offer an alternative to congestion.

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⁵ Westside Cities and Central LA Arterial Performance Baseline Conditions Analysis Reports, Exhibit 3.8
⁶ Westside Cities and Central LA Arterial Performance Baseline Conditions Analysis Reports, Exhibit 3.17
1.3.3 Travel Demand

High demand exists for trips within the Study Area as well as trips between the Study Area and surrounding region. Projected increased travel demand will place additional strain on an already overburdened system and further increase travel times.

Existing and future travel demand is demonstrated by the existing transit ridership, population and employment, and trip distribution of the Study Area.

Existing Transit Ridership

Metro has 135 local bus routes throughout its service area, of which 39 serve the broader Study Area. Of the top ten bus routes by ridership system-wide, six traverse the Study Area (Table 1-5 and Figure 1-15). The Crenshaw Northern Extension could support and leverage the existing system by improving connections between the high-volume Metro Local and Rapid bus and regional rail network.

Demand for bus service in the Study Area can be demonstrated by the total number of bus boardings per route and by stop (Figure 1-16). The stop boardings were collected at potential station locations along the alignment alternatives. The boardings by route indicate the importance of specific travel corridors, such as Wilshire Boulevard, while high numbers of total stop boardings reflect major transfer locations or trip generators (such as the Wilshire/Vermont Metro Red and Purple Line station).

---

7 Metro, Metro Rail and Bus GIS Files, 2016.
Table 1-5 Ranking by Weekday Ridership of Metro Bus Routes Serving Study Area

<table>
<thead>
<tr>
<th>Rank</th>
<th>Line</th>
<th>Route/Primary Street</th>
<th>Length (Miles)</th>
<th>Ridership</th>
<th>Riders/Mile</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>20/720</td>
<td>Wilshire</td>
<td>25</td>
<td>50,967</td>
<td>2,039</td>
</tr>
<tr>
<td>2</td>
<td>204/754</td>
<td>Vermont</td>
<td>13</td>
<td>42,748</td>
<td>3,288</td>
</tr>
<tr>
<td>3</td>
<td>207/757</td>
<td>Western</td>
<td>13</td>
<td>31,152</td>
<td>2,396</td>
</tr>
<tr>
<td>4</td>
<td>4/704</td>
<td>Santa Monica</td>
<td>19</td>
<td>28,258</td>
<td>1,487</td>
</tr>
<tr>
<td>7</td>
<td>16</td>
<td>3rd</td>
<td>12</td>
<td>22,938</td>
<td>1,912</td>
</tr>
<tr>
<td>8</td>
<td>33/733</td>
<td>Venice</td>
<td>19</td>
<td>22,513</td>
<td>1,185</td>
</tr>
<tr>
<td>12</td>
<td>40/740</td>
<td>Crenshaw</td>
<td>20</td>
<td>20,452</td>
<td>1,704</td>
</tr>
<tr>
<td>15</td>
<td>14</td>
<td>Beverly</td>
<td>20</td>
<td>19,054</td>
<td>952</td>
</tr>
<tr>
<td>18</td>
<td>28/728</td>
<td>Broadway</td>
<td>20</td>
<td>16,975</td>
<td>849</td>
</tr>
</tbody>
</table>

Source: AECOM, Metro, Metro Rail and Bus GIS Files, 2016.

An analysis of bus boarding activity indicates that the heaviest stop-level bus activity occurs at major transfer points between east-west and north-south services. It is expected, however, that this will change when the Purple Line extension opens for service, adding capacity to the Wilshire Boulevard corridor. This new high-capacity service will increase transfers at Wilshire Boulevard with north-south bus services, including the potential Crenshaw Northern Extension.
- The highest existing bus activity at proposed station locations occurs at 1) connections to the rail network, 2) at major north-south to east-west transfer locations, and 3) at major trip generators.

- The addition of the Purple Line extension and the Crenshaw Northern Extension will complement the “grid” of local bus service.

Figure 1-16 Metro Bus Routes and Potential Rail Stations with 2016 Daily Boardings

Source: Metro Stop-Level Boardings (bus only) (May 2016)

Population and Employment

Population and employment densities, along with income and workforce comparisons, are presented below to portray existing and potential transit markets. The demand for all modes of transportation, including public transit, is primarily a function of population and employment densities. Overall, Study Area population and employment densities are high, with many concentrations of civic, office, and retail activity existing throughout.

The high population density of the Study Area is a result of its transit-supportive land uses. The population density is more than twice that of Los Angeles (city) and nearly ten times that of Los Angeles County. Similarly, the high employment density creates a strong regional attraction for work, shopping, tourist, and other types of trips. Study Area employment density is approximately 2.5 times that of the City of Los Angeles and over 12 times that of the county (Table 1-6, Figure 1-17).

Table 1-6 Study Area Population and Employment Densities Comparison

<table>
<thead>
<tr>
<th></th>
<th>Study Area</th>
<th>City of Los Angeles Portion</th>
<th>City of West Hollywood</th>
<th>City of Los Angeles (total area)</th>
<th>Los Angeles County (total area)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Area</td>
<td>17 mi²</td>
<td>15.1 mi²</td>
<td>1.9 mi²</td>
<td>469 mi²</td>
<td>4,751 mi²</td>
</tr>
<tr>
<td>Total Population</td>
<td>337,889</td>
<td>301,667</td>
<td>36,222</td>
<td>3,971,883</td>
<td>10,170,292</td>
</tr>
<tr>
<td>Population Density (pop/sq. mi)</td>
<td>19,900</td>
<td>20,000</td>
<td>19,000</td>
<td>8,500</td>
<td>2,100</td>
</tr>
<tr>
<td>Total Employment</td>
<td>184,712</td>
<td>161,546</td>
<td>23,166</td>
<td>2,052,422</td>
<td>4,432,374</td>
</tr>
<tr>
<td>Total Employment Density (jobs/sq. mi)</td>
<td>10,900</td>
<td>10,700</td>
<td>12,200</td>
<td>4,400</td>
<td>900</td>
</tr>
</tbody>
</table>

To better understand socioeconomic features and travel patterns, the Southern California Association of Governments (SCAG) divides the Los Angeles region into Transportation Analysis Zones (TAZs). As part of its travel forecasting activities, SCAG maps and calculates existing and projected population by TAZ. The following data is presented by TAZ.

Projected concentrations of population in the Study Area relative to the surrounding area are shown in Figure 1-18. Population density is projected to increase in the Study Area by 22 percent by 2040 (Table 1-7, Figure 1-20).

Table 1-7 Existing and Projected Population in Study Area

<table>
<thead>
<tr>
<th></th>
<th>2012</th>
<th>2040</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Population</td>
<td>323,537</td>
<td>396,543</td>
<td>22%</td>
</tr>
<tr>
<td>Population Density (per acre)</td>
<td>35</td>
<td>43</td>
<td></td>
</tr>
</tbody>
</table>

Current and projected employment density in the Study Area reflects the fact that the Study Area is among the major regional travel attractors (Figure 1-19). Employment density is projected to increase in the Study Area by 20 percent by 2040. Strong employment growth is projected throughout the Study Area, with the highest growth in the heart of West Hollywood and along major arterial roadway and transit corridors (Table 1-8, Figure 1-21).

Table 1-8 Existing and Projected Employment in Study Area

<table>
<thead>
<tr>
<th></th>
<th>2012</th>
<th>2040</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Employment</td>
<td>212,331</td>
<td>254,894</td>
<td>20%</td>
</tr>
<tr>
<td>Employment Density (per acre)</td>
<td>22</td>
<td>27</td>
<td></td>
</tr>
</tbody>
</table>

Source: Southern California Association of Governments 2012-2035 Regional Transportation Plan (RTP)/Sustainable Communities Strategies (SCS) Tier 2 Transportation Analysis (TAZ) Socio-Economic Data
Figure 1-18 Study Area Population Density (2012 and 2040)
Figure 1-19 Study Area Employment Density (2012 and 2040)
Figure 1-20 Population Growth (2012 – 2040)

Figure 1-21 Employment Growth (2012-2040)
Trip Distribution

Comparing trips to, from, and within the Study Area further demonstrates the Study Area’s existing and increasing influence on regional trip making. Trips from the Study Area are projected to have the largest increase in total daily trip volume and trips to the Study Area are projected to have the largest transit mode share, suggesting the need for increased access and convenient connections to the larger regional transit network (Table 1-9 and Figure 1-22).

![Diagram showing trip distribution](image)

Figure 1-22 Trips to, from, and within the Study Area

<table>
<thead>
<tr>
<th>Table 1-9 Study Area Travel Patterns for HBW Trips</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012</td>
</tr>
<tr>
<td>---</td>
</tr>
<tr>
<td>Trips within Study Area</td>
</tr>
<tr>
<td>Transit mode share within Study Area</td>
</tr>
<tr>
<td>Trips to the Study Area</td>
</tr>
<tr>
<td>Transit mode share to the Study Area</td>
</tr>
<tr>
<td>Trips from the Study Area</td>
</tr>
<tr>
<td>Transit mode share from the Study Area</td>
</tr>
</tbody>
</table>

The combined effect of regional trips originating and terminating in the Study Area, simultaneously with trips within the Study Area, indicates the potential to further develop and grow as an urban hub of residential clusters, commercial uses, and job centers. Therefore, the Crenshaw Northern Extension should not only serve long-distance commuting trips from north and south, but also facilitate local trips within the Study Area.

In summary, growing high densities of population and employment are generating increasing travel demand that is constrained by the existing transportation network of the Study Area.
1.3.4 Demand for High-Quality (Fast and Reliable) Transit

The Study Area consists largely of transit-supportive land uses that attract a high volume of transit trips from both within the Study Area and the entire region. Despite existing high levels of transit use, additional ridership is discouraged by slow speeds, circuitous travel routes, high travel times, and unreliability due to congestion.

Existing land use in the Study Area is characterized by multi-family residential and commercial and services uses (Figure 1-23 and Table 1-10). The Study Area contains over 12 times the percentage of multi-family residential as the County of Los Angeles, and over six times the percentage of commercial/service uses (Figure 1-23). Conversely, the Study Area contains less than half the proportion of single-family residential as greater Los Angeles. Approximately 80% of the Study Area is composed of transit-supportive land uses that are not single-family residential, industrial, or other low-density uses (Figure 1-24, Figure 1-25).

Table 1-10 Study Area Land Use Pattern Comparisons

<table>
<thead>
<tr>
<th>Major Land Use</th>
<th>Study Area</th>
<th>City of Los Angeles</th>
<th>City of West Hollywood</th>
<th>County of Los Angeles</th>
</tr>
</thead>
<tbody>
<tr>
<td>% Multi-Family</td>
<td>50%</td>
<td>14%</td>
<td>69%</td>
<td>4%</td>
</tr>
<tr>
<td>% Single Family</td>
<td>21%</td>
<td>45%</td>
<td>1%</td>
<td>40%</td>
</tr>
<tr>
<td>% Commercial and Services</td>
<td>19%</td>
<td>6%</td>
<td>25%</td>
<td>3%</td>
</tr>
</tbody>
</table>

Source: Southern California Association of Governments (SCAG) General Plan Land Use, 2012

Figure 1-23 Study Area Land Use Patterns Comparisons
Source: Southern California Association of Governments (SCAG) General Plan Land Use, 2012
The factors above indicate ideal conditions for the continued development and strengthening of transit-oriented communities in the project area. The project will cultivate the transit-friendly environment by encouraging denser, walkable land use patterns near proposed and existing transit stations. This enables users of the transit system to take advantage of the housing and employment opportunities in the study area while reducing regional auto dependency, urban sprawl, and other environmental impacts.

Figure 1-24 Study Area Transit-Supportive Land Use
Source: Southern California Association of Governments (SCAG) General Plan Land Use, 2012
1.3.5 Transit Dependency

The Study Area has a significant proportion of transit-dependent residents. Transit-dependent residents are disproportionately impacted by long travel times and crowding on the existing transit system.

Metro defines a transit-dependent area as achieving one or more of the following criteria:

- Zero-car ownership – 10% or more of the households do not own a car;
- Low-income – 26.7% or more of the households have income of $25,000 or less (in 2010 dollars); or
- Senior Citizens with medium-low-income – 11% or more of the households include individuals aged 65 or older and median household income for those ages 65 or older is less than $53,762.

Using information from the 2010-2014 American Community Survey (ACS) 5-year Estimates⁸, transit dependency was mapped in the Study Area across all TAZs and within the Study Area (Table 1-11 and Figure 1-25, Figure 1-26). Altogether, the concentration of transit dependency within the Study Area suggests the need for high-quality transit to, from, and within the Study Area.

<table>
<thead>
<tr>
<th>One Criteria</th>
<th>Two Criteria</th>
<th>Three Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>67% of Study Area</td>
<td>43% of Study Area</td>
<td>13% of Study Area</td>
</tr>
<tr>
<td>Hollywood, Mid-City, Koreatown</td>
<td>Hollywood, Mid-City, Koreatown, eastern West Hollywood</td>
<td></td>
</tr>
</tbody>
</table>

Source: 2014 TIGER/LINE Shapefiles and data from the 2010-2014 American Community Survey (ACS) 5-year Estimates

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⁸ The U.S Census Bureau prepares 5-year detailed estimates of socioeconomic and housing characteristics through the American Community Survey (ACS) for the purposes of describing the average characteristics of an area over a specific time period.
Transit Dependency

Figure 1-25 Transit Dependency
Source: 2014 TIGER/LINE Shapefiles and data from the 2010-2014 American Community Survey (ACS) 5-year Estimate

Figure 1-26 Crenshaw Northern Extension Study Area Percentage of Zero-Car Ownership Households by Census Tract
Source: 2014 TIGER/LINE Shapefiles and data from the 2010-2014 American Community Survey (ACS) 5-year Estimate
The Study Area has a higher percentage of population below the poverty level than the Los Angeles County average (Figure 1-27), which has implications for transit utilization in the Study Area, as this population group has significantly lower automobile ownership rates, and a higher propensity to use transit. This points to the opportunity for higher transit utilization within the Study Area. When combined with the regional connectivity that the proposed northern extension is designed to provide, there is a compelling case to be made for the project.

![Pie chart showing % of population below poverty level]

Figure 1-27 Income and Workforce Demographic Comparisons (Study Area vs. County of Los Angeles)

Source: 2014 TIGER/Line Shapefile and data from 2010-2014 American Community Survey (ACS) 5-Year Estimate

Transit dependent populations are impacted the most by existing deficiencies in the transportation network that decrease transit reliability and efficiency. As such, a purpose of this project is to improve mobility for transit dependent residents by providing alternatives to congestion, efficient transit service and a cohesive, high-capacity and high-speed transit network.

1.3.6 Purpose and Need Statement

The five mobility problems presented in this section demonstrate the overall need for the project. Each project purpose summarized below supports the overall project goal to provide local transit service via a critical link in the regional network.

- **Transit Network**: Transit options within the Study Area are limited to east-west rail services and buses that operate on congested roadways. North-south travel on the rail network requires transferring through downtown Los Angeles, thus decreasing network efficiency.
  - **Purpose**: Leverage the high-volume east-west network to provide new north-south connections and close a regional network gap.

- **Congestion & Transit Reliability**: Commuters’ willingness to use transit is negatively impacted by long and unpredictable travel times due to traffic congestion.
  - **Purpose**: Increase the efficiency and convenience of transit trips by providing faster, more direct service in turn creating more connections and mobility options.

- **Travel Demand**: High demand exists for trips within the Study Area as well as trips between the Study Area and surrounding region. Projected increased travel demand will place additional strain on an already overburdened system and further increase travel times.
  - **Purpose**: Provide an alternative to congested roadways by providing high-capacity, grade-separated transit to meet existing, growing demand.

- **Demand for High-Quality (Fast and Reliable) Transit Service**: The Study Area consists largely of transit supportive land uses that attract a high volume of transit trips from both within the Study Area and the entire region. Despite existing high levels of transit use, additional ridership is discouraged by slow speeds, circuitous travel routes, high travel times, and unreliability due to congestion.
Purpose: Cultivate the transit-friendly environment with mobility options that extend beyond congested roadways and auto-dependency. Maximize the potential for “smart” population and job growth through the implementation of frequent and reliable rail service.

Transit Dependency: The Study Area has a significant proportion of transit-dependent residents. Transit-dependent residents are disproportionately impacted by long travel times and crowding on the existing transit system.

Purpose: Improve mobility for transit dependent residents by providing alternatives to congestion with efficient transit service and a cohesive high-capacity and high-speed transit network.

Altogether, the Crenshaw Northern Extension has the potential to enhance mobility and accessibility by providing a high-capacity, reliable, high-quality, and connected service that will enhance the vitality of the Study Area and the region.

1.4 Study Methodology

The Project Team began this study with alternatives identified in the Wilshire/La Brea LRT Extension Feasibility Study (2009) (Figure 1-1), which included San Vicente Boulevard, La Cienega Boulevard, Fairfax Avenue, La Brea Avenue, and added Vermont Avenue as another alternative (Figure 1-28).

![Figure 1-28: Crenshaw Northern Extension Feasibility/Alternatives Analysis Study Alternatives](image)

Source: AECOM

Focusing on the five main alignment corridors shown above, the Project team conducted an existing conditions analysis; including a visual survey and field review of the Study Area with an emphasis on key issue areas along the corridors included in this study. Physical characteristics of the Study Area were analyzed to gain an understanding of the constraints and conditions that influence design configuration considerations, including elevation changes, right-of-way width, density/height of adjacent buildings,
vertical and horizontal clearances, intersection turning movements, potential construction staging sites and station locations, and existing land uses (Figure 1-29). The analysis resulted in baseline information on vertical profile compatibility with the established physical character along the five key corridors included in this study.

1. Crenshaw Boulevard (Exposition - Jefferson Boulevards)
2. Crenshaw Boulevard at I-10 Freeway Crossing
3. Crenshaw Boulevard (Washington Boulevard-Venice Boulevard)
4. Historic West Boulevard Bridge
5. Midtown Crossing and Pico/Rimpau Transit Center
6. Changing Elevation on San Vicente Boulevard
7. San Vicente Boulevard (Olympic-Redondo Boulevards)
8. Three-Way Intersection at Fairfax Ave/San Vicente Blvd/Olympic Blvd
9. San Vicente Boulevard at Wilshire Boulevard
10. San Vicente Boulevard at La Cienega Boulevard
11. Cedars-Sinai Medical Center
12. Pacific Design Center, Metro Division 7 Bus Maintenance & Operations Facility, and Los Angeles County Sheriff’s Station
13. Santa Monica Boulevard between Palm and Orlando Avenues
14. Santa Monica Blvd between Orlando and La Brea Ave.
15. Santa Monica Blvd, West of La Brea Avenue: Development Opportunity
16. La Cienega Boulevard (3rd Street - Melrose Avenue)
17. Fairfax Avenue (Wilshire Boulevard - 3rd Street)
18. The Grove and Farmers Market
19. CBS Television City
20. Fairfax Avenue (Beverly Boulevard - Melrose Avenue)
21. Fairfax Avenue at Santa Monica Boulevard
22. West to North Turn from San Vicente Blvd to La Brea Ave
23. La Brea Avenue (8th - 3rd Streets)
24. Concrete Plant at La Brea Avenue/Romaine Street
25. Hollywood/Highland Station Area
26. Olympic Boulevard (Westchester Place - Kingsley Road)
27. Wilshire/Vermont Station

Figure 1-29: Study Area Key Issue Areas
Source: AECOM
With an understanding of existing conditions, key issue areas, and opportunities and constraints, the Project Team defined and conducted an initial performance evaluation of the alignment alternatives. The five alignment alternatives and options evaluated in this study are presented in further detail in Chapter 2: Definition of Alternatives.

The five alignment alternatives are evaluated for cost, ridership, and overall feasibility in Chapter 3: Analysis.

Chapter 4: Findings summarizes the performance of the alternatives and potential next steps for the project.
Definition of Alternatives
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2 Definition of Alternatives

To define alternatives for analysis in this study, factors such as existing street right-of-way width, traffic conditions, track geometry, environmental impacts, urban design issues and stakeholder feedback were considered. The resulting alternatives are representative alignments for the purpose of feasibility analysis only and do not imply any details have been finalized. Alignment locations, guideway types, transition locations, station locations, and construction methods are all subject to change as the project progresses through environmental clearance and preliminary engineering.

The following is a description of the screening process (see also Figure 2-1):

Stage 1- Identify Potential Physically Feasible Guideway Profiles through Corridors

*Involved parties:* Metro team

1. Analyze existing street Right-of-Way (ROW) widths along corridors to determine guideway configuration types that could be accommodated within the existing ROW (at-grade, aerial, or below grade)
2. Identify intersections that would be infeasible for crossing at-grade
3. Analyze track alignment at turns and guideway profile “transitions” to identify potential ROW requirements

Stage 2- Identify Potential Alternatives Appropriate for the Urban Context of the Corridor

*Involved parties:* Metro team, City of West Hollywood and City of Los Angeles

1. Evaluate environmental feasibility through a high-level fatal flaw analysis
2. Evaluate urban design context through a high-level analysis of the size and scale of project within the corridors and neighborhoods, including historic context
3. Analyze cost effectiveness based on order of magnitude costs for type and length of different guideway types (at-grade, aerial, or below-grade)
4. Consider feedback gained through stakeholder coordination meetings with key staff members of the City of West Hollywood and the City of Los Angeles

![Figure 2-1 Screening Process](image)
2.1 Alternatives Analyzed in this Feasibility Study
The screening process resulted in the definition of a set of potentially feasible alternatives (Figure 2-2 and Table 2-1).

![Map of Crenshaw Northern Extension Feasibility/Alternatives Analysis Study Alignment Alternative]

**Figure 2-2 Crenshaw Northern Extension Feasibility/Alternatives Analysis Study Alignment Alternative**

<table>
<thead>
<tr>
<th>Alternative</th>
<th>Length</th>
<th>Aerial Stations</th>
<th>Underground Stations</th>
</tr>
</thead>
<tbody>
<tr>
<td>SAN VICENTE</td>
<td>9.5 miles</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>(and La Cienega)</td>
<td>9.2 miles</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FAIRFAX</td>
<td>8.1 miles</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>LA BREA</td>
<td>6.5 miles</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>VERMONT</td>
<td>10.2 miles</td>
<td>No Aerial</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>stations</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(4.8 miles new)</td>
<td></td>
</tr>
</tbody>
</table>

**Table 2-1: Crenshaw Northern Extension Feasibility/Alternatives Analysis Study Alignment Alternatives Summary**
Figure 2-3 Guideway Type by Alternative
2.2 San Vicente and La Cienega Alternatives

2.2.1 Alignment and Configuration

The San Vicente Alignment Alternative is a double-track guideway approximately 9.5 miles in length extending from the Crenshaw/Exposition Station of the Metro Crenshaw line (currently under construction) to a new station near Hollywood/Highland via Crenshaw Boulevard, Venice Boulevard, San Vicente Boulevard, Santa Monica Boulevard, and Highland Avenue.

The La Cienega Alignment Alternative is a double-track guideway approximately 9.2 miles in length extending from the Crenshaw/Exposition Station of the Metro Crenshaw line (currently under construction) to a new station near Hollywood/Highland via Crenshaw Boulevard, Venice Boulevard, San Vicente Boulevard, La Cienega Boulevard, Santa Monica Boulevard, and Highland Avenue.

Figure 2-4 shows both alignment alternatives with an option in the southern portion of the alternative. The option is a cross-country route directly to Midtown Crossing. Each segment is described in detail below.

![Figure 2-4 San Vicente & La Cienega Alternative](image-url)
**Crenshaw Boulevard Segment**

The alignment alternative as defined for this study extends north from the existing underground Metro Crenshaw/Expo station, continuing north in twin bored tunnels along Crenshaw Boulevard to a proposed underground station at the intersection of Crenshaw Boulevard and Adams Boulevard. Two options have been identified for the segment between Adams Boulevard and the intersection of Pico Boulevard and San Vicente Boulevard:

**Crenshaw-Venice Boulevard to Midtown Crossing:**

The base alternative continues north from the intersection of Crenshaw Boulevard and Adams Boulevard in twin bored tunnels along Crenshaw Boulevard to Venice Boulevard. The alignment then turns west and transitions from an underground alignment to an aerial alignment within Venice Boulevard near the West Boulevard Bridge. The aerial guideway continues north on San Vicente Boulevard with an aerial station along San Vicente Boulevard between Venice Boulevard and Pico Boulevard, then descends into the median of San Vicente Boulevard (Figure 2-5).

![Figure 2-5 Crenshaw-Venice Blvd. to Midtown Crossing](image)

**Cross-country to Midtown Crossing (Option):**

The Midtown cross-country option (Figure 2-6) continues north from Adams Boulevard in twin bored tunnels running directly (cross-country) to a point near the intersection of Venice Boulevard and San Vicente Boulevard where the alignment turns west to align with San Vicente Boulevard and then transitions to an aerial configuration north of Pico Boulevard. An underground station is proposed along San Vicente between Venice Boulevard and Pico Boulevard. The alignment then ascends into the median of San Vicente Boulevard.

The Midtown cross-country option yields a shorter overall route length and thus travel time, but includes more bored tunnel length as well as an underground station in lieu of an aerial station, resulting in a higher capital cost.

![Figure 2-6 Cross-country to Midtown Crossing (Option)](image)
San Vicente Boulevard Segment

The San Vicente Boulevard segment is primarily at-grade from Midtown Crossing to Olympic Boulevard with aerial grade separations at La Brea Avenue and Olympic Boulevard/Fairfax Avenue. The at-grade configuration along San Vicente creates grade crossings at Redondo Boulevard and Hauser Boulevard and may also restrict through-traffic at other existing cross streets. An aerial station is proposed at the intersection of Olympic Boulevard and Fairfax Avenue.

North of the grade separation at Olympic Boulevard, the alignment continues at-grade across McCarthy Vista then transitions to an aerial guideway near Warner Drive to cross Wilshire Boulevard. An aerial station is proposed at the intersection of Wilshire Boulevard and San Vicente Boulevard. Placement of vertical circulation and pedestrian access to the station at the northwest corner of the intersection of Wilshire Boulevard is important to maintain proximity to the Purple Line station access at La Cienega. The Purple Line station includes a “knock-out panel” approximately 500 feet from San Vicente Boulevard near Gale Drive, which could be used to provide a closer access point for transfers. A potential extension to the mezzanine of the Purple Line station would offer even more direct access for transfers.

North of Wilshire Boulevard, the alignment briefly transitions to an at-grade configuration for the segment between Orlando Avenue and Clifton Way. The alignment then returns to an aerial configuration over the intersection of San Vicente Boulevard, La Cienega Boulevard, Burton Way, and 3rd Street, near the Beverly Center.

Two alternatives have been identified for the alignment between the intersection of San Vicente Boulevard and La Cienega Boulevard and the intersection of Santa Monica Boulevard and La Cienega Boulevard. This feasibility study identifies both options as independent alternatives.

San Vicente Alternative:

The San Vicente Alternative (Figure 2-7) continues in an aerial configuration northwest along San Vicente Boulevard into the City of West Hollywood. The alignment turns east at Santa Monica Boulevard into the Metro Division 7 maintenance facility, transitioning to an underground configuration within the Metro ROW. The alignment then continues east in twin bored tunnels under Santa Monica Boulevard.
La Cienega Alternative:

The La Cienega Alternative (Figure 2-8) alignment is shorter than the San Vicente alignment and eliminates potential impacts to civic spaces near San Vicente Boulevard and Santa Monica Boulevard in West Hollywood, while still providing access to West Hollywood via stations at the Beverly Center and Santa Monica Boulevard. This alternative travels in an aerial configuration along La Cienega from the intersection of San Vicente Boulevard and then transitions underground before reaching Santa Monica Boulevard. The ROW of La Cienega Boulevard can accommodate the columns necessary for the aerial guideway but may impact on-street parking along the guideway transition approaching Santa Monica Boulevard. An underground station is proposed near the intersection of Santa Monica Boulevard, La Cienega Boulevard, and Holloway Drive.

Santa Monica Boulevard to Hollywood Segment

The San Vicente and La Cienega alternatives continue eastbound in twin-bore tunnels along Santa Monica Boulevard and then turn north on Highland Avenue to the terminus at the Metro Hollywood/Highland Station. This segment includes underground stations at Fairfax Avenue and La Brea Avenue. After the La Brea Avenue station, the alignment continues eastbound then turns cross-country onto Highland Avenue and continues to a new underground station and terminal tracks at Hollywood Boulevard and Highland Avenue. The new underground station would connect to the existing underground Hollywood/Highland station via existing knock-out panels to facilitate transfers between the terminus of the Crenshaw Northern Extension and the Metro Red Line. The vertical positioning of this station is important in determining the access configuration which affects where the terminal “tail tracks” can be placed and whether or not the line can be extended north of the Metro Red Line in the future.

2.2.2 Station Locations

This section includes the station locations as defined for the purposes of analysis in this feasibility study. In the cases where a station location is shared across multiple alternatives, the applicable alternative(s) are listed in parentheses following the station name.
- **Station Description**: Existing underground station with 270' platform length within Crenshaw Boulevard right-of-way (Figure 2-9) built as part of the Crenshaw light rail project.
- **Station Area**: Commercial corridor and a mix of single-family and multi-family developments.
- **Station Location**: This station is at the intersection of two major arterial streets and between two Metro joint development sites.
- **Potential Station Access Points**: at any of four corners of the intersection of Crenshaw Boulevard and Exposition Boulevard. Existing access to the Crenshaw project is provided at only the southeast corner.
**Station Description:** Underground station with mezzanine in cut-and-cover box with 270’ platform length within Crenshaw Boulevard right-of-way (Figure 2-10).

**Station Area:** Light commercial corridor and multi-family residential developments with neighborhood retail.

**Station Location** at the intersection of two major arterial streets and adjacent to a major freeway.

**Potential Station Placement** north or south of intersection on Crenshaw Boulevard, or at the intersection for the cross-country alignment option. The final station placement will depend upon appropriate access points, track geometry, right-of-way availability, and operational factors.

**Potential Station Access Points** at any of four corners of the intersection of Crenshaw Boulevard and Adams Boulevard. The existing gas stations at each corner provide opportunities for station access plazas/entrances and/or potential joint development.
**Definition of Alternatives**

- **Station Description:**
  - Crenshaw-Venice to Midtown Crossing (Aerial Station): Aerial station with no mezzanine and 270' platform length within San Vicente Boulevard right-of-way and/or on commercial redevelopment site.
  - Cross-country to Midtown Crossing Option (Underground Station): Underground station with mezzanine in cut-and-cover box with 270' platform length within San Vicente Boulevard ROW and/or on commercial redevelopment site (Figure 2-11).

- **Station Area:** Multiple commercial shopping centers surrounded by single-family residences.
- **Station Location** is at the intersection of three major arterial streets and an existing bus transfer location.
- **Potential Station Placement** along San Vicente Boulevard between Venice Boulevard and Pico Boulevard. The final station placement will depend upon appropriate access points, track geometry, right-of-way availability, and operational factors.
- **Potential Station Access Points** along the west side of San Vicente between Venice Boulevard and Pico Boulevard as well as an aerial connection over San Vicente to the Metro Pico/Rimpau Transit Center. Existing parking lots and strip centers in the station area provide opportunities for potential joint development.
• **Station Description**: Aerial station with 270’ platform length within San Vicente Boulevard right-of-way. (Figure 2-12).
• **Station Area**: Multifamily residential, light commercial developments and Little Ethiopia restaurant district.
• **Station Location** at the intersection of three major arterial streets on a major east-west transit corridor and about halfway between adjacent stations.
• **Potential Station Placement** along San Vicente Boulevard over the intersection of Olympic Boulevard and Fairfax Boulevard. The final station placement will depend upon appropriate access points, track geometry, ROW availability, and operational factors.
• **Potential Station Access Points** at all four corners of the intersection of Fairfax Avenue and San Vicente Boulevard as well as along the north side of San Vicente Boulevard between Olympic Boulevard and Fairfax Avenue.
• **Station Description:** Aerial station with 270’ platform length within San Vicente Boulevard right-of-way. (Figure 2-13).

• **Station Area:** High density commercial, multi-family residential developments; High-rise office and medical commercial and strip retail and connection to Metro Purple Line La Cienega station.

• **Station Location** is a transfer point with the Metro Purple Line and on a major arterial corridor (Wilshire Boulevard).

• **Potential Station Placement** on San Vicente Boulevard just north of Wilshire Boulevard. The final station placement will depend upon appropriate access points, track geometry, right-of-way availability, operational factors, and proximity to knock-out panel of Purple Line Extension La Cienega station.

• **Potential Station Access Points** at north corners of San Vicente Boulevard and Wilshire Boulevard. The northwest corner of San Vicente Boulevard and Wilshire Boulevard is about 500’ to a Purple Line La Cienega Station knock-out panel at Gale Drive. There may be potential to configure station access points into existing commercial building plazas.
**Alignment Alternatives**

- Underground
- At-Grade
- Aerial
- Potential Station Box Location
- Typical Station Box Length

**Access**

- Potential Station Access

*Figure 2-14 San Vicente/Beverly/3rd Station (San Vicente Alternative)*

- **Station Description**: Aerial station with or without mezzanine and 270' platform length within San Vicente Boulevard right-of-way. *(Figure 2-14).*
- **Station Area**: High density commercial corridor, including the Beverly Center, a major retail and entertainment center, and Cedars Sinai, a large medical campus.
- **Station Location**: at a major commercial center as well as the east-west transit corridors of Beverly Boulevard and Third Street.
- **Potential Station Placement**: along San Vicente Boulevard between 3rd Street and Beverly Boulevard. Station placement will depend upon appropriate access points, track geometry and operational factors.
- **Potential Station Access Points**: along both sides of San Vicente Boulevard between 3rd Street and Beverly Boulevard. Access and vertical circulation would need to be incorporated into existing buildings including aerial connections directly into the Beverly Center and/or Cedars Sinai.
San Vicente/Santa Monica

Alignment Alternatives

- Underground
- At-Grade
- Aerial
- Potential Station Box Location
- Typical Station Box Length

Access

Potential Station Access

Figure 2-15 San Vicente/Santa Monica Station (San Vicente Alternative)

- **Station Description:** Aerial station with 270’ platform length within San Vicente Boulevard right-of-way. (Figure 2-15).
- **Station Area:** High-density commercial corridor located close to West Hollywood Park and Library, Pacific Design Center, Santa Monica Boulevard retail and entertainment district, as well as Melrose Avenue retail district, and surrounded by multi-family residential developments and City of West Hollywood municipal buildings.
- **Station Location** at a major commercial center and the municipal center of the City of West Hollywood.
- **Potential Station Placement** along San Vicente Boulevard just before the turn to Santa Monica Boulevard over the County Sherriff and Metro Division 7 sites. Station placement will depend upon appropriate access points, track geometry, right-of-way availability, and operational factors. The station could potentially be located within the Metro Division 7 and County Sherriff’s site to minimize impact to San Vicente Boulevard and West Hollywood Park.
- **Potential Station Access Points** along either side of San Vicente Boulevard south of Santa Monica Boulevard. There may be potential to configure station access points directly into the Pacific Design Center and West Hollywood Park. Impacts to event venues in the area must be considered with access placement. There is an opportunity to incorporate the station within a potential joint development on the Metro Division 7 and County Sherriff’s site.
**Station Description**: Aerial station with 270’ platform length within San Vicente Boulevard right-of-way. (Figure 2-16).

**Station Area**: High density commercial corridor, including the Beverly Center, a major retail and entertainment center, and Cedars Sinai, a large medical campus.

**Station Location**: at a major commercial center as well as the east-west transit corridors of Beverly Boulevard and Third Street.

**Potential Station Placement**: along La Cienega Boulevard between 3rd Street and Beverly Boulevard. The final station placement will depend upon appropriate access points, track geometry, right-of-way availability, and operational factors.

**Potential Station Access Points**: along both sides of La Cienega between 3rd Street and Beverly Boulevard. There may be potential to configure station access points into existing commercial plaza, including an aerial connection directly into the Beverly Center or Beverly Connection retail centers.
• **Station Description:** Underground station with mezzanine and 270’ platform length within the Santa Monica Boulevard right-of-way (Figure 2-17).

• **Station Area:** Mid-density commercial corridor with multi-family residential developments, located close to Sunset Strip and the entertainment district.

• **Station Location** proximal to the Santa Monica Boulevard commercial corridor, the City of West Hollywood municipal center on San Vicente, and the Sunset Strip.

• **Potential Station Placement** on Santa Monica Boulevard just after the turn from La Cienega Boulevard. The decision to place the station underground on Santa Monica after the turn rather than in an aerial configuration on La Cienega is due to the need for a tunnel launch site and the opportunity for redevelopment, construction staging, and station access provided by the existing strip development in the triangle formed by Santa Monica Boulevard, La Cienega Boulevard, and Holloway Drive. The final station placement will depend upon appropriate access points, track geometry, ROW availability, and operational factors.

• **Potential Station Access Points** along both sides of Santa Monica Boulevard.
**Definition of Alternatives**

Figure 2-18 Santa Monica/Fairfax (San Vicente and La Cienega Alternatives)

- **Station Description:** Underground station with mezzanine and 270’ platform length within the Santa Monica Boulevard right-of-way. (Figure 2-18).
- **Station Area:** Mid-density commercial corridor with multi-family residential developments.
- **Station Location** at the intersection of two major arterials about halfway between adjacent stations.
- **Potential Station Placement** is on Santa Monica Boulevard at any point east or west of Fairfax Avenue. The final station placement will depend upon appropriate access points, track geometry, ROW availability, and operational factors.
- **Potential Station Access Points** along both side of Santa Monica Boulevard and at the intersection of Santa Monica Boulevard and Fairfax Avenue. Existing parking lots and strip centers north of the station provide opportunity for station entrances and potential joint development. The existing retail uses on the southwest corner of the intersection are City-designated historic buildings.
• **Station Description**: Underground station with mezzanine and 270' platform length within the Santa Monica Boulevard right-of-way (Figure 2-19).

• **Station Area**: Mid-density commercial corridor, including the West Hollywood Gateway retail center and The Lot Studios, with multi-family and single family residential developments.

• **Station Location**: at the intersection of two major arterials on the eastern edge of West Hollywood.

• **Potential Station Placement**: on Santa Monica Boulevard at any point east or west of La Brea Avenue. The final station placement will depend upon appropriate access points, track geometry, ROW availability, and operational factors.

• **Potential Station Access Points**: along both sides of Santa Monica Boulevard, near the intersection of Santa Monica Boulevard and La Brea Avenue. There is potential to incorporate station access into an existing retail center and/or joint development on the east side of La Brea Avenue.
• **Station Description:** Underground terminal LRT station with 270' platform length with direct connection to existing Metro Red Line Hollywood/Highland Station. The station may need to be deeper than standard to facilitate terminal “tail tracks” under the Metro Red Line station box. Alternatively, a shallow station would place the platforms farther from the Red Line station but reduce vertical circulation and allow direct tie-in to the Red Line mezzanine (Figure 2-20).

• **Station Area:** High-density regional entertainment and retail center, including the Hollywood/Highland Entertainment Complex, the Hollywood Theater District, and the Hollywood Walk of Fame. The existing Metro Red Line entrance is on the north side of Hollywood Boulevard, just west of Highland Avenue.

• **Station Location** is the terminus of the study alignments at a major activity center and the transfer point to the regional Metro Rail system and the San Fernando Valley.

• **Potential Station Placement** on Highland Avenue between Selma Avenue and Hollywood Boulevard. The final station placement will depend upon appropriate access points, track geometry, right-of-way availability, and operational factors.

• **Potential Station Access Points** along both sides of Highland Avenue as well as potential for a direct underground connection to the existing Metro Red Line Hollywood/Highland Station. Additional potential access to the Hollywood/Highland station could be provided by activating an existing knock-out panel near the southeast corner of the intersection.
2.3 Fairfax Alternative

2.3.1 Alignment and Configuration

The Fairfax Alignment Alternative is a double-track guideway approximately 8.1 miles in length extending from the Crenshaw/Exposition Station of the Crenshaw line (under construction) to a new station near Hollywood/Highland via Crenshaw Boulevard, Venice Boulevard, San Vicente Boulevard, Fairfax Avenue, Santa Monica Boulevard, and Highland Avenue. Figure 2-25 shows the alignment and options. The Fairfax Alternative also includes the Midtown cross-country option and underground station as an option, similar to the San Vicente and La Cienega Alternatives.

![Fairfax Alternative Map](image)

**Figure 2-21 Fairfax Alternative**

Crenshaw Boulevard and San Vicente Boulevard Segments

The options for the Crenshaw Boulevard and San Vicente Boulevard Segments of the Fairfax Alignment Alternative are the same as described for the San Vicente and La Cienega Alternatives until the grade separation and station described at the intersection with Olympic Boulevard and Fairfax Avenue.

Fairfax Avenue Segment

The Fairfax Alternative would transition from at-grade to an underground configuration within the right-of-way of San Vicente Boulevard before crossing under Olympic Boulevard and turning up Fairfax Avenue. The alignment would run north in either a cut-and-cover or twin bored tunnels along Fairfax Avenue to an underground station near Wilshire Boulevard and Fairfax Avenue. This underground station would connect to the Purple Line underground station (under construction), by utilizing knock out panels, to facilitate transfers between the two lines. The Fairfax Alignment would continue north in twin bored tunnels along Fairfax Avenue to Santa Monica Boulevard including underground stations between 3rd Street and Beverly Boulevard and at Santa Monica Boulevard.
Santa Monica Boulevard to Hollywood Segment

The Fairfax Avenue Alternative would follow the same description as the San Vicente Alternative from the intersection of Santa Monica Boulevard and Fairfax Avenue to the terminus at Hollywood/Highland Station.

2.3.2 Station Locations

This section includes the potential station locations unique to the Fairfax Alternative. Refer to the San Vicente and La Cienega Alternatives section for stations that are shared among the alternatives.
**Connecting Metro Lines**  
*Alignments & Station Boxes*
- Red Line
- Purple Line (Existing & Future)
- Expo Line
- Purple Line Station Entrance
- Purple Line Knock-Out Panel

**Alignment Alternatives**
- Underground
- At-Grade
- Aerial
- Potential Station Box Location
- Typical Station Box Length

**Access**
- Potential Station Access

---

**Figure 2-22 Fairfax/Wilshire Station (Fairfax Alternative)**

- **Station Description:** Deep underground LRT station with 270’ platform length located within the Fairfax Avenue right-of-way with features to facilitate connection to the Metro Purple Line. The station would be deeper than typical to pass under the Metro Purple Line station box and tunnels (Figure 2-22).
- **Station Area:** High-density entertainment and commercial center with multi-family developments, including the LA County Museum of Art, Petersen Automotive Museum, Park La Brea complex and several office towers along Miracle Mile. The Metro Purple Line station entrance access plaza will be located on the southeast corner of Wilshire Boulevard and Orange Grove Avenue, one block east of Fairfax Avenue.
- **Station Location** is a transfer point with the Metro Purple Line, a regional activity center, and on a major arterial corridor (Wilshire Boulevard).
- **Potential Station Placement** on Fairfax Avenue either north or south of Wilshire Boulevard. The final station placement will depend upon appropriate access points, track geometry, right-of-way availability, phasing and constructability, and operational factors. Placement on the north side of Wilshire Boulevard may provide better access to the County museums if new vertical circulation is incorporated with the project.
- **Potential Station Access Points** along both sides of Fairfax Avenue including potential connection directly into museum buildings or office tower plazas. There is also potential for a direct underground connection to the Metro Purple Line Station.
Figure 2-23 Fairfax/Beverly/3rd/Beverly (Fairfax Alternative)

- **Station Description:** Underground station with mezzanine and 270’ platform length within the right-of-way of Fairfax Avenue (Figure 2-23).
- **Station Area:** Mid-density commercial and retail center, including The Grove, Farmers Market, and CBS Television City.
- **Station Location** at the intersection of two major arterials midway between adjacent stations within a major activity center.
- **Potential Station Placement** on Fairfax Avenue between 3rd Street and Beverly Boulevard. Ultimately some preference should be given to 3rd Street based on the screening above. The final station placement will depend upon appropriate access points, track geometry, right-of-way availability, and operational factors.
- **Potential Station Access Points** along the east side of Fairfax Avenue in front of the Farmers Market and the Grove as well as on the west side of Fairfax Avenue across from CBS Television City.
• **Station Description:** Underground LRT station with mezzanine and 270' platform length within the right-of-way of Fairfax Avenue, Santa Monica Boulevard, and adjacent commercial properties (Figure 2-24).

• **Station Area:** Mid-density commercial and multi-family residential developments.

• **Station Location** at the intersection of two major arterials and is a major activity center and transit hub.

• **Potential Station Placement** near the intersection of Fairfax Avenue and Santa Monica Boulevard on a diagonal between two curves to place the station as closely to the intersection as possible. Alternate track alignments for the curve may place the station in the public right-of-way but farther from the intersection (Figure 2-24). The final station placement will depend upon appropriate access points, track geometry, right-of-way availability, and operational factors.

• **Potential Station Access Points** along both sides of Santa Monica Boulevard and at the intersection of Santa Monica Boulevard and Fairfax Avenue. The existing parking lot on the northeast corner could accommodate a station entrance/plaza and potential joint development. The existing retail uses on the southwest corner of the intersection are City-designated historic buildings.
2.4 La Brea Alternative

2.4.1 Alignment and Configuration

The La Brea Alternative is a double-track guideway approximately 6.3 miles in length extending from the Crenshaw/Exposition Station of the Crenshaw line (under construction) to a new station near Hollywood/Highland via Crenshaw Boulevard, Venice Boulevard, San Vicente Boulevard, and La Brea Avenue. Figure 2-25 shows the alignment and options. The alternative, as defined for the purposes of this study, terminates at Hollywood/Highland in an underground station via a cross-country bored tunnel. Additional terminus options include an at-grade station on Hollywood, an aerial station on Highland, and an underground cut-and-cover alignment along Sunset, terminating in an underground station on Highland. The La Brea Alternative also includes the Midtown cross-country option and underground station as an option, similar to the San Vicente and La Cienega Alternatives.

![Figure 2-25 La Brea Alternative](image)

**Crenshaw Boulevard and San Vicente Boulevard Segments**

The Crenshaw Boulevard and San Vicente Boulevard segments of the La Brea Alignment Alternative are the same as described for the San Vicente and La Cienega Alternatives until the grade separation at La Brea Avenue.

**La Brea Avenue Segment**

After ascending from the median of San Vicente Boulevard to cross the ravine at La Brea Avenue, the aerial guideway crosses the northbound lanes of San Vicente Boulevard turning north onto La Brea Avenue to continue along La Brea for approximately 0.9 miles to an aerial station at Wilshire Boulevard that would facilitate transfers to the Purple Line underground station. The aerial alignment then continues north along La Brea Avenue for approximately 2 miles to Santa Monica Boulevard including a station at Beverly Boulevard.
Santa Monica Boulevard to Hollywood Segment

In addition to the baseline alternative, two additional options were identified for the terminus of the alignment between the intersection of La Brea Avenue and Santa Monica Boulevard and the Hollywood/Highland station.

**La Brea with Underground Highland Avenue Station:**

The La Brea Alternative transitions within the La Brea Avenue right-of-way from an aerial guideway to underground south of the intersection with Santa Monica Boulevard. The alignment continues north with an underground station before turning cross-country off of La Brea Avenue with an “S” curve to align with Highland Avenue and terminate at an underground station at Hollywood/Highland (Figure 2-26). The new underground station would be connected to the existing underground Hollywood/Highland station by utilizing knock-out panels to facilitate transfers between the terminus of the Crenshaw Northern Extension and the Metro Red Line.

**La Brea with At-Grade Hollywood Boulevard Station Option:**

The La Brea with At-Grade Hollywood Station Option (Figure 2-27) continues from an aerial station at Santa Monica Boulevard north along La Brea Avenue for 0.75 miles and then transitions within the right-of-way to an at-grade configuration south of the intersection with Hollywood Boulevard. The alignment turns east onto Hollywood Boulevard at-grade and terminates at an at-grade station near the existing underground Hollywood/Highland station. The at-grade alignment on Hollywood Boulevard would be a center-running, dedicated guideway with traffic and pedestrian crossings. This option assumes a significant street reconfiguration would accompany the project along Hollywood Boulevard between La Brea Avenue and Highland Avenue, including potentially transforming the street into a pedestrian-and-transit-oriented plaza.

**La Brea with Aerial on Sunset Option:**

The La Brea with Aerial on Sunset Option (Figure 2-28) has an aerial station at Santa Monica Boulevard and continues north along La Brea Avenue, making a right-angle turn onto Sunset Boulevard. The aerial guideway follows Sunset Boulevard, either remaining aerial or transitioning to an underground cut-and-cover configuration within the Sunset ROW. An aerial or cut-and-cover guideway continues to a right-angle turn onto Highland Avenue, terminating in an aerial or underground station within the right-of-way of Highland Avenue south of Hollywood Boulevard.
2.4.2 Station Locations
This section includes the potential station locations unique to the La Brea Alternative. Refer to the San Vicente and La Cienega Alternatives section for stations that are shared among the alternatives.

![Diagram of Wilshire/La Brea Station](image)

**Figure 2-29 La Brea/ Wilshire Station (La Brea Alternative)**

- **Station Description:** Aerial station with or without mezzanine and 270’ platform length within the right-of-way of La Brea Avenue (Figure 2-29).
- **Station Area:** High-density commercial and office uses along Miracle Mile, as well as multi-family residential developments and the Metro Purple Line transit plaza.
- **Station Location** is a transfer point with the Metro Purple Line and on a major arterial corridor (Wilshire Boulevard).
- **Potential Station Placement** just north of the intersection Wilshire Boulevard and La Brea Avenue, adjacent to the proposed Purple Line access plaza. The final station placement will depend upon appropriate access points, track geometry, right-of-way availability, and operational factors. There may be an opportunity to locate the station off-street incorporated with future joint development on Metro-owned sites currently being used for Purple Line construction.
- **Potential Station Access Points** on both sides of La Brea Avenue as well as potential for direct connection to the Metro Purple Line subway station at the northwest corner of the intersection. There may be an opportunity to integrate station access with future joint development on Metro-owned sites currently being used for Purple Line construction.
La Brea/Beverly

Alignment Alternatives
- Underground
- At-Grade
- Aerial

Access
- Potential Station Access

Figure 2-30 La Brea/Beverly Station (La Brea Alternative Only)

- **Station Description**: Aerial LRT station with no mezzanine and 270’ platform length within the right-of-way of La Brea Avenue (Figure 2-30).
- **Station Area**: Low-rise neighborhood retail, multi-family residential, commercial, and strip retail.
- **Station Location**: at the intersection of two major arterials and about halfway between adjacent stations.
- **Potential Station Placement**: north, south, or in the middle of intersection with Beverly Boulevard. The final station placement will depend upon appropriate access points, track geometry, right-of-way availability, and operational factors.
- **Potential Station Access Points**: at all four corners of La Brea Avenue and Beverly Boulevard. With no mezzanine, adequate access would be required from at least each side of La Brea Avenue and moving from the northbound to southbound station side platforms requires returning to street level.
• **Station Description:**
  - Option 1 - Underground LRT Station with mezzanine and 270’ platform length within the right-of-way of La Brea Avenue.
  - Option 2 - Aerial LRT station with no mezzanine and 270’ platform length within the right-of-way of La Brea Avenue.

• **Station Area:** Mid-density commercial corridor, including the West Hollywood Gateway retail center and the Lot Studios, with multi-family and single family residential developments.

• **Station Location** at the intersection of two major arterials about half-way between adjacent stations. For the La Brea Alignment Alternative this would be the only station located within the City of West Hollywood.

• **Potential Station Placement** just north of Santa Monica Boulevard for the underground option; for the aerial station option placement can be north of, south of, or over the intersection. The final station placement will depend upon appropriate access points, track geometry, right-of-way availability, and operational factors. There may be an opportunity to locate the station off-street incorporated into future joint development within the retail strip center or industrial sites along the east side of La Brea Avenue.

• **Potential Station Access Points** along both sides of Santa Monica Boulevard and at the intersection of Santa Monica Boulevard and La Brea Avenue. There may be an opportunity to incorporate station access into an existing retail center and/or joint development on the east side of La Brea Avenue.
**Definition of Alternatives**

- **Station Description:**
  - Underground station and terminal with 270' platforms within the right-of-way of Highland Avenue with direct pedestrian connection to Metro Red Line Hollywood/Highland Station (Figure 2-20).
  - Aerial station and terminal with 270' platforms within the right-of-way of Highland Avenue.
  - At-grade station and terminal with 270' platform length within the Hollywood Boulevard right-of-way (Figure 2-32).

- **Station Area:** High-density regional entertainment and retail center, including the Hollywood/Highland Entertainment Complex, the Hollywood Theater District, and the Hollywood Walk of Fame. The Metro Red Line transit plaza is also located at this intersection.

- **Station Location** is the terminus of the study alignments at a major activity center and the transfer point to the regional Metro system via Hollywood and the San Fernando Valley.

- **Potential Station Placement** on Hollywood Boulevard or Highland Avenue depending on guideway configuration, street geometry, and terminal track geometry including tail tracks and/or auxiliary platforms.

- **Potential Station Access Points** on both sides of Hollywood Boulevard or Highland Avenue.

---

**Alignment Alternatives**

- Underground
- At-Grade
- Aerial
- Potential Station Box Location
- Typical Station Box Length

**Access**

- Potential Station Access

Figure 2-32 Hollywood/Highland At-Grade Station (La Brea Alternative)
2.5 Vermont Alternative

2.5.1 Alignment and Configuration

The Vermont Alignment Alternative is a double-track guideway approximately 5 miles in length extending from the Crenshaw/Exposition Station of the Crenshaw line (under construction) to a new station near the existing Wilshire/Vermont station on the Metro Purple Line via Crenshaw Boulevard, Olympic Boulevard, and Vermont Avenue. Figure 2-33 shows the alignment.

![Diagram showing the alignment of the Vermont Alternative](image)

**Figure 2-33 Vermont Alternative**

**Crenshaw Boulevard Segment**

The Crenshaw Boulevard segment of the Vermont Alternative is the same as described for the San Vicente and La Cienega Alignment Alternatives from the existing Crenshaw/Expo station to the intersection of Crenshaw Boulevard and Venice Boulevard. The Vermont Alternative would have an underground station near this intersection or at Pico Boulevard, then continues northeast in twin bored tunnels along Crenshaw Boulevard, turning east at Olympic Boulevard.

**Olympic Boulevard to Vermont**

The Vermont Alternative would continue east in twin bored tunnels along Olympic Boulevard to Western Avenue where an underground station is proposed then to another underground station at Normandie Avenue. After turning north at Vermont Avenue, the alignment would continue in twin bored tunnels to a new underground station at Wilshire Boulevard and Vermont Avenue that would facilitate transfers to the Metro Red and Purple Lines.

2.5.2 Station Locations

This section includes the potential station locations unique to the Vermont Alternative. The Vermont Alternative shares two stations with the San Vicente and La Cienega Alternatives. Refer to the San Vicente and La Cienega Alternatives section for stations that are shared among the alternatives.
• **Station Description:** Underground station with mezzanine and 270’ platform length within Crenshaw Blvd. right-of-way (Figure 2-34).

• **Station Area:** The Crenshaw/Venice Station will be located in a mid-density residential corridor with single and multi-family housing; the Crenshaw/Pico Station will be in a mid-density residential corridor with single and multi-family housing as well as businesses at the intersection.

• **Station Location** at the intersection of two major arterials about halfway between adjacent stations.

• **Potential Station Placement** can be north, south, or at the intersection of Crenshaw Boulevard and Venice or Pico Boulevards. The final station placement will depend upon appropriate access points, track geometry, right-of-way availability, and operational factors.

• **Potential Station Access Points** on all four corners of the intersection of Crenshaw Boulevard and Venice Boulevard, or the southwest corner of the intersection of Crenshaw Boulevard and Pico Boulevard.
**Alignment Alternatives**
- Underground
- At-Grade
- Aerial
- Potential Station Box Location
- Typical Station Box Length

**Access**
- Potential Station Access

---

- **Station Description:** Underground station with mezzanine and 270’ platform length within Olympic Boulevard right-of-way (Figure 2-35).
- **Station Area:** Mid-density commercial corridor with multi-family housing, including the Koreatown Galleria Market.
- **Station Location:** At the intersection of two major arterials and about half-way between adjacent stations.
- **Potential Station Placement:** Can be east, west or at the intersection of Olympic Boulevard and Western Avenue. The final station placement will depend upon appropriate access points, track geometry, right-of-way availability, and operational factors.
- **Potential Station Access Points:** On all four corners of the intersection of Olympic Boulevard and Western Avenue include the potential to provide direct connection into the Galleria Market.
• **Station Description**: Underground station with mezzanine and 270’ platform length within Olympic Boulevard right-of-way (Figure 2-36).

• **Station Area**: Mid-density commercial and residential center located in Koreatown, including offices, retail, an elementary school, park, and multi-family residential developments.

• **Station Location** at the intersection of two major arterial streets about halfway between adjacent stations.

• **Potential Station Placement** on Olympic Boulevard east, west, or splitting the intersection of Olympic Boulevard and Normandie Avenue.

• **Potential Station Access Points** along both sides of Olympic Boulevard at all corners of the intersection.
**Connecting Metro Lines**

*(Alignments & Station Boxes)*
- Red Line
- Purple Line (Existing & Future)
- Expo Line
  - Purple Line Station Entrance
  - Purple Line Knock-Out Panel

**Alignment Alternatives**
- Underground
- At-Grade
- Aerial
- Potential Station Box Location
- Typical Station Box Length

**Access**
- Potential Station Access

**Figure 2-37 Wilshire/Vermont Station (Vermont Alternative)**

- **Station Description**: Underground LRT station with 270' platform length with features to facilitate connection to existing Metro Purple/Red Line. The station may need to be deeper than standard to facilitate tail tracks under the Metro Purple/Red Line tunnels (Figure 2-37).
- **Station Area**: High-density commercial and residential center located in central Koreatown, including office towers and residential towers. The Metro Purple/Red Line transit plaza is also located at this intersection.
- **Station Location** is the terminus of the study alignment at a major activity center and the transfer point to the regional Metro Rail system.
- **Potential Station Placement** can be on Vermont Avenue north, south, or splitting the intersection of Vermont Avenue and Wilshire Boulevard. The final station placement will depend upon appropriate access points, track geometry, right-of-way availability, and operational factors.
- **Potential Station Access Points** along both sides of Vermont Avenue at Wilshire Boulevard. Significant modifications to the basements and ground-level of existing buildings would be required to provide access on three out of four corners of the intersection. The new underground station would ideally connect directly to the existing mezzanine level of the Metro Red and Purple Lines’ Wilshire/Vermont station, but this may be precluded by the existing mixed-use development and underground parking that surrounds the station. Thus, transfers to the Red and Purple Lines here may have to occur at the surface.
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3. Analysis

The Metro Board of Directors has adopted a Performance Metrics Framework to be used in analyzing proposed major transit projects such as the Crenshaw Northern Extension. The adopted framework identifies goals and objectives for transit improvement projects as well as specific performance measures that can be used to analyze the achievement of these goals and objectives.

The following goals have been used for evaluation of the preliminary alternatives defined for the Crenshaw Northern Extension Feasibility/Alternatives Analysis Study. Each goal is consistent with the goals established in the adopted 2016 Southern California Association of Governments (SCAG) Regional Transportation Plan (RTP) and Metro’s 2009 Long Range Transportation Plan. Specific objectives and performance measures for each goal are identified in Table 3-1.

**Goal 1 – Improve Mobility and System Connectivity:** The project should improve public transit service and mobility for trips to, from, and within the Study Area, particularly for transit dependent populations, while enhancing connections to the existing and future transit network, including the Metro Red and Purple Lines.

**Goal 2 – Maximize Cost Effectiveness:** The project should maximize benefits relative to costs due to the scarcity of funding and resources, and to enhance project competitiveness for potential federal and/or state transit funds.

**Goal 3 – Maximize Project Feasibility and Constructability:** The project should be financially feasible, based on Metro’s Long Range Transportation Plan and funding commitments, and minimize risks associated with project construction. The project should minimize impacts to existing structures and utilities.

**Goal 4 – Minimize Environmental Impacts/Maximize Environmental Benefits:** The project should minimize displacement of residents and businesses and impacts to existing communities. The project should reduce tailpipe/greenhouse gas emissions, vehicle-miles traveled (VMT), and burdens on the existing transportation network.
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3.1 Goal: Improve Mobility and System Connectivity

The five alternative alignments were evaluated against the following mobility and system connectivity criteria:

- Ridership
- User Benefit/Travel Time Savings
- Vehicle Miles Traveled (VMT) Reduction

3.1.1 Travel Demand Modeling

The travel demand model forecasts trips for all modes of transportation including automobile and transit. Transit ridership is listed by total number of trips on each transit line and at each station. Additionally, the model produces estimates of travel time savings which demonstrate the overall travel time savings that can be achieved with the transit alternative compared to the no-build condition.

Ridership projections are formed based on inputs to the Metro travel demand model including socioeconomic data, highway and transit network geometry, and predicted trip origins and destinations. The Metro Travel Demand model was calibrated specifically for evaluating the Crenshaw Northern Extension alternatives by updating the model inputs to reflect the latest assumptions in the 2016 SCAG RTP. Year 2012 was chosen as the base year because of the availability of Year 2011 Metro Transit On-Board Survey data for validation, as well as to be consistent with SCAG 2016 RTP assumptions.

The following performance measures were identified for use in evaluating each alternative’s ability to achieve the goal of Improving Mobility and System Connectivity:

- **Project Boardings** refers to the total number of additional daily rail transit trips on the entire Metro system due to the project. The number of trips is measured as the difference in total ridership compared to the no-build condition. This includes boardings at stations along the project alignment as well as outside of the project alignment.

- **New Rider Trips** refers to the number of daily trips taken on rail transit that would have otherwise been taken by personal auto in the no-build condition. This is an estimate of the number of new transit riders introduced to the Metro system due to the project.

- **Local Trips (within the study area)** refer to trips that are taken between two stations along the project alignment.

- **Through Trips (end-to-end trips)** refer to trips that are taken along the entire project alignment and that do not board or alight at intermediate stations. Trips may begin, or end at destinations near the termini and/or transfer via connecting lines to complete their journey.

- **On-or-off-in-the-Corridor Trips (to/from the study area)** refer to trips where the rider boards at a station on a connecting line and alights at a station on the project alignment or trips where riders board at a station on the project alignment and alights at a station outside the study area and/or on another line.

- **Travel Time Savings** is an estimate of the total time saved by commuters within, through, and to/from the study area due to the project rail alternatives. Travel time savings are measured in passenger-hours of travel time saved for all riders. Travel time savings are aggregated over all travelers in a region.
3.1.2 Ridership Modeling Results

Figure 3-1 shows the average daily total project boardings and new rider trips generated from the travel demand model. All alternatives are forecasted to have high ridership potential. However, the demand for regional and local travel varies significantly between the alternatives. Alternatives with longer alignments serving concentrations of destinations within the study area have a greater proportion of trips within the study area, while alternatives with a more direct alignment have a greater proportion of more regional trips traveling end-to-end on the project alignment. The variation of trips within the study area (Local Trips), through the project alignment (Through Trips), and to/from the study area (On-or-Off-in-the-Corridor Trips) are shown in Figure 3-2.

![Daily Ridership](image)

Figure 3-1: Daily Ridership

![Daily Ridership Breakdown](image)

Figure 3-2: Daily Ridership Breakdown
The forecasted ridership decreases among the alternatives from west to east. The longer, western alternatives have more stations and provide access to a higher density of activity centers than the eastern alternatives, resulting in higher ridership. This is reinforced by population and employment data collected within a 1/2-mile radius of proposed stations and compared only for the differing stations for the four western alternatives between San Vicente/Pico and Santa Monica/La Brea (Figure 3-3). Even when compared “per mile”, the longer western alignments provide much greater access to jobs and housing. The San Vicente and La Cienega alignments provide access to nearly 70,000 jobs within 1/2 mile of the proposed stations, or over 11,000 jobs per mile. These alignments provide access to over four times as many total jobs as the La Brea alignment which provides access to nearly 16,500 jobs, or about 5,100 jobs per mile. The Fairfax alignment provides access to over twice as many jobs as the La Brea alignment, nearly 40,000 jobs or about 8,300 per mile.
3.1.3 Travel Time Savings

The travel demand model estimates a total daily travel time savings compared to the no-build scenario to determine the user benefit of the alternative. Figure 3-4 shows the total average daily travel time savings due to the project. The total travel time savings range from 21,524 to 29,897 hours per day, with longer alignments having greater aggregate time savings due to higher ridership. Travel time savings can also be represented in average time saved per trip. Average time saved per trip is calculated by dividing the total aggregated time savings by the total daily trips (Figure 3-5).

![Daily Travel Time Savings](image)

**Figure 3-4: Travel Time Savings Per Day**

![Time Savings per Project Trip](image)

**Figure 3-5: Travel Time Savings per Project Trip**
3.1.4 Vehicle-Miles Traveled Reduction

The travel demand model estimates the number of new riders’ trips that would have otherwise been taken by personal automobile, and the corresponding reduction in vehicle-miles traveled (VMT). Figure 3-6 shows the annual VMT reduction estimated for the project alternatives. The La Brea Alternative has the largest VMT reduction of 383,930 miles per year, followed by the Fairfax Alternative at 358,888 miles per year.

![Reduction of Annual Vehicle Miles Traveled](image)

Figure 3-6: Reduction of Vehicle Miles Traveled

3.2 Goal: Maximize Cost Effectiveness

3.2.1 Cost Effectiveness Approach

The cost effectiveness performance measurements include average cost-per-trip and average cost-per-hour of time savings. Costs include capital, operations, and maintenance estimates. Capital cost estimates were prepared as bottom-up rough-order-of-magnitude (ROM) estimates following the FTA Standard Cost Category format. Annual operations and maintenance (O&M) cost estimates were prepared as ROM estimates based on revenue service hours calculated from a rough operating plan based on service headways and spans and applying an average unit cost per revenue service hour from Metro’s current system. Annualized capital costs were calculated by using Annualized Capital Cost (Replacement Cost) per FTA standard assumptions.

Annual ridership and time savings were calculated by multiplying the daily estimates by an annualization factor of 318. This factor takes into account that weekend and holiday ridership is less than weekday ridership.

The average cost-per-trip is calculated by dividing the total annualized capital and O&M cost by the estimated annual transit boardings. Cost-per-hour is calculated by dividing the total annualized cost divided by the annual time savings in hours.

---

1 Using $4.17 \times 10^4$ metric tons of CO$_2$E per mile and an annual factor of 318 x daily VMT reduction.
https://www.epa.gov/energy/greenhouse-gases-equivalencies-calculator-calculations-and-references
### 3.2.2 Cost Estimates

The cost estimates presented in this study are based on standard Metro design criteria and historical cost data from previous Metro rail projects. Any design elements beyond typical Metro standards such as custom aerial guideway components with architecturally significant features could increase costs.

The costs presented are in present value only (2017 dollars) and do not include cost escalation to future years. An estimate of the project cost in the year of expenditure would include an additional 2-4% of the project total per year, compounded, to the mid-point of anticipated construction.

**Table 3-2** presents the total estimated ROM capital cost for each alternative. Capital costs range from $3 to $4.7 billion. The La Brea Alternative has the lowest capital cost at $3.0 billion (as low as $2.4 billion with an at-grade option in Hollywood), with a higher cost per mile than the San Vicente and La Cienega Alternatives. The San Vicente and La Cienega Alternatives have costs of $4.3 and $4.4 billion, respectively, and the lowest costs per mile. The Fairfax Alternative has the highest cost at $4.7 billion with the second highest cost-per-mile. The Vermont Alternative has the highest cost per mile new.

The La Brea alternative has the lowest capital cost per annual project trip at $34,000/trip. The San Vicente, La Cienega and Vermont Alternatives have similar capital costs per annual trip between $46,000 and $48,000/trip. The Fairfax Alternative is most expensive at $52,000 per annual trip. **Figure 3-7** includes a reference line at $2.33 billion to represent the 2017 value of funds estimated to be available from Measure M, approved in 2016. This reference line is shown for discussion purposes only and does not suggest this is the funding limit for this project, as additional funds may ultimately be sought from multiple sources. None of the alternatives as defined for this study could be delivered without additional funding sources.

<table>
<thead>
<tr>
<th>ALT #</th>
<th>NAME OF ALTERNATIVE</th>
<th>TOTAL CAPITAL COST (BILLIONS)</th>
<th>UNIT COST PER MILE (MILLIONS)</th>
<th>CAPITAL COST PER TRIP (THOUSANDS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>San Vicente</td>
<td>$ 4.3</td>
<td>$ 449</td>
<td>$ 47</td>
</tr>
<tr>
<td>2</td>
<td>La Cienega</td>
<td>$ 4.4</td>
<td>$ 477</td>
<td>$ 48</td>
</tr>
<tr>
<td>3</td>
<td>Fairfax</td>
<td>$ 4.7</td>
<td>$ 575</td>
<td>$ 52</td>
</tr>
<tr>
<td>4</td>
<td>La Brea (Underground Station at Hollywood)</td>
<td>$ 3.0</td>
<td>$ 482</td>
<td>$ 34</td>
</tr>
<tr>
<td>5</td>
<td>Vermont</td>
<td>$ 3.6</td>
<td>$ 712</td>
<td>$ 46</td>
</tr>
</tbody>
</table>

**Figure 3-7: Capital Cost Estimate 2017$ (billions)**
3.2.2.A O&M Cost Estimates

Figure 3-8 shows the total estimated O&M costs for the alternatives. In general, as the project length, travel time, and thus estimated revenue-hours of operation increase, the annual O&M costs also increase.

![O&M Cost Estimates](image)

**Figure 3-8: Operations & Maintenance Cost Estimates of Alternatives**

3.2.2.B Annualized Capital and O&M Costs

Figure 3-9 shows the estimated rough-order-of-magnitude sum of annualized capital and O&M costs for each alternative. This combined result shows the greater impact of the annualized capital cost in comparing the alternatives.

![Annualized Capital and O&M Cost Estimates](image)

**Figure 3-9: Total Annualized Capital and O&M Costs for Alternatives**
3.2.3 Cost Effectiveness Summary

Table 3-3 shows annualized costs and cost-effectiveness metrics for the alternatives. The annualized O&M and capital “replacement” costs range from $260 to $370 million per year. La Brea has the lowest annualized cost at $260 million, with a similar cost per mile as the San Vicente and La Cienega Alternatives. The San Vicente and La Cienega Alternatives have costs of $374 and $379 million per year, respectively, and the lowest costs per mile. The Fairfax Alternative has the highest cost at $386 million with the second highest cost-per-mile. The Vermont Alternative has the highest cost per mile. The La Brea alternative is the most cost effective with a capital cost per annual project trip at $2.9/trip. The Vermont Alternative is the second most cost effective at $3.7/trip. The San Vicente, La Cienega, and Fairfax Alternatives have similar cost effectiveness with annual costs per trip between $4.1-$4.3/trip.

<table>
<thead>
<tr>
<th>NAME OF ALTERNATIVE</th>
<th>ANNUALIZED O&amp;M &amp; REPLACEMENT COST (MILLIONS)</th>
<th>ANNUALIZED COST PER MILE ($)</th>
<th>ANNUALIZED COST PER TRIP ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>San Vicente /La Cienega</td>
<td>$379</td>
<td>$41</td>
<td>$4.2</td>
</tr>
<tr>
<td>Fairfax</td>
<td>$386</td>
<td>$48</td>
<td>$4.3</td>
</tr>
<tr>
<td>La Brea</td>
<td>$260</td>
<td>$41</td>
<td>$2.9</td>
</tr>
<tr>
<td>Vermont</td>
<td>$286</td>
<td>$57</td>
<td>$3.7</td>
</tr>
</tbody>
</table>

Figure 3-10 shows the FTA cost-effectiveness measure of average cost per trip and Figure 3-11 shows the cost-effectiveness measure of average cost per hour saved based on FTA-established scoring thresholds for funding grant applications. The La Brea alternative is the only alternative that has an FTA “medium-low” cost effectiveness for both measures with a capital cost per annual project trip at $2.9/trip (and the potential for a “medium” rating with an optional configuration at the Hollywood/Highland Station). The Vermont Alternative is the second most cost effective at $3.7/trip. The San Vicente, La Cienega, and Fairfax Alternatives have similar cost effectiveness with annual costs per trip between $4.1-$4.3/trip. Based on experience from other federally funded Metro transit projects, transit infrastructure projects should typically fall at least within the “medium” to “medium-low” cost-effectiveness ratings to be considered for federal grant funding.

---

1O&M and Replacement Costs are in 2017 base year dollar value and do not include escalation to year of construction. Costs will increase 2 to 4% per year to the midpoint of construction.
Figure 3-10: Annualized Average Cost per Trip

Figure 3-11: Annualized Average Cost per Time Savings
3.3 Goal: Maximize Project Feasibility and Constructability

The goal of maximizing project feasibility and constructability was measured for each alternative by analyzing a range of issues, including engineering challenges, construction impacts, operational feasibility, and project phasing. Alternatives with a lesser amount of engineering, constructability, operational, and/or phasing issues are generally more feasible than alternatives with more issues. Specific topics analyzed within this goal include engineering issues and construction impacts associated with underground segments, aerial structures, at-grade segments and traffic issues, operational challenges, and ability for the project to be phased.

3.3.1 Operations

All alternatives would operate as an extension of the existing Crenshaw line and are assumed to have direct service to the proposed Airport Metro Connector (AMC) station at 96th Street and south along the existing Metro Green Line to Redondo Beach or east to Norwalk. Trains originating at AMC or further south or east on the Metro Green Line would travel north along the Crenshaw line and continue onto the Crenshaw Northern Extension and terminate at the Hollywood/Highland Station or the Wilshire/Vermont Station (Vermont alternative only). The Hollywood/Highland Station would have direct pedestrian access to the Metro Red Line. Additionally, all alternatives would have a design peak headway of five minutes and are assumed to have three-vehicle trains during peak periods. Corridor guideways would be semi-exclusive, separated from auto traffic, and powered by an overhead traction-power system. LRT vehicles may travel up to the maximum design speeds as track geometry and station spacing allows. It is assumed for the purposes of this study, and for increased travel time reliability, that any at-grade roadway crossings would be preempted by the approach of the LRT trains.

3.3.2 Project Phasing

The timing and amount of available funding may result in the need to separate the project into multiple phases. The alternatives were analyzed for their ability to be delivered in phases, while providing a minimum operable segment between the Metro Expo Line and the Metro Purple Line as an extension of the Crenshaw Line (Figure 3-12). This section presents travel demand modeling and cost estimating results if the project is phased (Table 3-4).

In the phased scenario, the San Vicente and La Cienega Alternatives are the same alignment and are analyzed as one alternative. The San Vicente, La Cienega, Fairfax, and La Brea Phased Alternatives would terminate at their respective station at the Metro Purple Line. The Vermont Alternative could not be phased due to the fact that the full alternative terminates at the Purple Line.

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Alternative</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>San Vicente</td>
</tr>
<tr>
<td>Phaseable to the Metro Purple Line</td>
<td>Y</td>
</tr>
<tr>
<td>Capital Cost for Phase 1</td>
<td>$1.9B</td>
</tr>
<tr>
<td>Daily Ridership for Phase 1</td>
<td>47,121</td>
</tr>
<tr>
<td>Travel Time Savings (Hours)</td>
<td>13,126</td>
</tr>
</tbody>
</table>
3.3.2.A Ridership Modeling Results for Phased Project

The La Brea Alternative has the highest Total Trips on the project for the phased scenarios (Figure 3-13). With the phased scenario, the alternatives become more regional-serving. Therefore, the alignment with the shortest and fastest travel time connecting the Expo and Purple lines is expected to have the highest ridership compared to the other phased alternatives.

Phased Local Trips, Through Trips, and On/Off Corridor Trips are presented in Figure 3-14. The vast majority of trips on all phased alternatives are Through Trips. The western alignments serve more Local and On/Off Corridor Trips, but the main travel demand for the phased to Purple Line alternatives would be for connections between the Expo and Purple Lines.

Travel time savings for the phased scenarios are presented in Figure 3-15. La Brea Alternative has the largest travel time savings, closely followed by San Vicente/La Cienega Alternative. Similarly to the ridership results, the alignment with the shortest and fastest travel time connecting the Expo and Purple lines is expected to have the highest travel time savings compared to the other phased alternatives.
Figure 3-13: Daily Ridership for Project Phased to Purple Line

Figure 3-14: Daily Ridership for Project Phased to Purple Line

Figure 3-15: Travel Time Savings (Hours) for Project Phased to Purple Line
3.3.2.B Capital Cost Estimate for Phased Project to Purple Line

Figure 3-16 presents the total estimated ROM capital cost for the phased scenario of each alternative. All of the phased options fall within the Measure M funding allotment.

![Capital Cost Estimate](image)

Figure 3-16: Capital Cost Estimates of Phase 1 Options

3.4 Goal: Minimize Environmental Impacts/Maximize Environmental Benefits

A preliminary environmental scan was conducted for the corridors included in this study. Variations among the corridors present key findings, but overall do not show a clear environmentally preferred alternative or outlier. Instead, findings suggest that trade-offs are present among alternatives.

Potential environmental impacts were analyzed based on each of the environmental topics included in the California Environmental Quality Act (CEQA) Guidelines. Results demonstrate that environmental impacts are high across all alignment corridors in the categories of Greenhouse Gas (GHG) Emissions and Noise, thus requiring mitigation. A summary of these findings and potential mitigation measures are shown in Table 3-5.

<table>
<thead>
<tr>
<th>Category</th>
<th>Impact</th>
<th>Potential Mitigation Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Greenhouse Gas (GHG) Emissions</td>
<td>Indirect emissions from electricity used in stations and to power the train</td>
<td>Potential to reduce indirect emissions by:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Integration of renewable energy sources</td>
</tr>
<tr>
<td></td>
<td>Direct sources of GHG from construction equipment and motor vehicles during construction</td>
<td>Direct emissions would be offset by:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Transit Oriented Development (TOD) along rail alignment</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(increasing transit ridership, shortening commutes and reducing Vehicle Miles Traveled (VMT))</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Use of the rail line itself as a substitute for driving, taking cars off the road</td>
</tr>
<tr>
<td></td>
<td>Short-term increase in GHG emissions during construction (consistent with other recent Metro rail projects in Los Angeles)</td>
<td>Short-term increase in GHG emissions would be offset by:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Reduction in VMT (and associated emissions) within first few years of operation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Implementing mitigation measures and best practices similar to ones from recent Metro rail projects</td>
</tr>
</tbody>
</table>

Table 3-5: Summary of Potential Environmental Impacts
<table>
<thead>
<tr>
<th>Category</th>
<th>Impact</th>
<th>Potential Mitigation Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Noise</td>
<td>Substantial temporary or period increases in ambient noise levels due to construction equipment use in urbanized, densely populated area (70s dBA to 80s dBA, with pile driving peaking at 101 dBA)</td>
<td>Noise impacts from construction would be most significant for those alignment alternatives with at grade or aerial segments. Mitigation would be implemented to minimize noise impacts for all alternatives</td>
</tr>
</tbody>
</table>

While GHG Emissions and Noise scored high for potential environmental impacts across all alignment corridors, several categories provided variations among the corridors resulting in the following key differentiators:

The Fairfax Alternative has the greatest potential impact to archaeological and paleontological impacts due to its location near the La Brea Tar Pits.

The San Vicente, La Cienega, and Fairfax Alternatives have higher potential for construction air quality impacts due to length and number of proposed stations.

The Vermont Alternative has the lowest potential for operational noise impacts due its length of underground alignment.

The Vermont Alternative has the highest potential for hydrology and water quality impacts as it relates to affecting catch basins or storm drain structures due its length of below grade tunneling and station construction.

The La Brea, Fairfax, San Vicente, and La Cienega Alternatives have higher potential for construction noise, as compared to the Vermont Alternative, which is fully underground.

The Fairfax, San Vicente, and La Cienega Alternatives have the highest potential for construction noise and vibration due to the high number of sensitive receptors nearby, as well as their relative alignment lengths, compared to La Brea and Vermont Alternatives.

Despite these differentiators, the differences among the proposed alignments are relatively small, and the results show no clear environmentally preferred alternative or outlier. Generally, there is more environmental impact for longer alignments that have a higher number of proposed stations.

The total potential environmental impact was summarized by a numerical rating that assigns “0” for no impacts, “1/4” for impacts that are likely to be less than significant, “1/2” for impacts that would likely be avoided or reduced by regulation, “3/4” for impacts requiring mitigation, and “1” for potentially significant and unavoidable impacts. Overall, the Fairfax Alternative has potential for the most impacts, followed by San Vicente/La Cienega, and then by Vermont and La Brea (Table 3-6).

<table>
<thead>
<tr>
<th>Table 3-6: Environmental Impact Total Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vermont Alignment</td>
</tr>
<tr>
<td>18.00</td>
</tr>
</tbody>
</table>
Findings
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Figure 4-2 Comparative Summary of Alternatives ........................................................................................... 4-4
4 Findings

4.1 Alternatives Analyzed

The alternatives analyzed in this study represent a preliminary assessment of alternatives for the northern extension of the Crenshaw Line (Figure 4-1). In this feasibility study/alternatives analysis phase, a wide range of general assumptions were made. While sufficient for the purposes of this study, these assumptions do require further analysis in order to better inform planning and system design decisions and alignment definition.

Figure 4-1 Crenshaw Northern Extension Study Alignment Alternatives
4.2 Comparative Matrix of Performance Measures

The Metro Board of Directors has adopted a Performance Metrics Framework which identifies goals and objectives for transit improvement projects as well as specific performance measures that can be used to analyze the achievement of these goals and objectives. The following goals were identified for the Crenshaw Northern Extension feasibility Study:

- **Goal 1 – Improve Mobility and System Connectivity**
- **Goal 2 – Maximize Cost Effectiveness**
- **Goal 3 – Maximize Project Feasibility and Constructability**
- **Goal 4 – Minimize Environmental Impacts/Maximize Environmental Benefits**

The following table summarizes the analysis of the alternatives performed in the study.

<table>
<thead>
<tr>
<th>METRIC</th>
<th>SAN VICENTE</th>
<th>LA CIENEGA</th>
<th>FAIRFAX</th>
<th>LA BREA</th>
<th>VERMONT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alignment Summary</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td># Stations</td>
<td>9</td>
<td>9</td>
<td>7</td>
<td>6</td>
<td>5</td>
</tr>
<tr>
<td>Distance (Miles)</td>
<td>9.5</td>
<td>9.2</td>
<td>8.1</td>
<td>6.5</td>
<td>4.8</td>
</tr>
<tr>
<td>Travel Time (Minutes)</td>
<td>19.0</td>
<td>18.4</td>
<td>15.7</td>
<td>12.4</td>
<td>9.3</td>
</tr>
<tr>
<td>Speed (average miles per hour)</td>
<td>30.2</td>
<td>30.0</td>
<td>30.9</td>
<td>31.5</td>
<td>30.9</td>
</tr>
<tr>
<td>Goal 1: Mobility and Accessibility Analysis Findings</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Project Trips (Daily)</td>
<td>90,769</td>
<td>90,758</td>
<td>88,751</td>
<td>88,380</td>
<td>77,694</td>
</tr>
<tr>
<td>Through Trips</td>
<td>15,090</td>
<td>15,409</td>
<td>18,169</td>
<td>19,316</td>
<td>53,337</td>
</tr>
<tr>
<td>Local Trips</td>
<td>37,567</td>
<td>37,377</td>
<td>28,446</td>
<td>27,158</td>
<td>15,999</td>
</tr>
<tr>
<td>On or Off in the Corridor</td>
<td>38,112</td>
<td>37,972</td>
<td>42,136</td>
<td>41,906</td>
<td>8,358</td>
</tr>
<tr>
<td>New Rider Trips (Daily)</td>
<td>23,270</td>
<td>23,050</td>
<td>21,629</td>
<td>21,190</td>
<td>15,483</td>
</tr>
<tr>
<td>Travel Time Savings (hrs)</td>
<td>29,897</td>
<td>29,564</td>
<td>27,593</td>
<td>26,860</td>
<td>21,524</td>
</tr>
<tr>
<td>Travel Time Savings per Project Trip (mins)</td>
<td>20</td>
<td>20</td>
<td>19</td>
<td>18</td>
<td>17</td>
</tr>
<tr>
<td>VMT Reduction per year</td>
<td>343,340</td>
<td>341,869</td>
<td>358,888</td>
<td>389,930</td>
<td>324,096</td>
</tr>
</tbody>
</table>
### Goal 2: Cost Effectiveness Comparative Findings

<table>
<thead>
<tr>
<th>METRIC</th>
<th>SAN VICENTE</th>
<th>LA CIENEGA</th>
<th>FAIRFAX</th>
<th>LA BREA</th>
<th>VERMONT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Capital Cost (2017 BYD) (Millions)</td>
<td>$4,296</td>
<td>$4,397</td>
<td>$4,650</td>
<td>$3,030</td>
<td>$3,555</td>
</tr>
<tr>
<td>Total Capital Cost per Mile (2017 BYD) (Millions)</td>
<td>$449</td>
<td>$477</td>
<td>$575</td>
<td>$482</td>
<td>$712</td>
</tr>
<tr>
<td>Total Capital Cost per Daily Trip (2017 BYD) (Thousands)</td>
<td>$47</td>
<td>$48</td>
<td>$52</td>
<td>$34</td>
<td>$46</td>
</tr>
<tr>
<td>Annual O&amp;M Cost (2017 BYD) (Millions)</td>
<td>$61</td>
<td>$60</td>
<td>$51</td>
<td>$40</td>
<td>$31</td>
</tr>
<tr>
<td>Annualized Capital Cost (2017 BYD) (Millions)</td>
<td>$312</td>
<td>$319</td>
<td>$335</td>
<td>$220</td>
<td>$255</td>
</tr>
<tr>
<td>Total Annualized Capital &amp; O&amp;M Costs (2017 BYD) (Millions)</td>
<td>$374</td>
<td>$379</td>
<td>$386</td>
<td>$260</td>
<td>$286</td>
</tr>
<tr>
<td>Total annualized capital &amp; O&amp;M cost per annual transit rider</td>
<td>$13</td>
<td>$13</td>
<td>$14</td>
<td>$9</td>
<td>$12</td>
</tr>
<tr>
<td>Total annualized cost per hour of transit system user benefit (annual time savings)</td>
<td>$39</td>
<td>$40</td>
<td>$44</td>
<td>$30</td>
<td>$42</td>
</tr>
<tr>
<td>Cost Effectiveness Rating</td>
<td>med-low</td>
<td>med-low</td>
<td>med-low</td>
<td>medium</td>
<td>med-low</td>
</tr>
</tbody>
</table>

### Goal 3: Project Feasibility and Constructability Findings

<table>
<thead>
<tr>
<th>METRIC</th>
<th>SAN VICENTE</th>
<th>LA CIENEGA</th>
<th>FAIRFAX</th>
<th>LA BREA</th>
<th>VERMONT</th>
</tr>
</thead>
<tbody>
<tr>
<td>TBM Length (Route-Miles)</td>
<td>5.3</td>
<td>5.1</td>
<td>6.3</td>
<td>3.0</td>
<td>5.0</td>
</tr>
<tr>
<td>Number of Underground Stations</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>Number of TBM Launch Sites / Segments</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>1</td>
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<tr>
<td>Length of Aerial guideway Base Alt. (Route-Miles)</td>
<td>2.9</td>
<td>2.7</td>
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<td>0.0</td>
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<tr>
<td>Number of Long-Span Bridges (Big intersections)</td>
<td>4</td>
<td>4</td>
<td>1</td>
<td>1.2</td>
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<td>Number of Aerial Stations</td>
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<td>3-4</td>
<td>0-1</td>
<td>1-4</td>
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<tr>
<td>Number of Aerial Transitions</td>
<td>6</td>
<td>6</td>
<td>2</td>
<td>2</td>
<td>-</td>
</tr>
<tr>
<td>Phaseable to Purple Line</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Station Reachable with Measure M Funds</td>
<td>San Vicente / Santa Monica</td>
<td>La Cienega/ Beverly - 3rd Street</td>
<td>Fairfax / Wilshire</td>
<td>La Brea/ Santa Monica</td>
<td>Crenshaw / Pico</td>
</tr>
</tbody>
</table>

### Goal 4: Minimize Environmental Impacts/Maximize Environmental Benefits

<table>
<thead>
<tr>
<th>METRIC</th>
<th>SAN VICENTE</th>
<th>LA CIENEGA</th>
<th>FAIRFAX</th>
<th>LA BREA</th>
<th>VERMONT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Environmental Scan Score</td>
<td>18.75</td>
<td>18.75</td>
<td>19.5</td>
<td>18</td>
<td>18</td>
</tr>
</tbody>
</table>
The following are key findings from the travel demand modeling and rough-order-of-magnitude cost estimating:

- **Daily Trips on the Project:** All main alternatives for the Crenshaw Northern Extension show a high level of daily ridership, attracting approximately 77,000 to 90,000 daily Trips on the Project over the no-build scenario. The San Vicente Alternative is projected to have the highest daily project ridership, followed by La Cienega, Fairfax, La Brea, and Vermont.

- **New Rider Trips:** The ridership model forecasts a total number of new transit trips of 15,000 to 23,000 per day. Similar to the total trips, the San Vicente Alternative is projected to have the highest new transit trips, followed by La Cienega, Fairfax, La Brea, and Vermont.

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- **Capital Cost Estimate:** The capital cost estimates for the Crenshaw North Alternatives range from approximately $3 to $5b and the La Brea Options are slightly less at approximately $2.4b in 2017 base-year dollar values:
  - The La Brea Alternative has the lowest capital cost, followed by the Vermont Alternative, the San Vicente Alternative, the La Cienega Alternative, and the Fairfax Alternative.
  - The Vermont Alternative has the highest unit cost per mile and could not be completed to the Metro Purple Line within Measure M funds.

Even though not an original alignment from the previous Wilshire/La Brea LRT Extension Study, the Vermont Alternative was added to this Study as an alternative that would reach the Metro Purple and Red Line with the shortest distance, and thus potentially the fastest travel time, lower costs, and smaller impacts, etc. However the Vermont Alternative has shown poor performance among all of the alternatives analyzed, and therefore is not recommended for further analysis.

The Vermont Alternative does not meet the Purpose and Need of this project in the following areas:

- 70% of its ridership is through trips, which don’t serve origins and destinations within the Study Area,
- The alignment is largely redundant with the existing rail system and all the western alignments, which connect riders to the Purple Line quicker than via Vermont,
- While this alternative shaves 1-2 minutes from existing travel times to points east (including Downtown LA, etc.), it imposes an over 8-minute penalty for trips between the Study Area and the Westside, the San Fernando Valley, and Mid-City/Central Los Angeles; and
- This alignment does not serve any new neighborhoods or any areas that would not be served with any of the other alternatives.
4.3 Findings and Next Steps

Below is a summary of the key performance statistics of the five alternatives (Figure 4-2).

<table>
<thead>
<tr>
<th></th>
<th>SAN VICENTE</th>
<th>LA CIENEGA</th>
<th>FAIRFAX</th>
<th>LA BREA</th>
<th>VERMONT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Daily Ridership</td>
<td>90,800</td>
<td>90,800</td>
<td>88,700</td>
<td>87,200</td>
<td>77,700</td>
</tr>
<tr>
<td>(trips/boardings)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time Savings</td>
<td>29,900</td>
<td>29,600</td>
<td>27,600</td>
<td>26,900</td>
<td>21,500</td>
</tr>
<tr>
<td>(hours)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Baseline Capital</td>
<td>4.3</td>
<td>4.4</td>
<td>4.7</td>
<td>3.0</td>
<td>3.6</td>
</tr>
<tr>
<td>Cost per Rider</td>
<td>$13</td>
<td>$13</td>
<td>$14</td>
<td>$8</td>
<td>$12</td>
</tr>
<tr>
<td>($)</td>
<td></td>
<td></td>
<td>(highest)</td>
<td>(lowest)</td>
<td></td>
</tr>
<tr>
<td>Cost per Hour</td>
<td>$39</td>
<td>$40</td>
<td>$44</td>
<td>$26</td>
<td>$42</td>
</tr>
<tr>
<td>Saved ($),</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trip Types</td>
<td>Within 41%</td>
<td>Within 41%</td>
<td>Within 32%</td>
<td>Within 31%</td>
<td>Within 20%</td>
</tr>
<tr>
<td></td>
<td>Through 17%</td>
<td>Through 17%</td>
<td>Through 20%</td>
<td>Through 22%</td>
<td>Through 69%</td>
</tr>
<tr>
<td></td>
<td>To/From 42%</td>
<td>To/From 42%</td>
<td>To/From 48%</td>
<td>To/From 47%</td>
<td>To/From 11%</td>
</tr>
<tr>
<td>Travel Times</td>
<td>19.0</td>
<td>18.4</td>
<td>15.7</td>
<td>12.4</td>
<td>26.8</td>
</tr>
<tr>
<td>(min)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figure 4-2 Comparative Summary of Alternatives

While all of the alternatives are forecast to serve high ridership comparable to Metro’s highest-performing rail lines, the western alternatives demonstrate higher total ridership and user benefits. The La Brea Alternative has the lowest capital cost and is the most cost effective, but does not serve many of the major regional job centers and activity centers. Alternatives to the west have dramatically higher access to jobs and housing in the vicinity of proposed station locations.

The shorter, eastern alternatives do a better job at serving more regional, longer distance trips, but do not serve the denser concentration of jobs and major activity centers along the western alignments, while the longer western alignments do a better job at serving these areas but due to their added length and travel time, don’t serve as many regional trips. As transit improves around the region, though, the western alignments may prove to increase in ridership potential with their access to high concentrations of existing, growing job centers, whereas the La Brea Avenue corridor is unlikely to experience major increases in jobs or housing in the future.

The alternatives analyzed in this study represent a preliminary assessment of alternatives for the northern extension of the Crenshaw Line. The findings of this study should be carried forward to further refine the alternatives by conducting additional stakeholder and public outreach in addition to engineering refinement and advanced environmental analysis. This effort would result in a screening of the five alternatives to a single Locally Preferred Alternative (LPA) that can be environmentally cleared for construction and potential future funding opportunities.
The following are key findings from the travel demand modeling and rough-order-of-magnitude cost estimating:

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