

Los Angeles County
Metropolitan Transportation Authority

Advanced Alternative Analysis Study Executive Summary

CRENSHAW NORTHERN EXTENSION



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Prepared for:

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Metro

AECOM



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1 Background

The project currently under evaluation is an extension of the Crenshaw/LAX project to destinations north of the current terminus at Crenshaw and Exposition. The original concept of the Crenshaw/LAX Line was first introduced in the 1990s to better serve transit-dependent residents and to stimulate economic growth in South Los Angeles. Metro completed the Draft Environmental Impact Report (DEIR) for this transit line in 2009 and selected a light rail alternative as the Locally Preferred Alternative based on public input and environmental analysis. While the original plan was to connect from Wilshire Boulevard (Blvd.) to LAX, due to budget constraints the portion north of Exposition Blvd. was deferred and considered as a future extension of the original Crenshaw/LAX Line. Also in 2009, Metro released a feasibility report of this northern extension to Wilshire Blvd.¹ (Final Feasibility Study - Wilshire/La Brea Light Rail Transit Extension), which determined that future extensions of the Crenshaw/LAX line would consider north/south alignments including La Brea, Fairfax and La Cienega Blvds., given great compatibility with land use, plans, and cost-effectiveness measures. Further potential extensions heading north of Wilshire Blvd. into West Hollywood and/or the Hollywood area were also briefly discussed in this report (Figure ES - 1).

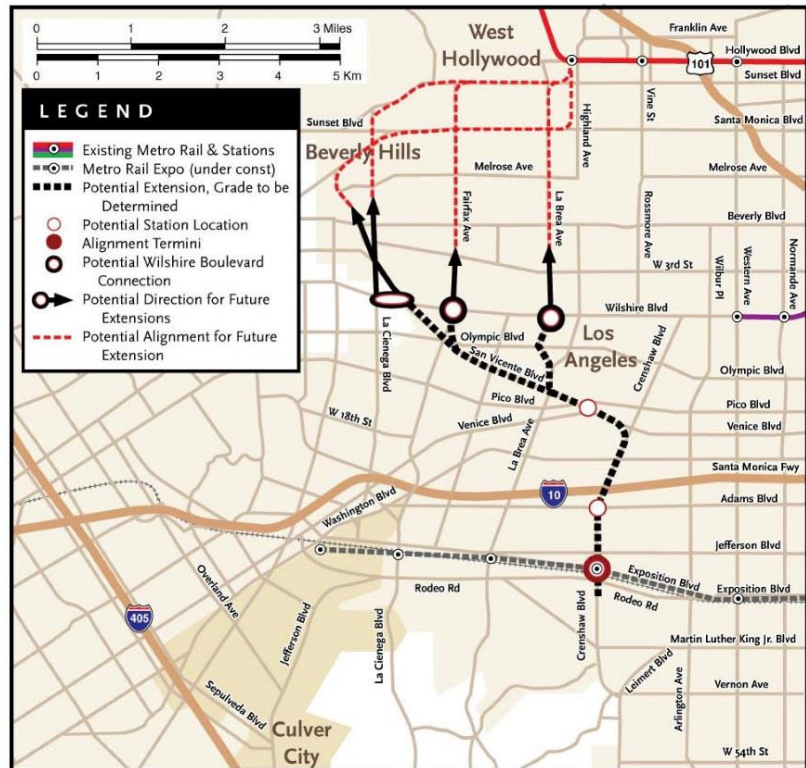


Figure ES - 1 Potential Alignments for Extension of Crenshaw Line from the 2009 Wilshire/La Brea LRT

According to the 2009 feasibility report, the ridership on the Crenshaw/LAX Line was forecast to increase up to 150% if the line were extended to the Purple Line at Wilshire/La Brea, suggesting notable demand for additional transit connectivity and providing grounds to further refine and analyze the alignment alternatives. Building on the alignments identified in the 2009 feasibility report, seven years later, Metro initiated the Crenshaw Northern Extension Feasibility/Alternatives Analysis Study in 2018 (2018 Feasibility Study²) to analyze the northern extension of the Crenshaw/LAX Line from the Metro Expo Line to connect to the Purple and Red Lines via Mid-City Los Angeles, West Hollywood and Hollywood.

Based on review of the existing street right-of-way, traffic conditions, track geometry, and other engineering criteria, five alternatives were established (including San Vicente, La Cienega, Fairfax, La Brea and Vermont Alternatives, as shown in Figure ES - 2). These alternative configurations were then initially analyzed on their ability to provide reliable transit service while attempting to maximize use of

¹ Metro. May 2009. Crenshaw Transit Corridor Project Final Feasibility Study - Wilshire/La Brea Transit Extension" (PDF). Available at http://media.metro.net/projects_studies/crenshaw/images/Feasibility%20Study%20Wilshire-La%20Brea%20LRT%20Extension%20Report.pdf

² Metro. June 2018. Crenshaw Northern Extension Feasibility/Alternative Analysis Study Final Report. https://media.metro.net/projects_studies/crenshaw_northern_extension/images/executive_summary_crenshaw_north.pdf

at- or above-ground guideways to limit capital cost. The alignments were then further refined considering operations, potential for environmental sensitivities, urban design, and stakeholder feedback. While this study concluded with a set of preliminary alternatives with the most cost-effective and potentially feasible configurations, additional study was still needed to further define the feasibility of at-grade operation. Similarly, more detailed engineering analysis was needed to confirm the viability for aerial alignments given specific roadway constraints related to traffic and transit access as well as other issues of concern such as turn radius, property impacts, and community fit.



Figure ES - 2 Crenshaw Northern Extension Feasibility/Alternatives Analysis Study Universe of Alternatives

Upon completion of the 2018 Feasibility Study, in 2019 Metro initiated the Advanced Alternative Analysis study intended to inform stakeholders and communities about alternative alignments being considered, gather input to further refine and screen alternatives, incorporate Metro’s Transit-Oriented-Communities and First/Last Mile policies into the screening process, update ridership, further refine engineering feasibility of alignment configurations, and most importantly, to determine which alternatives should be carried forward into the environmental process.

2 Purpose and Need

The Crenshaw/LAX Line Northern Extension project (the Project) has significant potential local and regional benefits serving as a critical north-south link between Metro's east-west rail lines and providing reliable travel time and transit connectivity not currently available north of the Expo Line. The purpose and need for the Project have not changed from what was established in the 2018 Feasibility Study. A summary description is provided below.

As stated in the 2018 Feasibility Study, the study area is a major travel destination with high-density tourism spots, shopping and employment centers. The study area is also currently faced with some of the region's worst surface traffic due to the relatively narrow right-of-way on its arterial network, a network that dates back to the early twentieth century, and the high volume of trips traveling within and through the study area. As the population and employment within the study area grow further, these conditions will continue to intensify and will impact economic development, quality of life, and the environment. The 2018 Feasibility Study identified five main mobility problems demonstrating that the study area is in need of high-capacity north-south transportation infrastructure based on the existing travel conditions, transportation infrastructure performance and travel demand:

- **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 transfer through downtown Los Angeles, thus decreasing network efficiency. The lack of high capacity roadways/highways in the study area, combined with existing congestion levels and the inability to expand the existing roadway network all negatively impact existing bus service. 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.
- **Congestion & Transit Reliability:** Commuters' willingness to use transit is negatively impacted by long and unpredictable travel times due to traffic 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.
- **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. The Project would provide a high-capacity, grade-separated transit service to meet growing travel 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 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 compared to the average of L.A. County. Transit-dependent residents are disproportionately impacted by long travel times and crowding on the existing transit system. The 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 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). 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.

A north-south connection is greatly needed for the study area to facilitate local and regional trips more efficiently, so that riders will not need to make detours through the downtown area. Such a connection can also improve transit efficiency by providing direct connections to Metro rail lines. The investment in the original Crenshaw/LAX Line will be better leveraged, and the regional network from the Valley to South Los Angeles will also be complete with this connection (Figure ES - 3).

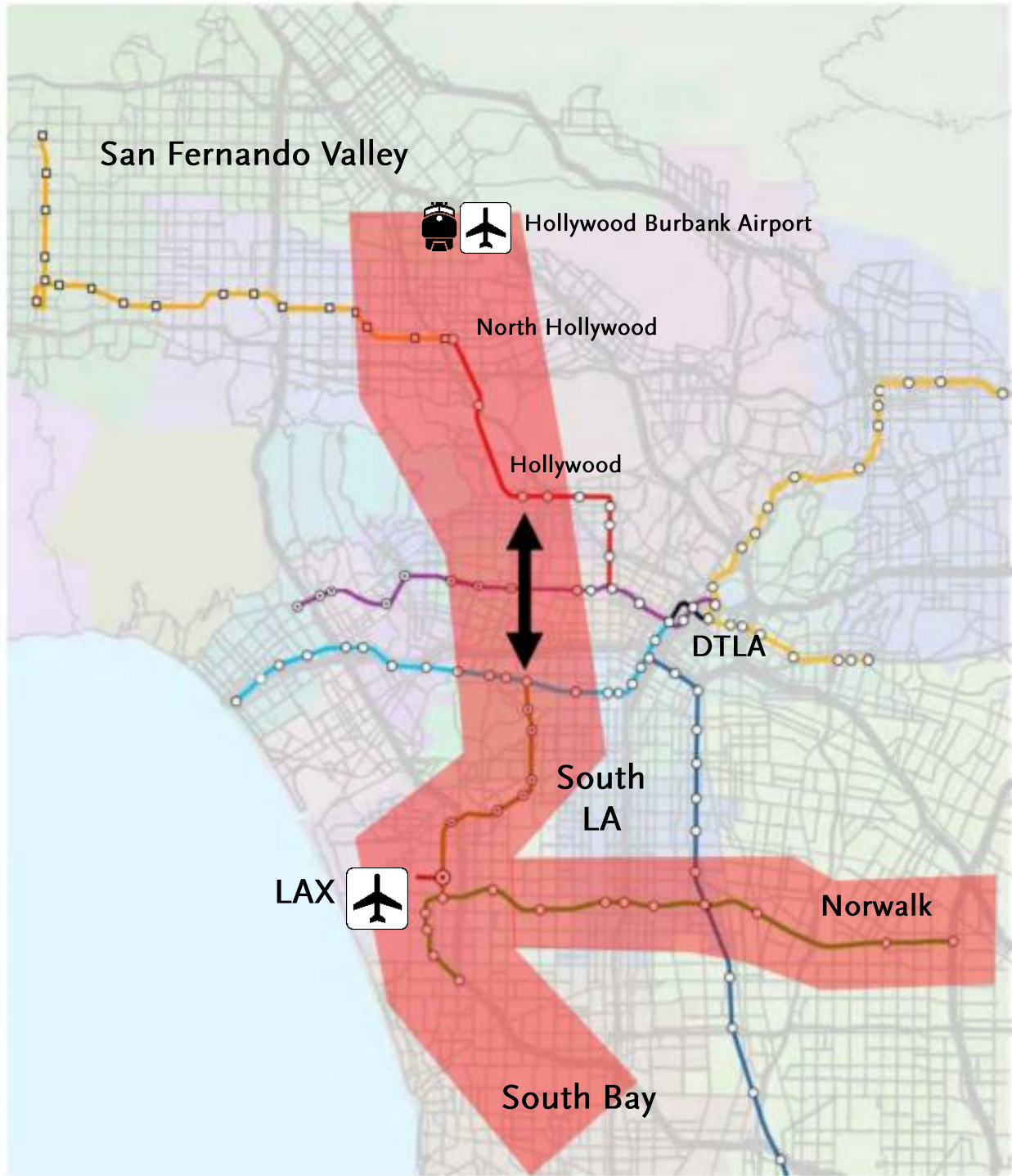


Figure ES - 3 Regional Connectivity with Project

Table ES - 1 provides examples of anticipated travel times between several key origins and destinations that can be realized with the development of the Project. Travel times between key locations can be dramatically improved with the Project. For example, a transit trip between Hollywood and CBS/The Grove that currently takes 24 minutes could be completed in 5 minutes with the Project. Similarly, trips between LAX and CBS/The Grove and Leimert Park and Beverly Hills could be reduced by about half or more, providing significant travel time savings.

Table ES - 1 Anticipated Travel Times between Major Destinations with the Project

Between	And	Without Project	With Project
Hollywood	LAX	64	32-39
Hollywood	CBS/The Grove	24	5-9
Hollywood	Culver City	52	24-31
Hollywood	Inglewood	60	27-34
Hollywood	Cedars-Sinai	44	8
Hollywood	Westwood	35	17-21
LAX	CBS/The Grove	90	31
LAX	Cedars-Sinai	102	32
LAX	Miracle Mile	84	27-29
LAX	WeHo Rainbow District	105	32-34
West Adams	CBS/The Grove	35	11
Leimert Park	CBS/The Grove	47	17
Leimert Park	Beverly Hills	59	21-22
Leimert Park	Westwood	44	25-26
Leimert Park	Cedars-Sinai	53	18
WeHo Rainbow District	LACMA	35	15
WeHo Rainbow District	Hollywood	34	6
North Hollywood	Culver City	58	34-41
North Hollywood	Expo/Crenshaw	50	22-29
Burbank Airport	Culver City	84	56-63

3 Alternatives Considered

3.1.1 2018 Feasibility Study

Preliminary alternatives developed during the 2018 Feasibility Study built upon alignments studied in the 2009 Wilshire/La Brea LRT Extension Feasibility Study and served as the starting point for Advanced Alternatives Analysis. These included the following route alternatives between Expo/Crenshaw and Hollywood/Highland:

- **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.
- **Vermont Avenue:** Crenshaw to Wilshire/Vermont via Olympic Blvd.

The Vermont Avenue alternative was included in the universe of 2018 Feasibility Study alternatives as it provided the shortest connection to both the Red and Purple Lines at the Wilshire/Vermont Station, whereas all other alternatives connect to the Metro Purple Line along Wilshire Blvd. and the Metro Red Line at the Hollywood/Highland Station.

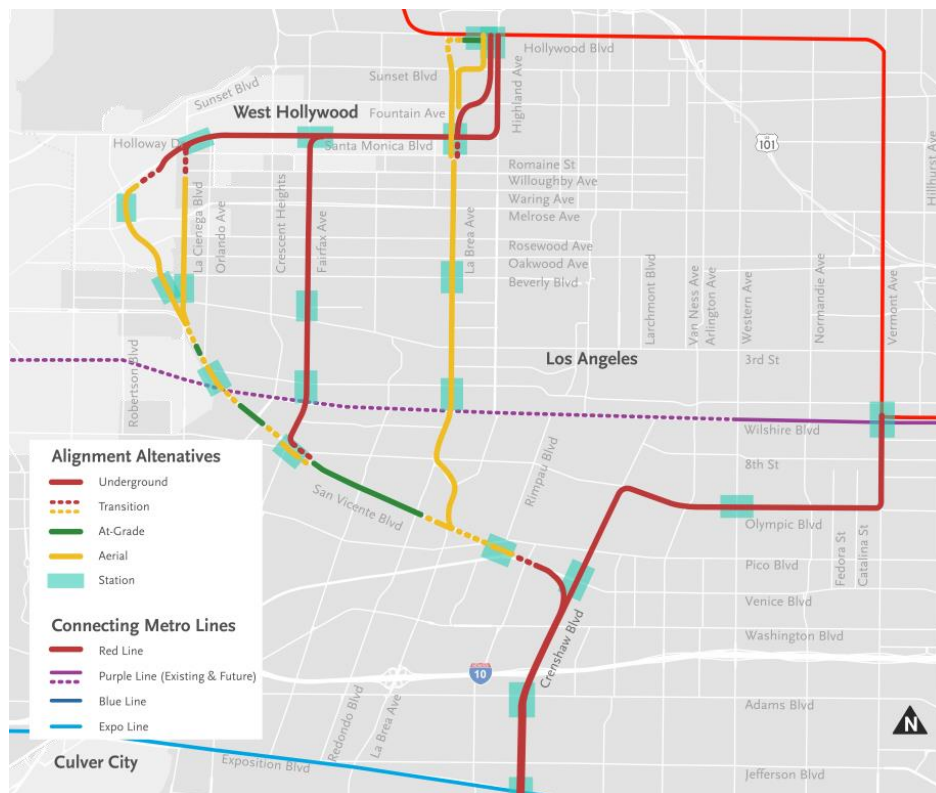


Figure ES - 4 Alternative Alignment Baseline Configurations in the Feasibility/Alternative Analysis Study

With the establishment of the preliminary routes as mentioned above, baseline alignments were developed on the rationale of maximizing at- or above-ground configuration in order to reduce capital cost (Figure ES - 4). At the 2018 Feasibility Study phase, the alignments did not address detailed issues related to constructability, urban form, or community fit. Alternatives were primarily evaluated based on performance measures related to ridership and cost-effectiveness.

At the conclusion of the 2018 Feasibility Study process, the Vermont Alternative was recommended for dismissal from further consideration due to poor performance relative to the other alternatives and its inability to meet several aspects of the project's purpose and need. All other alternatives were recommended to be further evaluated in the next phase of the project. Since no public outreach occurred as part of the 2018 Feasibility Study effort, however, the Vermont Alternative was included in initial public outreach conducted as part of the Advanced Alternatives Analysis as described below.

3.1.2 Advanced Alternatives Analysis

A critical first step for the Advanced Alternatives Analysis was to engage with stakeholders and the public through a series of outreach meetings. The 2018 Feasibility Study process did not include public engagement, so Metro wanted to share information developed during that study and get feedback from the public on alternatives and issues that should be evaluated as part of the Advanced Alternatives Analysis. Although the Vermont Alternative was recommended for dismissal during the 2018 Feasibility Study, it was included along with all other alternatives shared to obtain public input on all alternatives that were considered.

Four outreach meetings were held in spring 2019, at the outset of the Advanced Alternatives Analysis. Information shared at these meetings included alternative alignment corridor locations, summary of performance of alternatives as identified during the 2018 Feasibility Study, and descriptions of additional performance measures (ridership, cost, travel time savings, Transit Oriented Communities (TOC) and First and Last Mile (FLM) characteristics), proposed to be utilized as part of the Advanced Alternatives Analysis screening.

Several public meeting participants expressed an interest in exploring further extending the project north to connect to the Hollywood Bowl. Although not initially considered as part of the project goals and purpose and need, this idea was determined to have merit, particularly related to the constructability of alternatives in light of the limited number of options for tunnel boring machine (TBM) launch sites near the Hollywood/Highland Station location. Metro recommends that a potential extension north to the Hollywood Bowl be considered as part of all alternatives that advance to the environmental and advanced conceptual engineering phase of project development. Although not specifically considered or evaluated as part of the Advanced Alternatives Analysis, an extension to the Hollywood Bowl will be addressed as part of analysis during the next phase and will be accommodated by the conceptual design of alternatives included in the Advanced Alternatives Analysis that connect with the Red Line at Hollywood/Highland Station.

Three new alternatives were also suggested by the communities at the initial public outreach meetings conducted in spring 2019. The suggestions included continuing the alignment to Burbank Airport, interlining with the Expo Line, and a new hybrid alignment that would serve Fairfax Ave. and San Vicente Blvd. After closer investigation, the first two community-suggested alternatives were dismissed from further study by not meeting the purpose and need established for the Project as well as engineering and right-of-way constraints along the Expo line.

The hybrid alignment was determined to be a viable alternative, meeting project goals and the purpose and need. Therefore, it was included for additional analysis as a design option to the San Vicente Alternative. The alternative is a hybrid of alignment characteristics of both the Fairfax and San Vicente

Alternatives investigated in the 2018 Feasibility Study, while providing service to additional regional cultural, retail, and employment destinations along both alternatives, including LACMA, the Grove, the Beverly Center, Cedars-Sinai, etc. (Figure ES - 5).



Figure ES - 5 San Vicente Alternative Design Option 2 – Hybrid Alignment Map

During the fall of 2019, four additional outreach meetings were conducted. Information shared with the public at these meetings included updated results from performance measures, station location options for each alternative corridor, information on the funding analysis undertaken by the City of West Hollywood as part of Metro’s Early Project Delivery Strategy, and criteria analyzed as part of the TOC/FLM analysis for the current phase of study. Feedback received from the public at this second round of meetings was largely supportive of the project. No new alternatives were recommended as part of the second round of outreach meetings that require additional analysis.

Throughout the outreach efforts, communities consistently expressed more interest in western alternatives that provide better access to large activity and employment centers and less support for alternatives in the eastern portion of the study area. As part of outreach meetings, Metro shared with the public that the Vermont Alternative was recommended for elimination for two reasons. First, it does not meet some key goals of the project, and second, recent action by the Metro Board called for a separate transit study along the Vermont corridor. Existing Metro rail service (Expo Line) already provides rail service for a large portion of through trips headed towards Downtown L.A. and points east. The other four alignments under consideration would provide much greater travel time savings for trips to, from and between the major study area activity centers/destinations, offering a speedier connection to the Purple Line and significantly lower travel times to points further north throughout Central Los Angeles and the San Fernando Valley, and west, including major employment centers on the Westside.

Additionally, the Measure M Expenditure Plan includes a high capacity Bus Rapid Transit (BRT) project along the Vermont Corridor which would partially compete with the Vermont Alternative analyzed in the 2018 Feasibility Study. The 2019 Vermont Transit Corridor Rail Conversion & Feasibility Study and Metro Board actions in April 2019 indicate that an underground heavy rail system along this corridor interlining with the Red Line or Purple Lines will be evaluated. In this context, the Vermont Alternative of the 2018 Feasibility Study would preclude a separate rail project that would serve the Vermont corridor south of Wilshire Blvd. and the existing Red Line.

The alternatives considered as part of the Advanced Alternative Analysis build on initial concepts developed during the 2018 Feasibility Study and were modified to reflect the initial screening performance, community and stakeholder input, and Metro Board direction. The five alternatives evaluated as part of this study are illustrated on Figure ES - 6. They include San Vicente (A), San Vicente Design Options for La Cienega (A1) and the Hybrid (A2), Fairfax (B), and La Brea (C).

In addition to the alternatives described above, the Advanced Alternatives Analysis also included a high-level evaluation of the potential locations where a maintenance facility could be constructed that would provide storage and maintenance capacity necessary to accommodate the vehicle fleet associated with the Crenshaw Northern Extension.



Figure ES - 6 Map Alternatives for the Advanced Alternative Analysis Phase

4 Performance of Alternatives

The five alternatives and options were evaluated against several performance measures, including ridership, costs, and TOC/FLM-supportiveness. Issues related to environmental sensitivity and equity concerns were also included as part of the evaluation. Alternatives were also further evaluated for engineering feasibility of vertical configurations, constructability of the full alignment, and phasing of an initial operating segment (IOS) based on potential funding availability.

4.1.1 Ridership Forecasting³

The Advanced Alternatives Analysis alternatives are projected to attract approximately 88,000 to 91,000 daily trips on the project over the no-build scenario based on the results of ridership projections from the Metro Regional Travel Demand Model. It should be noted that the ridership projections from the Metro model focus on home-based work trips. As a result, the model does not necessarily capture all trips that might occur for unique purposes such as tourism and special events. Nevertheless, projected ridership is at the same level as Metro’s heavy rail lines and some heavily utilized rail lines in the nation

³ The ridership forecasting results are based on home-based work trips on weekdays, and did not reflect potential impacts from tourism, special events, surrounding land use, etc.

(like the MBTA Orange Line in Boston). Among those, 21,000 to 23,000 trips are by new transit users, who would not have used transit for their trip purpose without this project (Figure ES - 7). The San Vicente Alternative and San Vicente Alternative Option 1 - La Cienega are projected to have the highest daily project ridership and new transit trips, followed by San Vicente Alternative Option 2 – Hybrid, Fairfax, and La Brea Alternatives.

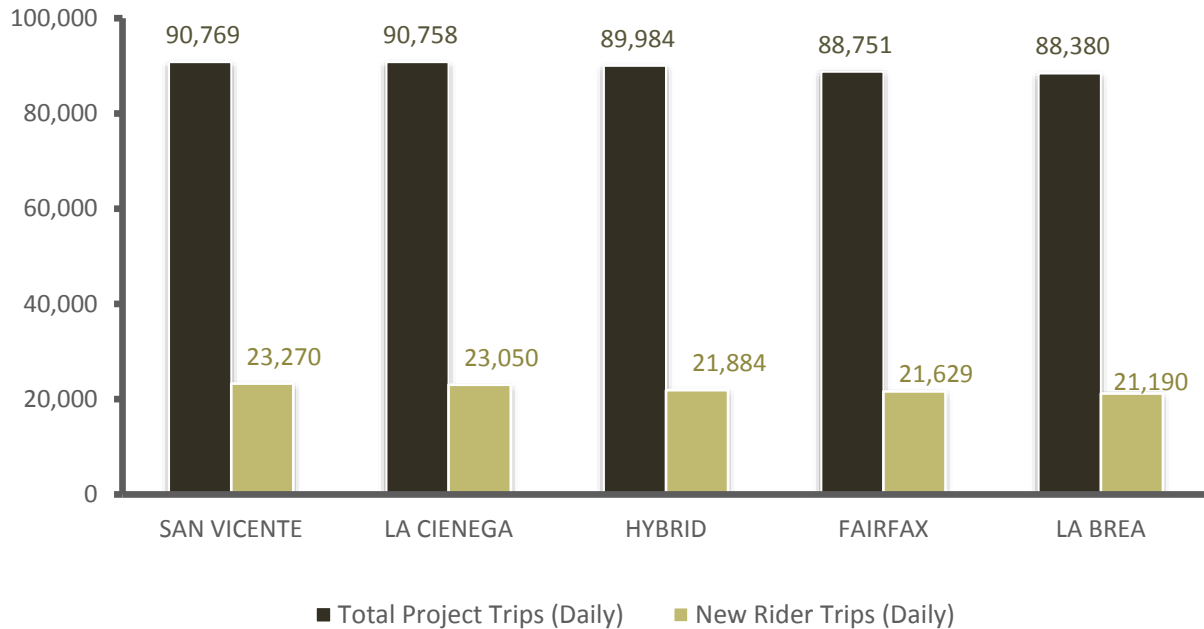


Figure ES - 7 Daily Ridership and New Rider Trips for Alternatives

A similar pattern is illustrated for travel time savings (Figure ES - 8). While all alternatives would result in notable reduced transit travel times and improved transit service compared to existing conditions, the western alignments have greater overall time savings as well as travel time savings per project trip, and thus can provide larger benefits.

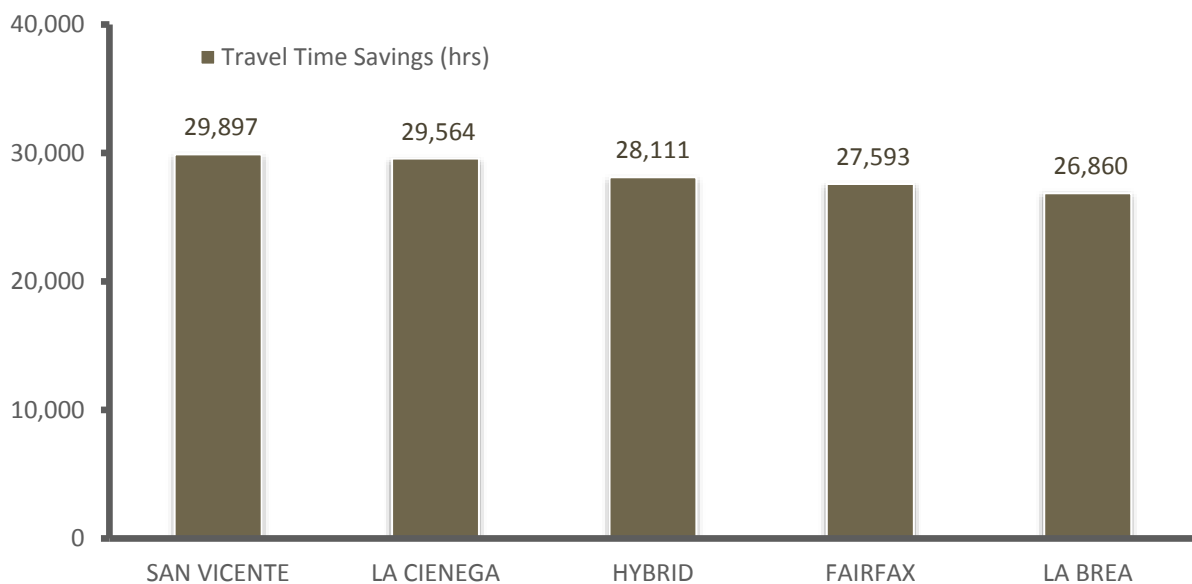


Figure ES - 8 Travel Time Savings by Alternative

Figure ES - 9 provides an illustration of the number of through trips, local trips, and riders who get on or off within the corridor for each alternative. A couple of clear patterns emerge from this information. One is that alignments further east serve a higher level of through trips originating outside the study area and terminating outside the study area. This is likely a result of the lower travel time associated with the more direct alternatives such as La Brea or Fairfax. Another pattern is that the alignments further west serve a much higher level of local trips due to the connectivity they provide with key activity and employment centers. This suggests that the western alignments provide a greater combination of both local trips within and through the study area than that provided by eastern alignments.

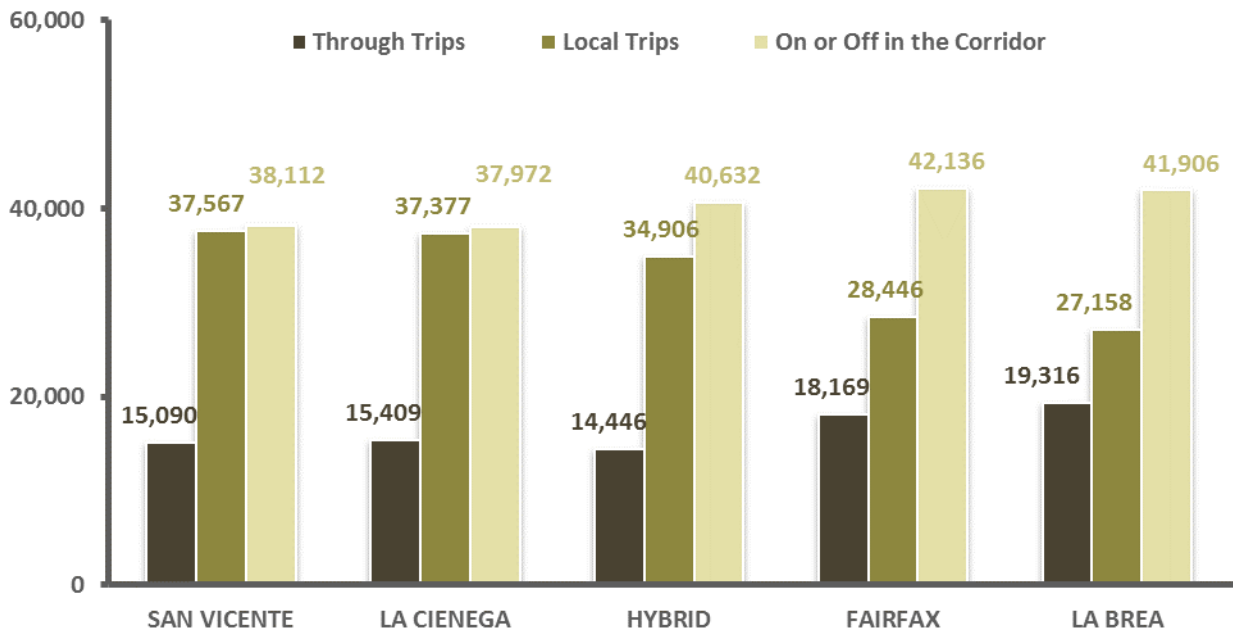


Figure ES - 9 Daily Ridership Breakdown for Alternatives

4.1.2 Socio-economic Analysis

As seen in **Error! Reference source not found.** and Figure ES - 9, the forecasted daily ridership decreases among the alternatives from west to east. The longer, western alternatives have higher ridership because they have more stations and provide better access to more activity, population, and employment centers than the eastern alternatives. This is reinforced by the number of projected jobs and population that could potentially be served by each alternative in 2040 within a half-mile of proposed stations (Figure ES - 10). For example, not including Venice/Vineyard and Santa Monica/La Brea (which are shared by all alternatives), the longer western alignments (San Vicente Alternative and La Cienega and Hybrid Design Option) provide access to twice as many jobs (from 55,700 to 64,500) and more than four times as many residents (from 62,400 to 67,400) compared to the La Brea Alternative (21,600). Conversely, while the Fairfax Alternative provides fewer total jobs (44,500) it is on par with the San Vicente Alternative and Design Options in providing job accessibility on a per mile basis (at 9,300 jobs/mile). In all, the San Vicente Alternative and Design Options serve significantly more people near their proposed station areas - about double the population of the Fairfax Alternative stations areas and more than five times as many people near the stations along the La Brea Alternative.

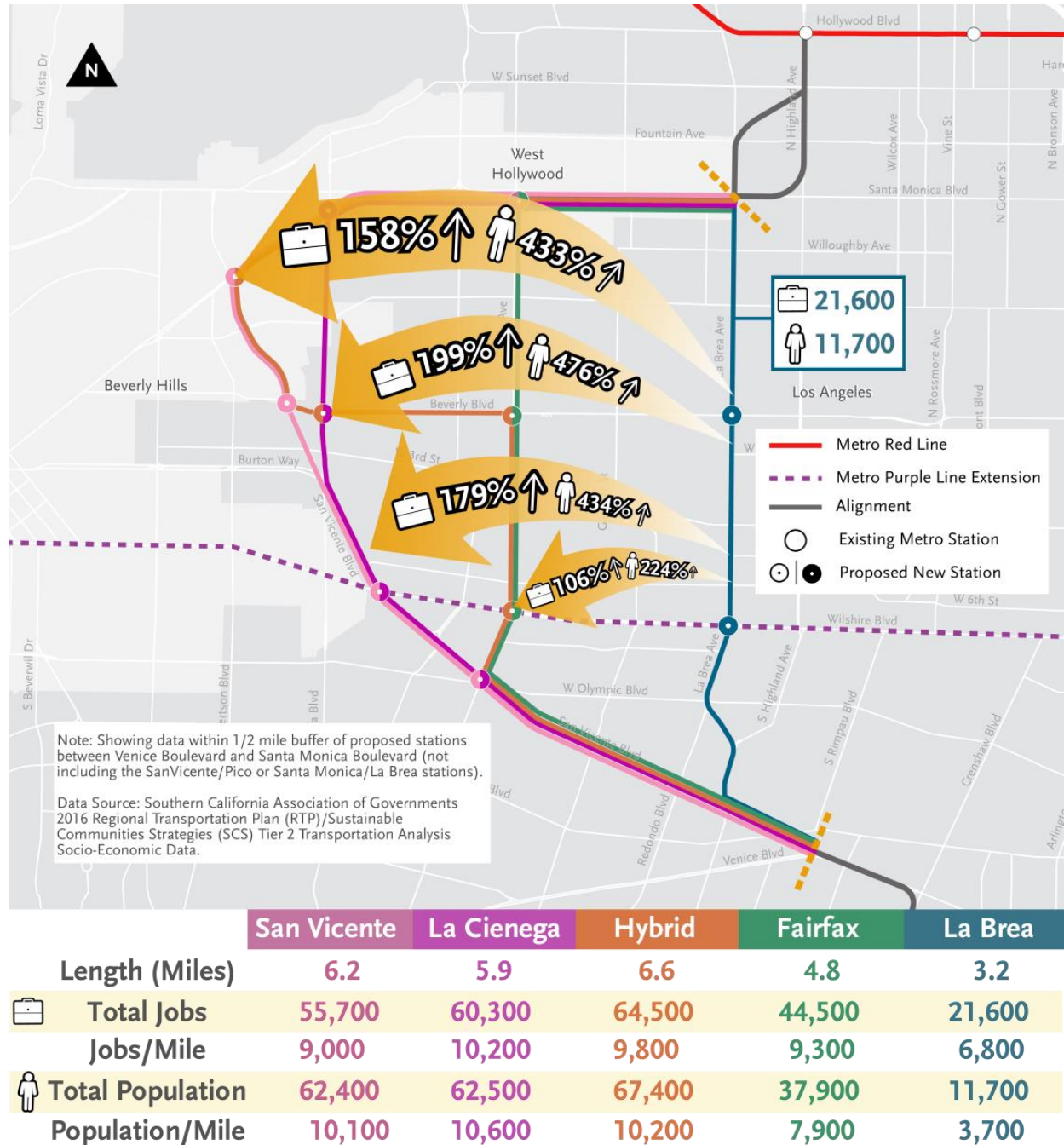


Figure ES - 10 Comparison of Alternatives Access to Employment and Population in 2040

In addition, the western alignments go through more census tracts that are considered transit dependent, where high percentages of zero-car, low-income, and/or low-income senior citizen households are present, presenting extensive opportunities to provide robust transit options for vulnerable and transit dependent residents (Figure ES - 11).

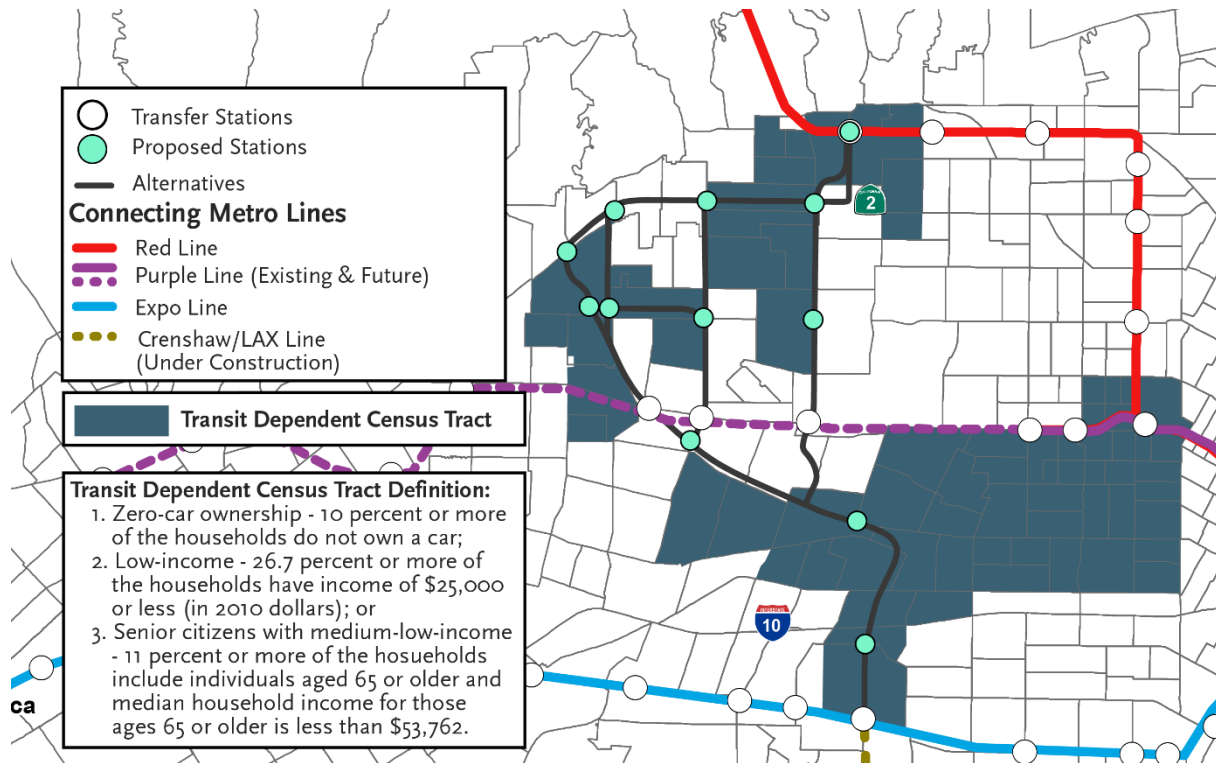


Figure ES - 11 Crenshaw Northern Extension study area Transit Dependency by Census Tract

4.1.3 Cost Estimating

The capital cost of the project alternatives ranges from \$3 to \$6.5 billion (Figure ES - 12). While the La Brea Alternative has fewer project trips and serves less transit-dependent populations compared to the San Vicente Alternative and Design Options, it has the lowest capital cost (\$3.0 to \$4.4 Billion, depending on the design configuration). The same pattern exists for annual operations & maintenance (O&M) costs. As the project length, travel time, and estimated revenue-hours of operation increase, the annual O&M costs also increase. As a result, the La Brea Alternative has the lowest annual O&M costs at \$42 million and the San Vicente Alternative Design Option 2 – Hybrid has the highest at \$75 million (Figure ES - 13).

Alignment and guideway vertical configurations have the potential to dramatically impact capital and operating costs. This is reflected in the range of costs presented which capture a best-case baseline condition (as reflected in the 2018 Feasibility Study alignments where at and above-grade configuration was maximized), to a fully underground configuration where all guideway and stations are in subway (avoiding environmental and other impacts).

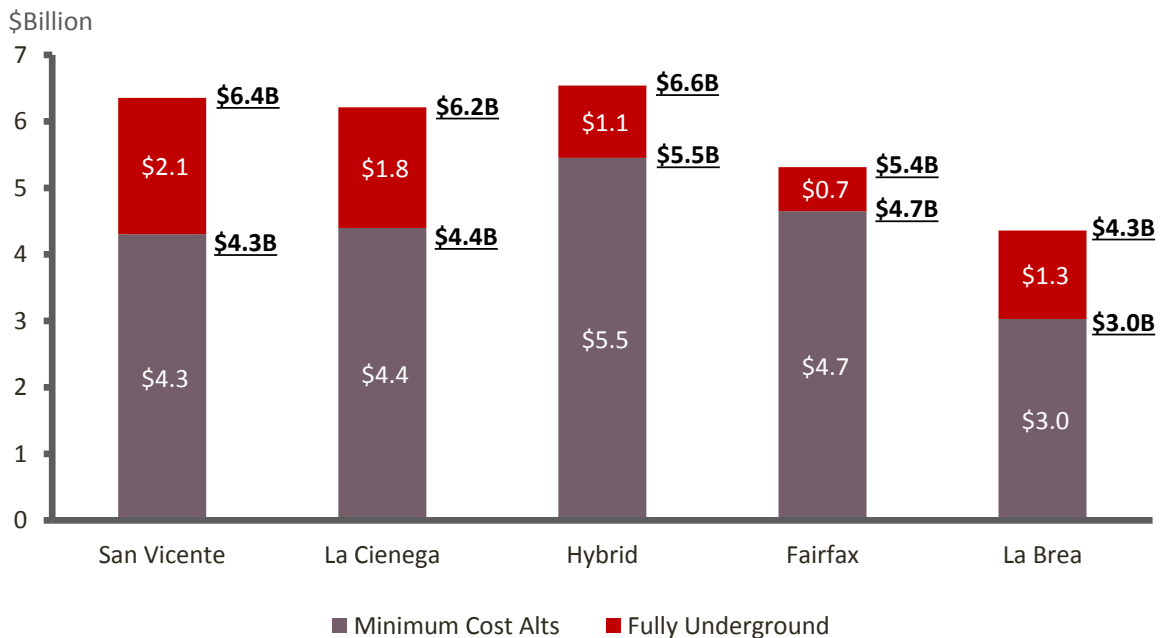


Figure ES - 12 Capital Cost Estimates for Project Alternatives

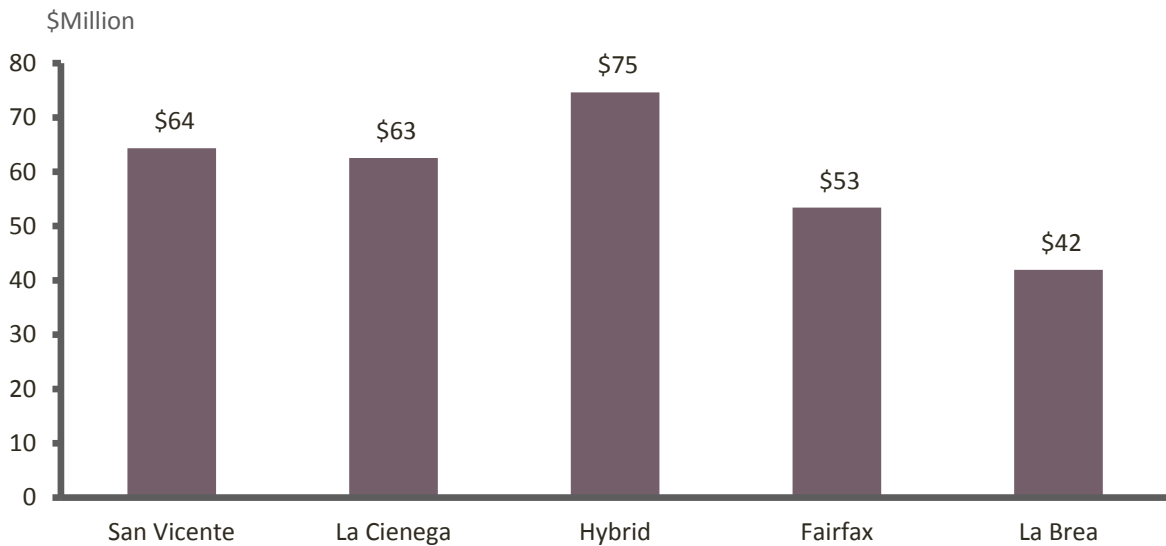


Figure ES - 13 O&M Cost per Project Trip by Alternative

4.1.4 Engineering Constraints and Limitations

The alternative configurations have notable engineering constraints for design and construction that substantially impact the feasibility and cost-effectiveness of at-grade or aerial configurations for certain segments. Some constraints are universal, for example, it's difficult to find a potential TBM launch site (at minimum 3 acres) on the north side of Wilshire Blvd. for all alternatives. This limitation makes certain potential underground segments infeasible if construction were to require cut and cover methodology as opposed to boring. The infeasibility is a function of cost for land and the potential for significant environmental impacts. Specific engineering constraints and limitations for the alternative configurations that were developed during the 2018 Feasibility Study process to minimize cost were

further evaluated as part of the Advanced Alternatives Analysis. The constraints and limitations specific to each alternative corridor are described below:

- **San Vicente Alternative:** Four primary engineering constraint issues exist along the unique portion of the San Vicente Alternative that limit viability of aerial and at-grade configurations developed during the 2018 Feasibility Study. First, the combination of aerial and at-grade configuration through the Carthay Circle area would allow for only a limited amount (approximately 1,300 feet) of actual at-grade operation due to the need for aerial transitions necessary to cross the Fairfax/Olympic/San Vicente (asterisk) intersection and the aerial crossing of Wilshire Blvd. This would result in the need for aerial structure within the Historic Preservation Overlay Zone (HPOZ) established for Carthay Circle which would be in conflict with the HPOZ designation of the area. Second, an aerial crossing of Wilshire Blvd. would require placement of the Wilshire Station north of Wilshire Blvd. while the Purple Line station is located west of San Vicente Blvd. This would necessitate a walk of about 1,300 feet for passengers who would transfer between the Crenshaw Northern Extension and the Purple Line stations in this location which is a concern due to the large volume of passenger transfers (potentially 20,000 plus) forecast between the two lines. Third, an aerial configuration north of Wilshire Blvd. through the Cedars Sinai/Beverly Center area would be extremely difficult to construct based on the level of existing and proposed future development. Combined with a likely need for straddle bents to accommodate a wide crossing of La Cienega Blvd., the aerial alignment in this area is considered too impactful to be viable. The fourth constraint pertains to the option for underground alignment through the Carthay Circle portion of the alignment. There are not identifiable adequate locations for potential TBM launch or extraction sites within this area that would foster development of an initial operating segment (IOS) between the Exposition Line and the Purple Line.
- **San Vicente Alternative Design Option 1 – La Cienega:** The primary constraint associated with an aerial alignment on La Cienega Blvd. is the limited right-of-way width. An aerial station or a transition from aerial to underground alignment would result in the need to reduce travel lanes from three to two in each direction or would require major real estate impacts due to the need to acquire adjacent property. For those reasons, an alignment utilizing La Cienega Blvd. would need to be underground prior to reaching La Cienega Blvd.
- **San Vicente Alternative Design Option 2 – Hybrid:** The primary design constraint for this alternative is also related to the roadway right-of-way width, but for this alternative it is the widths along Beverly Blvd. (approximately 70 feet) and Fairfax Ave (as low as 55 feet). The limited width results in similar impacts related to either travel lane reduction or property acquisition. As a result, this alternative would need to be underground starting just south of the Fairfax/Olympic/San Vicente (asterisk) intersection and would continue underground to the northern terminus. The alternative avoids the issues described above for the San Vicente Blvd. Alternative and also could provide an opportunity to utilize either La Cienega or San Vicente Blvd. north of Beverly Blvd.
- **Fairfax Alternative:** The 2018 Feasibility Study recognized that the Fairfax corridor is not viable for aerial or at-grade configuration due to limited right-of-way width that exists along the street combined with high volumes of ADT. Additional engineering constraints identified during the Advance Alternatives Analysis include those associated with potential stations at Wilshire/Fairfax and Santa Monica/Fairfax. At Wilshire/Fairfax, the 2018 Feasibility Study identified the station location north of Wilshire but did not consider in detail the impacts for construction of a cut and cover station on the adjacent land use or the impacts associated with the depth of station required to be beneath the planned Purple Line in this location. The adjacent

land use includes important cultural and historic properties that would likely represent significant environmental impacts due to the extent and duration of construction that would be required to build the deep station. Furthermore, construction of a potential IOS to Wilshire Blvd. would be substantially more viable if the station were to be located on the south. As a result, it is recommended that the station should be moved to the south side of Wilshire Blvd. where better construction staging opportunities exist relative to adjacent land use. At the intersection of Santa Monica Blvd. and Fairfax Blvd. the most desirable location for a station is directly under the intersection with access provided from the intersection quadrants. Due to the need for the alignment to turn east on Santa Monica Blvd. from Fairfax Blvd., the placement of a station would have to be located near Genesee Ave., approximately 1,000 feet to the east of the intersection, due to turn radii limitations associated with TBM equipment. An alignment option was developed that would allow placement of the station directly at the intersection, but it would result in substantial impact to adjacent land use due to the diagonal station placement required and the cut and cover construction method utilized for station construction.

- La Brea Alternative: Three primary engineering constraints limit the viability for aerial configuration through this corridor. First, the turn from San Vicente Blvd. to La Brea Blvd. would require either a tight radius configuration that would slow operations or property acquisition in order to accommodate a flatter curve and higher speed operation. Second, a series of roadway turns exist along La Brea Blvd. between San Vicente Blvd. and Olympic Blvd. that would likely require straddle bent structures due to limitations for placement of columns, thus impacting adjacent land use and necessitating right-of-way acquisition while significantly limiting speed through this segment. Finally, aerial configuration would require acquisition of additional right-of-way in order to maintain current traffic lane configurations, particularly at station locations. The existing average daily traffic (ADT) volumes along La Brea Blvd. are the highest of those in any corridor under consideration at over 27,000 ADT. Therefore, traffic lane elimination or reduced width is not considered viable due to potentially significant impacts associated with increased congestion or land acquisition. Alternatively, the existing traffic lane configuration could be preserved, but reduction of sidewalk width would be necessary to accommodate aerial stations. This condition presents limitations for aerial station development at Wilshire, Beverly, and Santa Monica Blvds. Reduction of sidewalk width would not only conflict with the City of LA's standards for streets and sidewalk widths which require 15 feet at minimum, but also would counter Metro's FLM policies that encourage pedestrian connectivity and the creation of an inviting public realm. An underground configuration along La Brea Blvd. is considered to be the only viable solution for an alignment in this corridor due to roadway and land use impacts associated with the limited right-of-way space in the corridor.

The Southwestern Yard Maintenance and Storage Facility (MSF) serving the Crenshaw/LAX Line and Green Line are unlikely to have additional capacity to accommodate the maintenance and storage needs of this project's full fleet (including overnight storage of vehicles, routine maintenance, and overhauls) and maintenance equipment (for maintaining the guideway and right-of-way). Approximately 9.7 to 13.3 acres at minimum are estimated to accommodate the fleets for the alternatives analyzed during this phase of study. The study area consists of densely developed residential and commercial uses and has few vacant and underutilized properties. An MSF in such an urban setting could pose significant environmental impacts to the neighborhoods or require challenging and costly underground construction. However, several potential sites have been identified outside of the study area along the Crenshaw/LAX corridor in the vicinity of LAX. These sites will be further evaluated during the next phase of the study.

4.1.5 Transit Oriented Communities and First/Last Mile Analysis

To promote transit accessibility for existing neighborhoods, healthy and active lifestyles, improve access to jobs and economic opportunities, and reduce greenhouse gas emissions, a TOC and FLM compatibility analysis was conducted during the Advanced Alternatives Analysis. The TOC/FLM analysis process integrates Metro's TOC/FLM policies and planning principals to ensure that expansion of the transit system connects communities, integrates future, and promotes accessibility via active transportation modes.

The analysis was developed for the area within a half-mile radius around each proposed station (which is roughly a 15-minute walk).

For TOC the analysis consisted of the following elements:

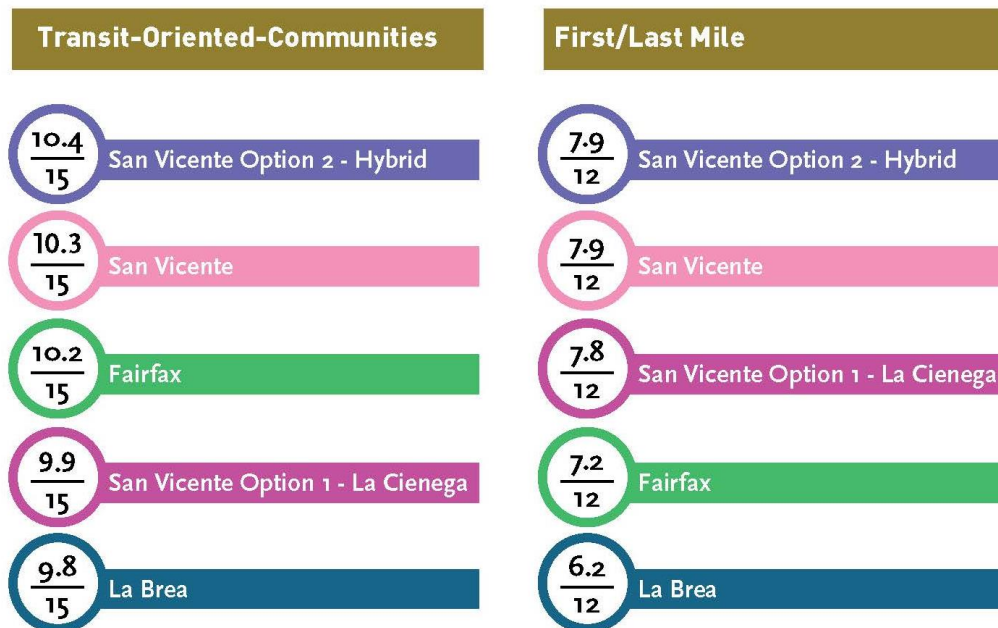
- Transit supportive density expressed through the population and employment surrounding stations including:
 - Activity units – total jobs plus total population divided by acreage of the half-mile catchment area
 - Activity centers – mixed-use areas that draw a high number of visitors such as retail corridors, shopping centers, universities, or medical centers
- The presence of vacant or underutilized parcels
- Transit supportive plans, parking management policies, and affordable/ inclusionary housing policies in place by local municipalities

For FLM, the analysis consisted of the following elements:

- FLM supportive infrastructure including block size (intersection density), pedestrian access, bicycle facilities, ADA, and new mobility access.
- Quality of the public realm
- FLM supportive plans and policies
- Safety and security including active transportation collision rates, lighting, visibility, crossings, and security elements

Results show that the San Vicente Alternative Design Option 2 – Hybrid scored highest and the La Brea Alternative scored lowest. Generally speaking, alternatives and design options are relatively comparable in their existing TOC supportiveness within the corridor. The main differences between alternatives relate to higher densities and activity centers along western alignments and amount of vacant and underutilized parcels. Applicable transit supportive plans and policies relate to a majority of proposed stations, with some cities leading the charge for early adoption of existing plans.

Similar results are seen for FLM supportiveness, with the San Vicente Alternative Design Option 2 - Hybrid and San Vicente Alternatives tied for first place ranking, closely followed by the San Vicente Design Option 1 - La Cienega. The Fairfax and La Brea alternatives are in fourth and fifth positions respectively. The existing conditions and planned investments in West Hollywood have led to higher intersection density levels, existing and planned supportive infrastructure for active transportation modes, and enhancements to the public realm improving accessibility, safety and security, and thus resulting in the difference in the scoring of all alternatives (Figure ES - 14).



Note: Metro will develop TOC baseline studies to analyze additional detail in the next phase of project development.

Figure ES - 14 TOC/FLM Analysis Results by Alternative

4.1.6 Environmental Considerations

A high-level environmental evaluation was completed for the 2018 Feasibility Study based on baseline alternative configurations that maximized the potential above-grade vertical alignment for each alternative. Due to the high-level nature of the analysis conducted to date and the likely changes to alternative vertical configurations from the baseline configurations evaluated during the 2018 Feasibility Study, additional environmental analysis was limited to a similar evaluation for the new San Vicente Alternative Design Option 2 – Hybrid in order to provide a similar base of comparison. Inclusion of this new alternative did not result in any new conclusions overall. Similar to earlier analysis, the longer alignments have potentially greater environmental effects depending upon final vertical configuration. The San Vicente Alternative – Design Option 2 resulted in a slightly higher expectation for potential environmental effects based on its longer length and the baseline vertical alignment that included aerial and underground configuration. Additional detailed environmental analysis was not conducted for the Advanced Alternatives Analysis since vertical alignment has not been confirmed. This will be the subject of the next phase of project development during environmental review.

Several conclusions can be drawn however, from qualitative review of alternatives in light of environmental considerations and the potential for impacts. For example, all alternatives would be anticipated to contribute to lower regional Vehicle Miles Traveled (VMT) and associated improvements in air quality conditions by increasing the volume of travel by public transit and reducing travel by automobile. Similarly, all alternatives would have the benefit of improved travel time and increased accessibility for many individuals, particularly those transit dependent populations present within the study area. Specific additional conclusions for each alternative include:

- San Vicente Alternative: the baseline alternative included substantial at-grade and aerial configuration throughout San Vicente Blvd. Impacts likely to be associated with this configuration include impacts related to visual and aesthetic conditions; noise and vibration, particularly near adjacent residential areas; cultural resource impacts, particularly for areas along the corridor designated as historic preservation overlay zones (HPOZ); and traffic impacts resulting from the

reconfiguration of streets necessary to accommodate a rail guideway and potential columns for aerial structure. Many of these impacts would be substantially mitigated by an underground alignment through this corridor, however, an underground alignment would be likely to have some other impacts including those related to underground gases or hazardous materials such as oil wells/deposits, utility conflicts and relocations, and potential discovery of cultural or paleontological resources requiring special treatment.

- San Vicente Alternative Design Option 1 – La Cienega: the baseline alternative included similar at-grade and aerial configuration throughout San Vicente Blvd. as well as aerial configuration along La Cienega Blvd. Impacts along San Vicente Blvd. between the Venice/Vineyard Station location (between San Vicente and Pico Blvds.,) and La Cienega Blvd. would be identical to those described above for the San Vicente Alternative, including those related to visual and aesthetic conditions, noise and vibration, and cultural resources. Along La Cienega Blvd. this alternative would have high potential for additional impacts related to visual and aesthetic conditions; noise and vibration, particularly near adjacent residential areas; and traffic impacts resulting from the reconfiguration of streets necessary to accommodate guideway columns or related property acquisitions to maintain current street configuration. Many of these impacts would be substantially mitigated by an underground alignment through this corridor, however, an underground alignment would also be likely to have impacts similar to those described for the San Vicente Alternative, but they would occur on La Cienega Blvd. instead of on San Vicente Blvd. between about Burton Way and Santa Monica Blvd.
- San Vicente Alternative Design Option 2 – Hybrid: the baseline alternative included vertical alignment options similar to those for the Fairfax Alternative on the south, an aerial configuration along Beverly Blvd. between Fairfax Blvd. and San Vicente Blvd. and aerial configuration along San Vicente Blvd. north to Santa Monica Blvd. where the alignment would transition to underground. As a consequence of the additional length for this alternative, additional impacts would be anticipated, particularly along Beverly Blvd. where traffic impacts resulting from the reconfiguration of the street necessary to accommodate guideway columns or related property acquisitions to maintain current street configuration would be necessary. Many of these impacts would be substantially mitigated by an underground alignment through this corridor, however, an underground alignment would also be likely to have impacts related to underground gases or hazardous materials such as oil wells/deposits, utility conflicts and relocations and potential discovery of cultural or paleontological resources along Beverly Blvd. in addition to San Vicente Blvd. north of Beverly Blvd.
- Fairfax Alternative: the baseline alternative included an underground configuration due to the limitations of street width in many sections of Fairfax Blvd. Impacts likely to be associated with this configuration include those related to underground gases or hazardous materials, utility conflicts and relocations, and potential discovery of cultural or paleontological resources requiring special treatment. Depending upon the location for access portals to stations, this alternative could also have the potential to impact some recognized historic resources located with the corridor.
- La Brea Alternative: the baseline alternative included aerial configuration throughout the length of the alignment, therefore this alternative would have high potential for impacts related to visual and aesthetic conditions; noise and vibration, particularly near adjacent residential areas; and traffic impacts resulting from the reconfiguration of streets necessary to accommodate guideway columns and station locations or related property acquisitions to maintain current street configuration. Many of these impacts would be substantially mitigated by an underground alignment through this corridor, however, an underground alignment would be likely to have some other impacts including those related to underground gases or hazardous materials, utility conflicts and relocations, and potential discovery of cultural or paleontological resources requiring special treatment.

4.1.7 Phasing

Measure M provides approximately \$2.3 billion in funding for the project. As a result, it is possible that the project will need to be constructed in more than a single construction phase, through Interim Operable Segments (IOS), in order to complete the full extension to Hollywood/Highland and/or the Hollywood Bowl. One potential IOS that would produce considerable benefits is between the Metro Expo Line and the Metro Purple Line (Figure ES - 15).

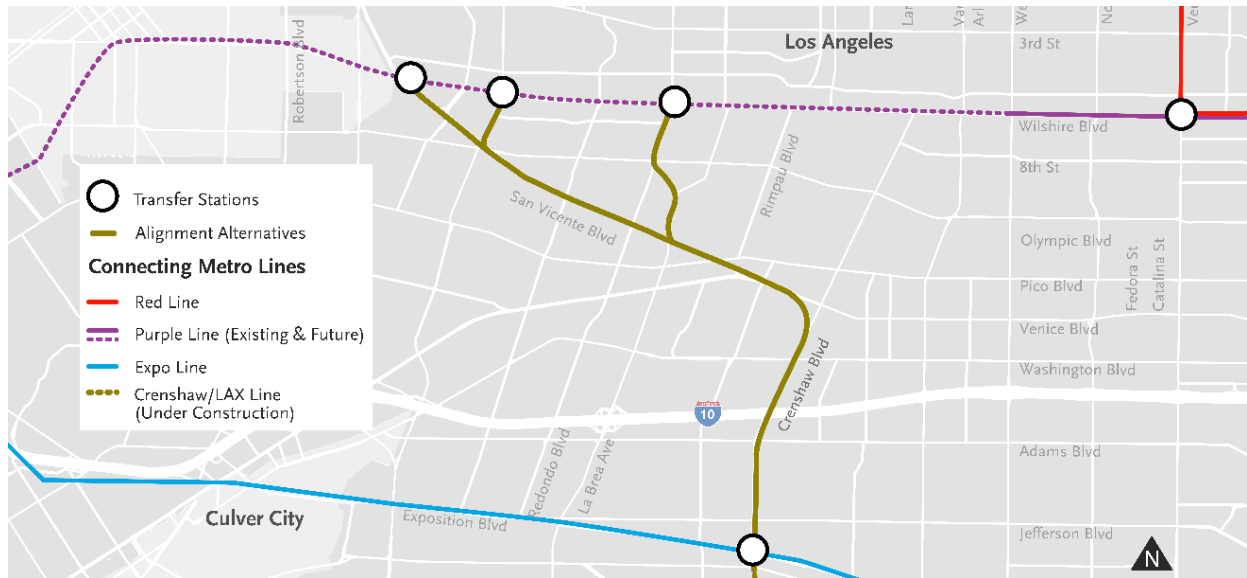


Figure ES - 15 Initial Operable Segments for Alternatives

In contrast to the full alternatives, the total trips on IOS segments between the Expo Line and the Purple Line are higher for the eastern alignments than the western alignments (Figure ES - 16). This is due to the fact that the phased scenario would operate more as a regional serving alignment and less as a locally serving alignment, given the concentration of activity and employment centers north of Wilshire Blvd. Therefore, the alignment with the shortest and fastest travel time connecting the Expo and Purple lines is expected to have the highest ridership among the IOS options.

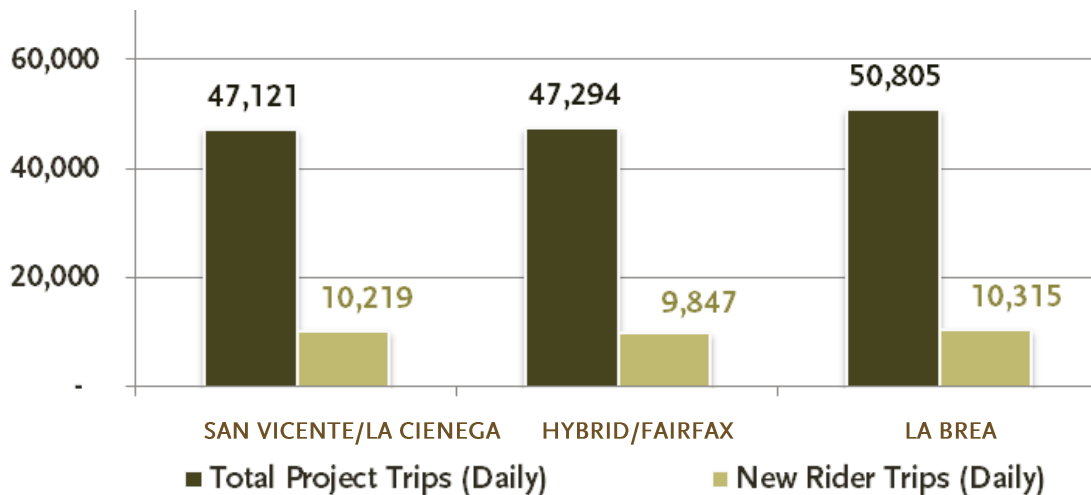


Figure ES - 16 Daily Ridership for Project Phased to Purple Line

As mentioned above, all IOSs to Wilshire Blvd. will fall within the Measure M funding allotment for their respective baseline configurations developed during the feasibility study phase (Figure ES - 17). The Fairfax Alternative IOS will have the highest capital cost, followed by San Vicente and La Brea Alternatives. Fully underground configurations may require additional funding in order to complete an IOS segment to the Purple Line.

If the IOSs were built as fully underground alignments, the costs would exceed the Measure M funding allotment. If additional funds were secured to deliver the initial phase of the project, the project alternatives could be delivered to the Metro Purple Line. The fully underground San Vicente IOS would cost roughly \$3.1 billion, or about \$800M more than the Measure M funding in 2017 value. The fully underground Fairfax IOS would cost roughly \$2.8 billion, or about \$500M more than the Measure M funding in 2017 value. The fully underground La Brea IOS would cost roughly \$2.6 billion, or about \$300M more than the Measure M funding in 2017 value.

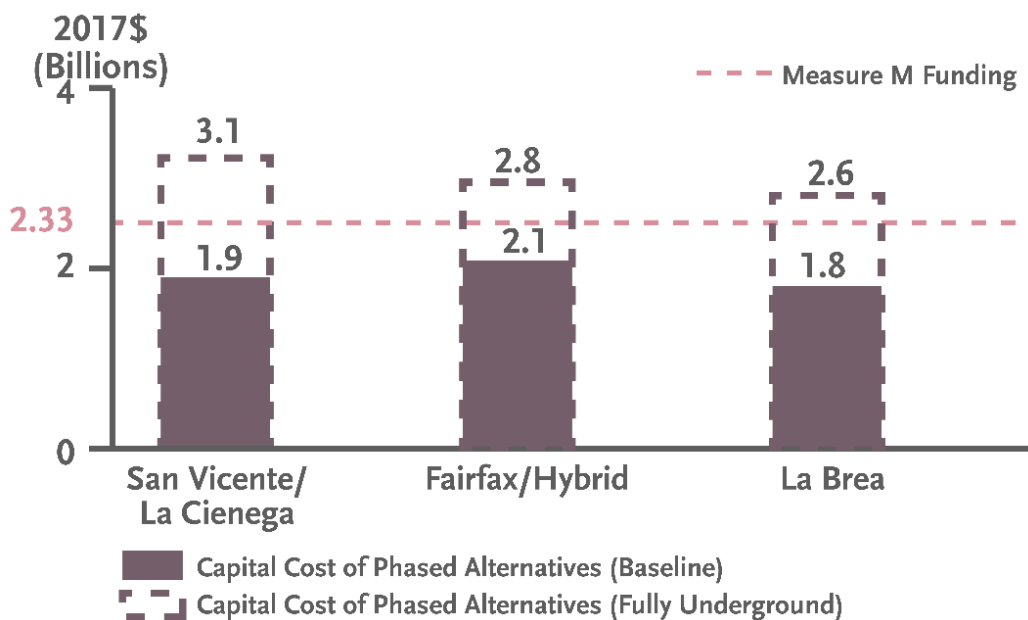






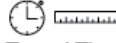




Figure ES - 17 Capital Cost Estimates of Phased Alternative

In addition, there have been discussions on potential acceleration for this project through Metro's Early Project Delivery Strategy, and the City of West Hollywood has conducted early project delivery study with input from City of Los Angeles and Metro. According to the study findings, the potential maximum additional funding sources identified to date within the City of West Hollywood include: \$47 Million from local return, \$447 Million from West Hollywood's sales tax, \$65 Million from advertising and \$573 Million from the Enhanced Infrastructure Financing District (EIFD) funding, totaling \$1.13 Billion. Given the City of West Hollywood's role as a potential funding partner, future environmental review will consider additional IOS segments or multiple segments that provide the opportunity to extend the project to Santa Monica Blvd. within an initial phase and at the earliest date possible.

5 Findings, Recommendations and Next Steps

Below is a summary of the key performance statistics of the alternatives considered in the Advanced Alternatives Analysis (Figure ES - 18).

	SAN VICENTE	SAN VICENTE DESIGN OPTION 1 - LA CIENEGA	SAN VICENTE DESIGN OPTION 2 - Hybrid	FAIRFAX	LA BREA
 Key Map					
 Travel Time & Distance	19.0 min 9.6 mi	18.4 min 9.2 mi	20.6 min 9.9 mi	15.7 min 8.0 mi	12.4 min 6.3 mi
 Ridership	90,800	90,800	90,000	88,800	88,400
Low-income Riders*	32,100	32,500	32,000	32,500	32,700
 Cost	\$4.3-\$6.4 B	\$4.4-\$6.2 B	\$5.5-\$6.5 B	\$4.7-\$5.3 B	\$3.0-\$4.4 B

*Based on home-based work trips

Figure ES - 18 Key Performance Results for the Advance Alternative Analysis Alternatives

Overall, all alternatives have high ridership projections and great potential in serving low-income riders. While the benefits are comparable among all alternatives, the issues of constructability (including engineering constraints) have resulted in notable differences in project costs and impacts.

The San Vicente Alternative has a few segments that will go through sensitive neighborhoods that are traffic-heavy, residentially dense, and environmentally constrained that require additional right-of-way or property acquisition or underground configuration for the majority of the alignment, reducing the cost-effectiveness of the project. While some of the issues could be avoided by utilizing the La Cienega alignment from Beverly Blvd. to Santa Monica Blvd., at- or above-grade configuration is still unlikely due to the built environment, natural conditions, and utilities placement in this area. A hybrid alignment (San Vicente Design Option 2) that travels on Fairfax north to Beverly Blvd. is the seemingly most constructible alignment that will still serve similar neighborhoods and produce considerable benefits. It would also avoid most issues identified for the other design options of this alternative by utilizing different routes or underground configuration.

Most aerial segments of Fairfax and La Brea Alternatives are faced with right-of-way acquisition issues due to tight design curvature and station placement challenges because of street and alignment configurations.

Therefore, despite the small differences between the alternatives and design options in project benefits, the feasibility of the alignments and configurations are largely driven by engineering constraints which will result in considerable differences in costs and other impacts. The alignments developed during the 2018 Feasibility Study phase to maximize at-grade configurations and to reduce costs have been screened and refined further from the feasibility and constructability perspectives in the Advanced Alternative Analysis phase.

5.1.1 Recommendations

Based on the findings described above related to ridership, costs, TOC/FLM, and engineering constraints, the following recommendations are proposed:

1. Dismiss the San Vicente Alternative from further study in favor of the San Vicente Alternative Design Option 2 – Hybrid. This recommendation is based on several issues including the limitations for a quality transfer connection between the extension and the Purple Line at Wilshire and San Vicente where a transfer connection would require passengers to walk approximately 1,300 feet to access the Purple Line. Additional complications include the difficulty of constructing at-grade/aerial alignment along San Vicente Blvd. in the vicinity of Carthay Circle due to its designation as an HPOZ area. Underground construction for operation of an IOS would require a cut and cover method that would be highly disruptive and impactful to adjacent land uses. As a result, the benefits of this alignment will be better captured with the San Vicente Alternative Design Option 2 – Hybrid since it would connect all major activity centers and destinations while avoiding the complicated asterisk intersection of Olympic/Fairfax/San Vicente Blvds. and a suboptimal connection to the Purple Line.
2. Dismiss the San Vicente Alternative Design Option 1 – La Cienega in favor of a new design option associated with the San Vicente Alternative Design Option 2 – Hybrid whereby the alignment would turn north from Beverly Blvd. under La Cienega Blvd. This recommendation is based on the recommendation above for dismissal of the San Vicente Alternative in favor of Design Option 2 - Hybrid.
3. Retain the San Vicente Alternative Design Option 2 – Hybrid for further study due to its the high level of connectivity for destinations/activity centers, the highest rating of all alignments for combined TOC/FLM, public popularity, and general constructability and quality transfer connection with the Purple Line. The alternative would include options for above ground or underground configuration at Venice/Vineyard Station (between San Vicente and Pico Blvds) and on San Vicente Blvd. between the Venice/Vineyard Station and just south of Olympic Blvd. The alignment would then transition to underground before turning north at Fairfax Blvd. and west under Beverly Blvd. The primary alignment would connect with San Vicente Blvd. and continue underground along Santa Monica Blvd. to the Red Line connection at Hollywood/Highland and potentially further north to the Hollywood Bowl. A design option for the Hybrid Alternative would be to turn onto La Cienega Blvd., remaining below grade north to Santa Monica Blvd. and to Hollywood/Highland and/or the Hollywood Bowl.
4. Retain the Fairfax Alternative for further study as an option to the San Vicente Alternative Design Option 2 – Hybrid. This recommendation is based on the common alignment characteristics of the two alternatives up to the vicinity of Beverly Blvd. Although there are fewer destinations/activity centers located along Fairfax Blvd. north of Beverly Blvd., and potential engineering challenges associated with development of a station location at the intersection of Fairfax and Santa Monica Blvd., the alternatives would still serve the primary destinations/activity centers within the Fairfax corridor and would provide a faster end-to-end travel time than the San Vicente Alternative Design Option 2 – Hybrid.
5. Retain the La Brea Alternative, but dismiss further consideration of an aerial configuration due to community opposition, roadway and property impacts, and the potential for substantial visual and aesthetic effects. Retain an underground configuration in the La Brea corridor due to high cost effectiveness and the high level of regional connectivity provided by the alternative.

6. Dismiss the Vermont Alternative as recommended at the conclusion of the 2018 Feasibility Study. The Vermont Alternative does not meet several key goals of the project. For example, other alignments under consideration would provide much greater travel time savings for trips to, from and between the major study area activity centers/destinations, offering a speedier connection to the Purple Line and significantly lower travel times to points further north throughout Central Los Angeles and the San Fernando Valley, and west. In addition, action by the Metro Board calls for a separate transit study along the Vermont corridor including a potential underground heavy rail system interlining with the Red Line or Purple Lines. In this context, the Vermont Alternative as developed under the 2018 Feasibility Study would preclude a separate rail project that would serve the Vermont corridor south of Wilshire Blvd. and the existing Red Line.
7. For all agreed-upon recommendations noted above (including La Brea Alternative, Fairfax Alternative and Hybrid Alternative La Cienega option), connections to the Hollywood Bowl will be considered and studied in the next phase of work.

Figure ES - 19 illustrates the proposed preliminary configurations for the three alternatives and one design option to be further screened in the next phase of study.



Figure ES - 19 Proposed Preliminary Configurations of Alternatives

6 Next Steps

The next steps for the Advance Alternative Analysis include the Metro Board's consideration and acceptance of the recommendations noted above and the initiation of the CEQA environmental process and advanced conceptual engineering. A funding plan would then need to be in place before preliminary engineering and final design/construction.

