



WESTSIDE SUBWAY EXTENSION

Energy Technical Report



August 2010



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1.0 INTRODUCTION

This technical report examines the potential energy impacts associated with the project. The purpose of this report is to quantitatively discuss the energy consumption characteristics associated with each of the alternatives. Energy consumption levels are discussed for both construction and operation phases for each of the alternatives.



2.0 PROJECT DESCRIPTION

This chapter describes the alternatives that have been considered to best satisfy the Purpose and Need and have been carried forward for further study in the Draft Environmental Impact Statement/Environmental Impact Report. Details of the No Build, Transportation Systems Management (TSM), and the five Build Alternatives (including their station and alignment options and phasing options (or minimum operable segments [MOS]) are presented in this chapter.

2.1 No Build Alternative

The No Build Alternative provides a comparison of what future conditions would be like if the Project were not built. The No Build Alternative includes all existing highway and transit services and facilities, and the committed highway and transit projects in the Metro Long Range Transportation Plan and the Southern California Association of Governments Regional Transportation Plan. Under the No Build Alternative, no new transportation infrastructure would be built within the Study Area, aside from projects currently under construction or projects funded for construction, environmentally cleared, planned to be in operation by 2035, and identified in the adopted Metro Long Range Transportation Plan.

2.2 TSM Alternative

The TSM Alternative emphasizes more frequent bus service than the No Build Alternative to reduce delay and enhance mobility. The TSM Alternative contains all elements of the highway, transit, Metro Rail, and bus service described under the No Build Alternative. In addition, the TSM Alternative increases the frequency of service for Metro Bus Line 720 (Santa Monica–Commerce via Wilshire Boulevard and Whittier Boulevard) to between three and four minutes during the peak period.

In the TSM Alternative, Metro Purple Line rail service to the Wilshire/Western Station would operate in each direction at 10-minute headways during peak and off-peak periods. The Metro Red Line service to Hollywood/Highland Station would operate in each direction at five-minute headways during peak periods and at 10-minute headways during midday and off-peak periods.

2.3 Build Alternatives

The Build Alternatives are considered to be the “base” alternatives with “base” stations. Alignment (or segment) and station options were developed in response to public comment, design refinement, and to avoid and minimize impacts to the environment.

The Build Alternatives extend heavy rail transit service in subway from the existing Metro Purple Line Wilshire/Western Station. Heavy rail transit systems provide high speed (maximum of 70 mph), high capacity (high passenger-carrying capacity of up to 1,000 passengers per train and multiple unit trains with up to six cars per train), and reliable service since they operate in an exclusive grade-separated right-of-way. The subway will operate in a tunnel at least 30 to 70 feet below ground and will be electric powered.

Furthermore, the Build Alternatives include changes to the future bus services. Metro Bus Line 920 would be eliminated and a portion of Line 20 in the City of Santa Monica would be



eliminated since it would be duplicated by the Santa Monica Blue Bus Line 2. Metro Rapid Bus Line 720 would operate less frequently since its service route would be largely duplicated by the Westside Subway route. In the City of Los Angeles, headways (time between buses) for Line 720 are between 3 and 5 minutes under the existing network and will be between 5 and 11.5 minutes under the Build Alternatives, but no change in Line 720 would occur in the City of Santa Monica segment. Service frequencies on other Metro Rail lines and bus routes in the corridor would be the same as for the No Build Alternative.

2.3.1 Alternative 1—Westwood/UCLA Extension

This alternative extends the existing Metro Purple Line from the Wilshire/Western Station to a Westwood/UCLA Station (Figure 2-1). From the Wilshire/Western Station, Alternative 1 travels westerly beneath Wilshire Boulevard to the Wilshire/Rodeo Station and then southwesterly toward a Century City Station. Alternative 1 then extends from Century City and terminates at a Westwood/UCLA Station. The alignment is approximately 8.60 miles in length.

Alternative 1 would operate in each direction at 3.3-minute headways during morning and evening peak periods and at 10-minute headways during midday. The estimated one-way running time is 12 minutes 39 seconds from the Wilshire/Western Station.

2.3.2 Alternative 2—Westwood/Veterans Administration (VA) Hospital Extension

This alternative extends the existing Metro Purple Line from the Wilshire/Western Station to a Westwood/VA Hospital Station (Figure 2-2). Similar to Alternative 1, Alternative 2 extends the subway from the Wilshire/Western Station to a Westwood/UCLA Station. Alternative 2 then travels westerly under Veteran Avenue and continues west under the I-405 Freeway, terminating at a Westwood/VA Hospital Station. This alignment is 8.96 miles in length from the Wilshire/Western Station.

Alternative 2 would operate in each direction at 3.3-minute headways during the morning and evening peak periods and at 10-minute headways during the midday, off-peak period. The estimated one-way running time is 13 minutes 53 seconds from the Wilshire/Western Station.

2.3.3 Alternative 3—Santa Monica Extension

This alternative extends the existing Metro Purple Line from the Wilshire/Western Station to the Wilshire/4th Street Station in Santa Monica (Figure 2-3). Similar to Alternative 2, Alternative 3 extends the subway from the Wilshire/Western Station to a Westwood/VA Hospital Station. Alternative 3 then continues westerly under Wilshire Boulevard and terminates at the Wilshire/4th Street Station between 4th and 5th Streets in Santa Monica. The alignment is 12.38 miles.

Alternative 3 would operate in each direction at 3.3-minute headways during the morning and evening peak periods and operate with 10-minute headways during the midday, off-peak period. The estimated one-way running time is 19 minutes 27 seconds from the Wilshire/Western Station.

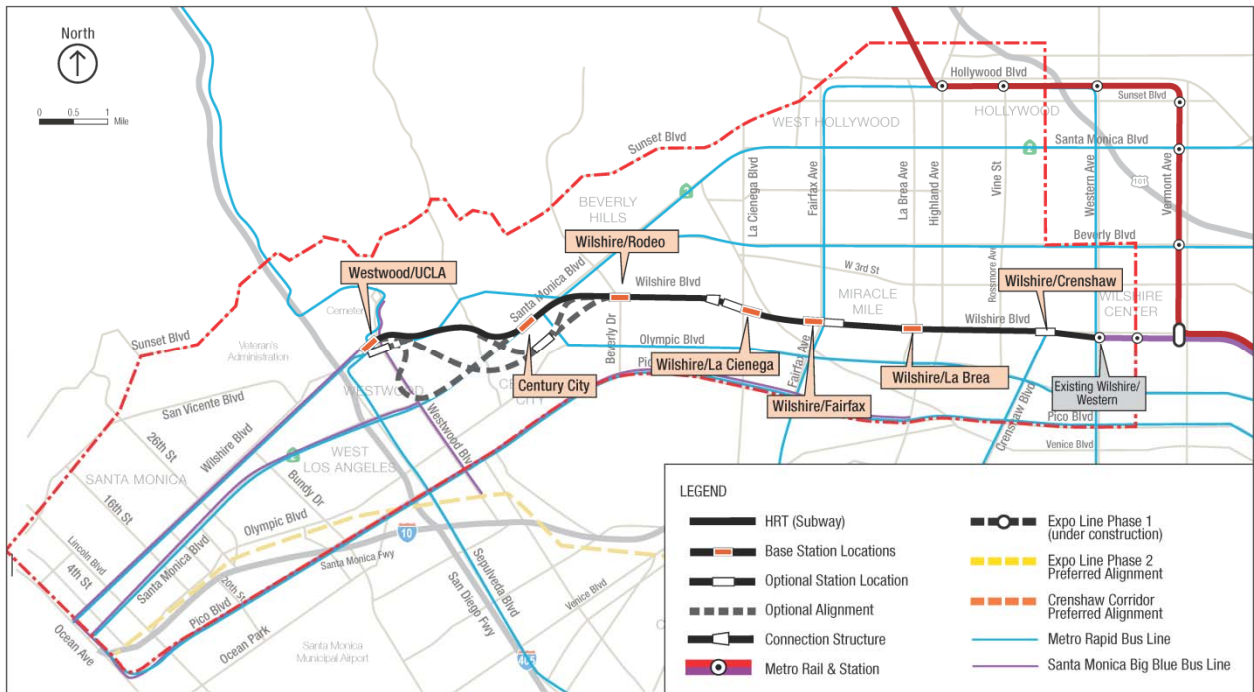


Figure 2-1. Alternative 1—Westwood/UCLA Extension

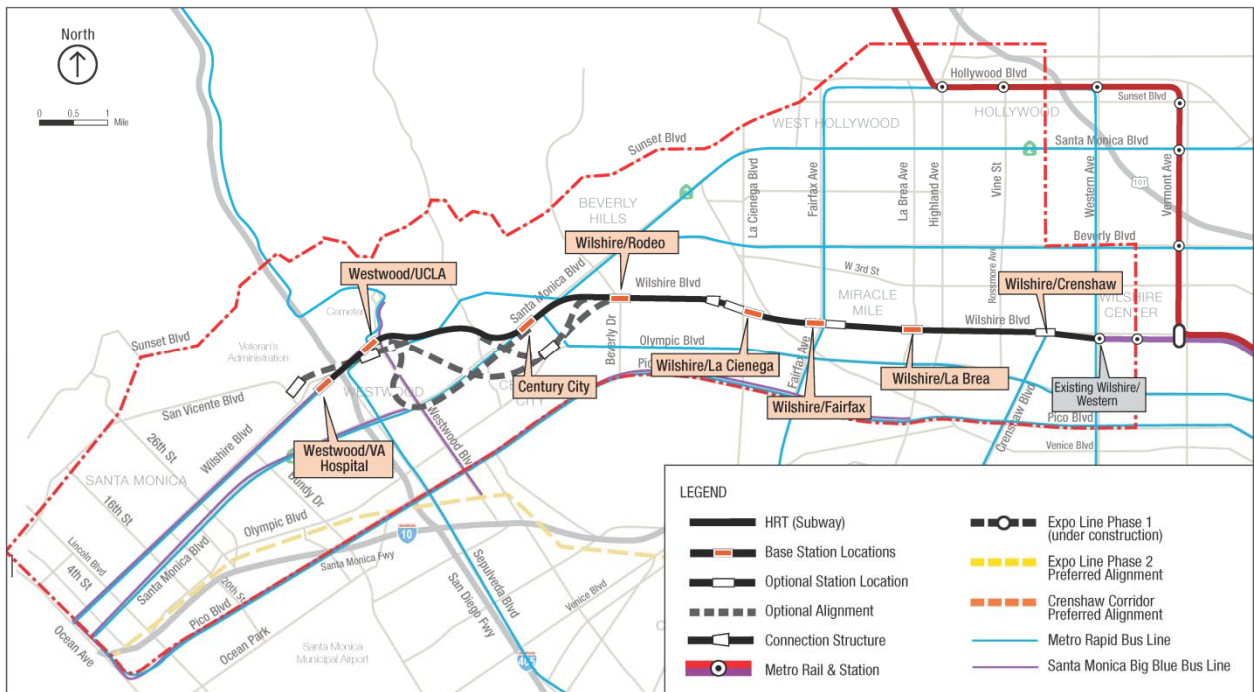


Figure 2-2. Alternative 2—Westwood/Veterans Administration (VA) Hospital Extension

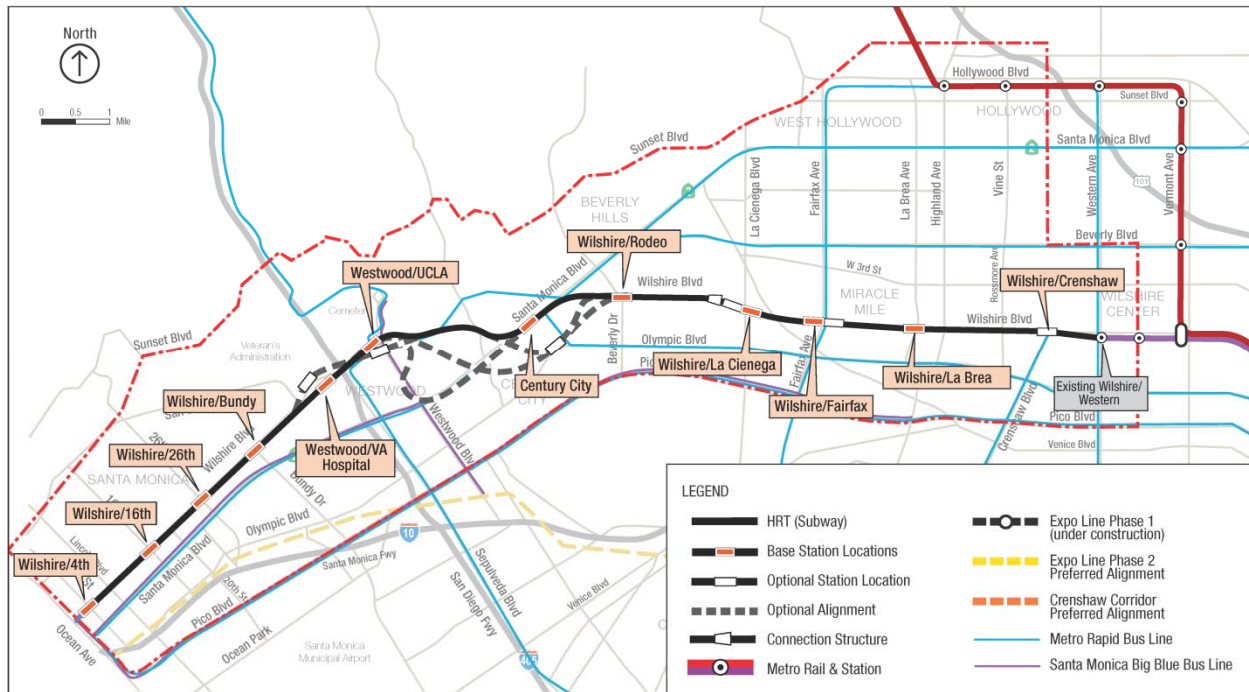


Figure 2-3. Alternative 3—Santa Monica Extension

2.3.4 Alternative 4—Westwood/VA Hospital Extension plus West Hollywood Extension

Similar to Alternative 2, Alternative 4 extends the existing Metro Purple Line from the Wilshire/Western Station to a Westwood/VA Hospital Station. Alternative 4 also includes a West Hollywood Extension that connects the existing Metro Red Line Hollywood/Highland Station to a track connection structure near Robertson and Wilshire Boulevards, west of the Wilshire/La Cienega Station (Figure 2-4). The alignment is 14.06 miles long.

Alternative 4 would operate from Wilshire/Western to a Westwood/VA Hospital Station in each direction at 3.3-minute headways during morning and evening peak periods and 10-minute headways during the midday off-peak period. The West Hollywood extension would operate at 5-minute headways during peak periods and 10-minute headways during the midday, off-peak period. The estimated one-way running time for the Metro Purple Line extension is 13 minutes 53 seconds, and the running time for the West Hollywood from Hollywood/Highland to Westwood/VA Hospital is 17 minutes and 2 seconds.

2.3.5 Alternative 5—Santa Monica Extension plus West Hollywood Extension

Similar to Alternative 3, Alternative 5 extends the existing Metro Purple Line from the Wilshire/Western Station to the Wilshire/4th Street Station and also adds a West Hollywood Extension similar to the extension described in Alternative 4 (Figure 2-5). The alignment is 17.49 miles in length. Alternative 5 would operate the Metro Purple Line extension in each direction at 3.3-minute headways during the morning and evening peak periods and 10-minute headways during the midday, off-peak period. The West Hollywood extension would operate in each direction at 5-minute headways during peak periods and 10-minute headways during the midday, off-peak period. The estimated one-way running time for the Metro Purple Line extension is 19 minutes 27 seconds, and the running time from the Hollywood/Highland Station to the Wilshire/4th Street Station is 22 minutes 36 seconds.

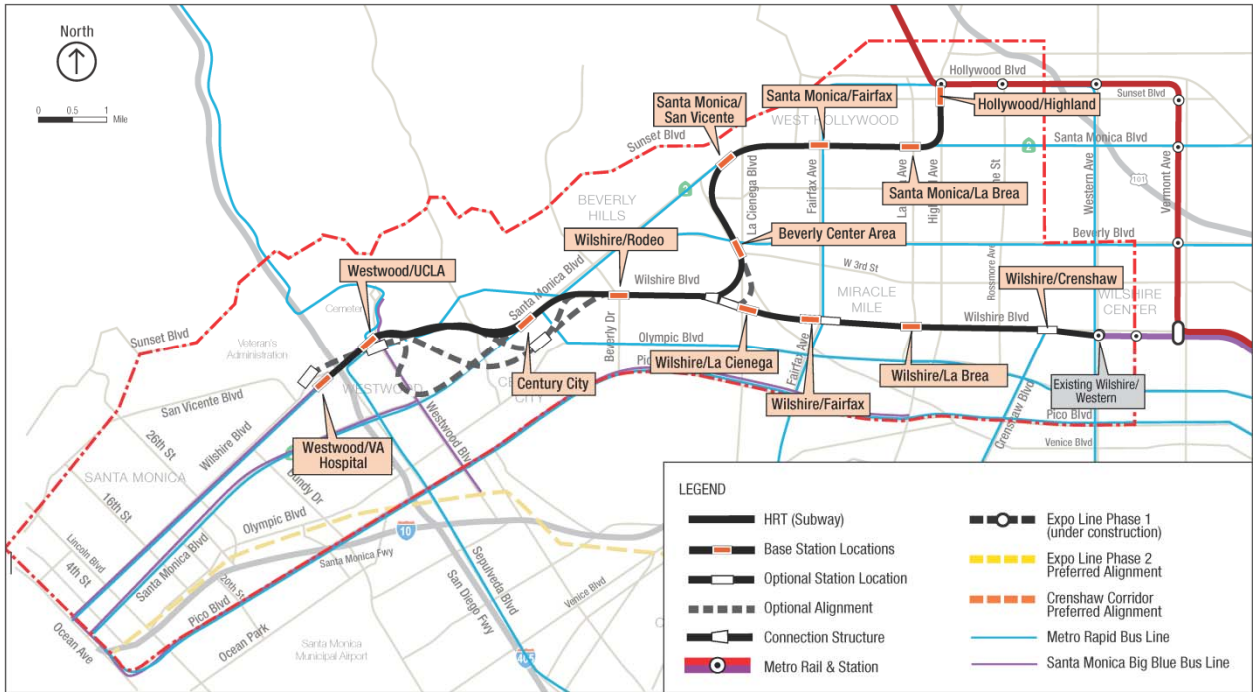


Figure 2-4. Alternative 4—Westwood/VA Hospital Extension plus West Hollywood Extension

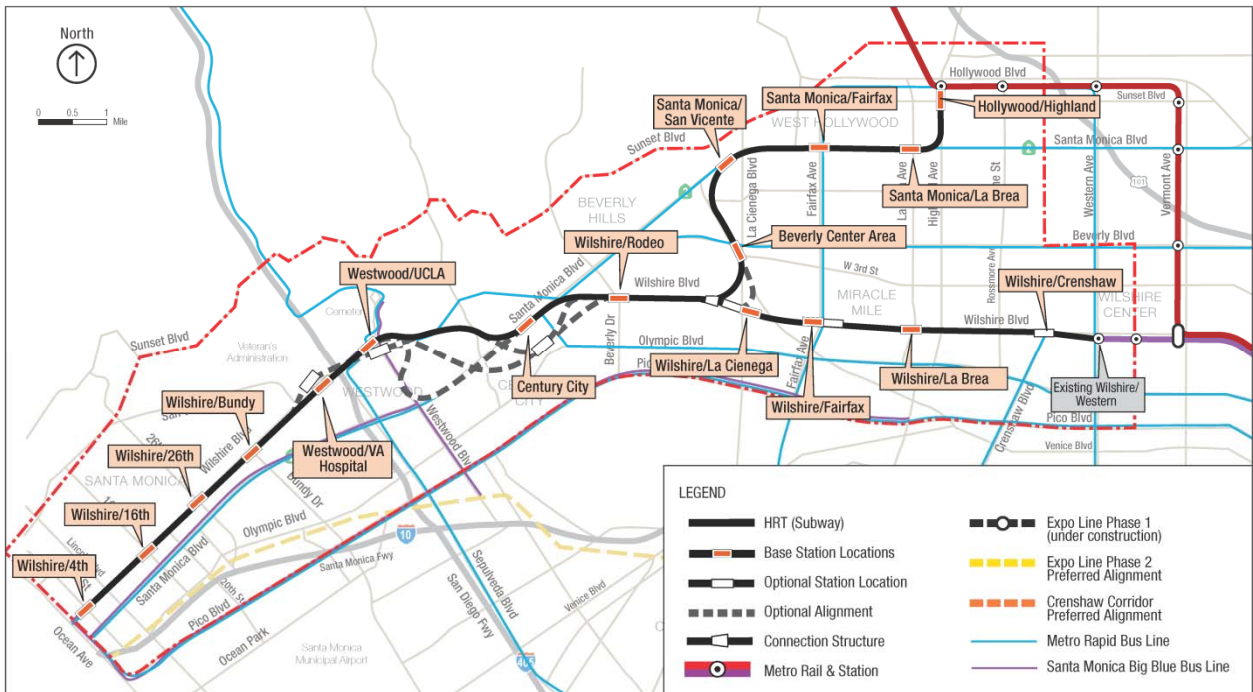


Figure 2-5. Alternative 5—Santa Monica Extension plus West Hollywood Extension



2.4 Stations and Segment Options

Heavy rail transit stations consist of a station “box,” or area in which the basic components are located. The station box can be accessed from street-level entrances by stairs, escalators, and elevators that would bring patrons to a mezzanine level where the ticketing functions are located. The 450-foot platforms are one level below the mezzanine level and allow level boarding (i.e., the train car floor is at the same level as the platform). Stations consist of a center or side platform. Each station is equipped with under-platform exhaust shafts, over-track exhaust shafts, blast relief shafts, and fresh air intakes. In most stations, it is anticipated that only one portal would be constructed as part of the Project, but additional portals could be developed as a part of station area development (by others). Stations and station entrances would comply with the *Americans with Disabilities Act of 1990*, Title 24 of the California Code of Regulations, the California Building Code, and the Department of Transportation Subpart C of Section 49 CFR Part 37.

Platforms would be well-lighted and include seating, trash receptacles, artwork, signage, safety and security equipment (closed-circuit television, public announcement system, passenger assistance telephones), and a transit passenger information system. The fare collection area includes ticket vending machines, fare gates, and map cases.

Table 2-1 lists the stations and station options evaluated and the alternatives to which they are applicable. Figure 2-6 shows the proposed station and alignment options. These include:

- Option 1—Wilshire/Crenshaw Station Option
- Option 2—Fairfax Station Option
- Option 3—La Cienega Station Option
- Option 4—Century City Station and Alignment Options
- Option 5—Westwood/UCLA Station Option
- Option 6—Westwood/VA Hospital Station Option

Table 2-1. Alternatives and Stations Considered

Stations	Alternatives				
	1	2	3	4	5
	Westwood/ UCLA Extension	Westwood/ VA Hospital Extension	Santa Monica Extension	Westwood/ VA Hospital Extension Plus West Hollywood Extension	Santa Monica Extension Plus West Hollywood Extension
Base Stations					
Wilshire/Crenshaw	•	•	•	•	•
Wilshire/La Brea	•	•	•	•	•
Wilshire/Fairfax	•	•	•	•	•
Wilshire/La Cienega	•	•	•	•	•
Wilshire/Rodeo	•	•	•	•	•
Century City (Santa Monica Blvd)	•	•	•	•	•
Westwood/UCLA (Off-street)	•	•	•	•	•
Westwood/VA Hospital		•	•	•	•
Wilshire/Bundy			•		•
Wilshire/26th			•		•
Wilshire/16th			•		•
Wilshire/4th			•		•
Hollywood/Highland				•	•
Santa Monica/La Brea				•	•
Santa Monica/Fairfax				•	•
Santa Monica/San Vicente				•	•
Beverly Center Area				•	•
Station Options					
1—No Wilshire/Crenshaw	•	•	•	•	•
2—Wilshire/Fairfax East	•	•	•	•	•
3—Wilshire/La Cienega (Transfer Station)	•	•	•	•	•
4—Century City (Constellation Blvd)	•	•	•	•	•
5—Westwood/UCLA (On-street)	•	•	•	•	•
6—Westwood/VA Hospital North		•	•	•	•

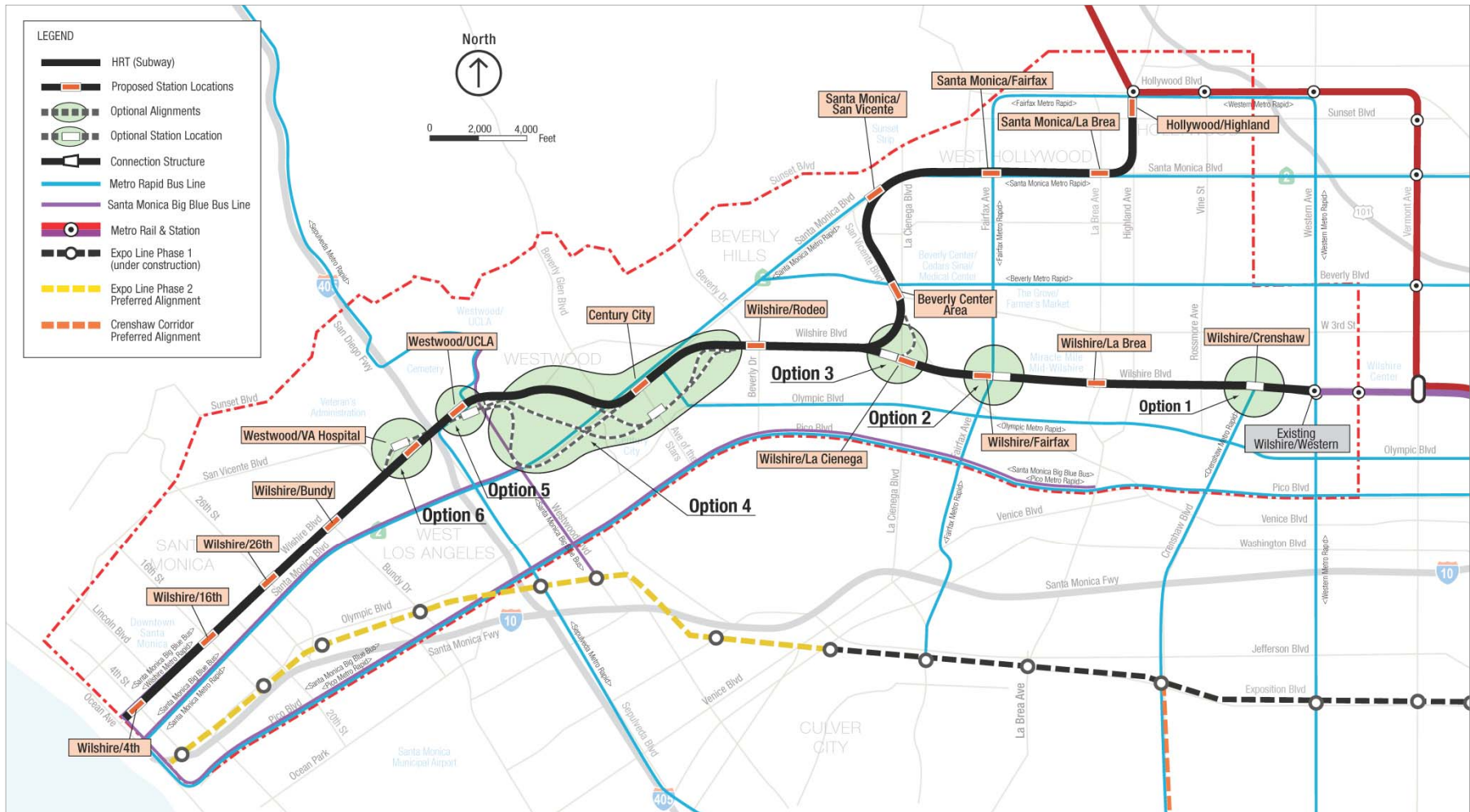


Figure 2-6. Station and Alignment Options

WESTSIDE SUBWAY EXTENSION

2.4.1 Option 1—Wilshire/Crenshaw Station Option

- **Base Station: Wilshire/Crenshaw Station**—The base station straddles Crenshaw Boulevard, between Bronson Avenue and Lorraine Boulevard.
- **Station Option: Remove Wilshire/Crenshaw Station**—This station option would delete the Wilshire/Crenshaw Station. Trains would run from the Wilshire/Western Station to the Wilshire/La Brea Station without stopping at Crenshaw. A vent shaft would be constructed at the intersection of Western Avenue and Wilshire Boulevard (Figure 2-7).

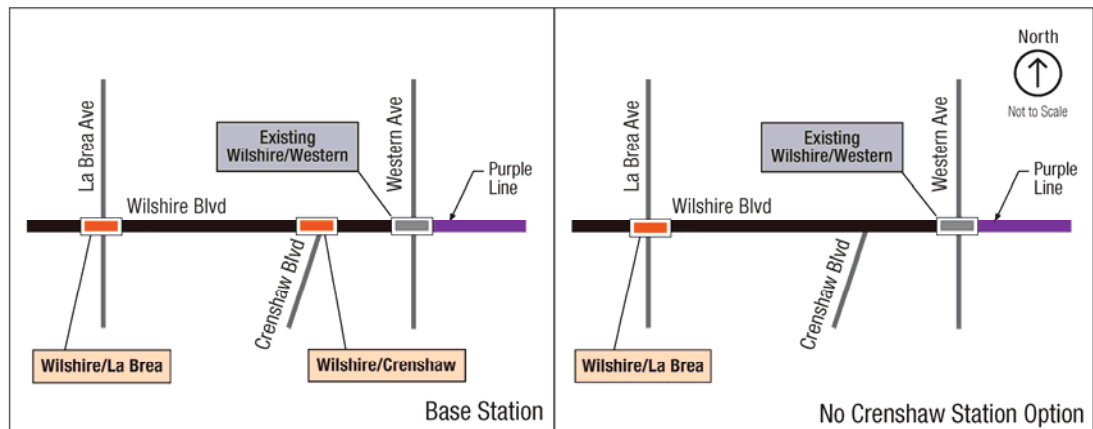


Figure 2-7. Option 1—No Wilshire/Crenshaw Station Option

2.4.2 Option 2—Wilshire/Fairfax Station East Option

- **Base Station: Wilshire/Fairfax Station**—The base station is under the center of Wilshire Boulevard, immediately west of Fairfax Avenue.
- **Station Option: Wilshire/Fairfax Station East Station Option**—This station option would locate the Wilshire/Fairfax Station farther east, with the station underneath the Wilshire/Fairfax intersection (Figure 2-8). The east end of the station box would be east of Orange Grove Avenue in front of LACMA, and the west end would be west of Fairfax Avenue.

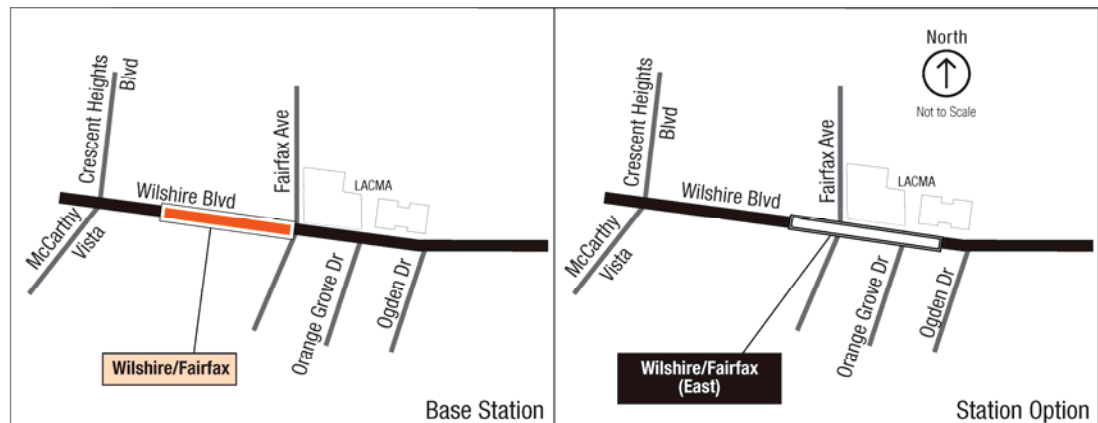


Figure 2-8. Option 2—Fairfax Station Option

2.4.3 Option 3—Wilshire/La Cienega Station Option

- Base Station: Wilshire/La Cienega Station**—The base station would be under the center of Wilshire Boulevard, immediately east of La Cienega Boulevard. A direct transfer between the Metro Purple Line and the potential future West Hollywood Line is not provided with this station. Instead, a connection structure is proposed west of Robertson Boulevard as a means to provide a future heavy rail transit connection to the West Hollywood Line.
- Station Option: Wilshire/La Cienega Station West with Connection Structure**—The station option would be located west of La Cienega Boulevard, with the station box extending from the Wilshire/Le Doux Road intersection to just west of the Wilshire/Carson Road intersection (Figure 2-9). It also contains an alignment option that would provide an alternate heavy rail transit connection to the future West Hollywood Extension. This alignment portion of Option 3 is only applicable to Alternatives 4 and 5.

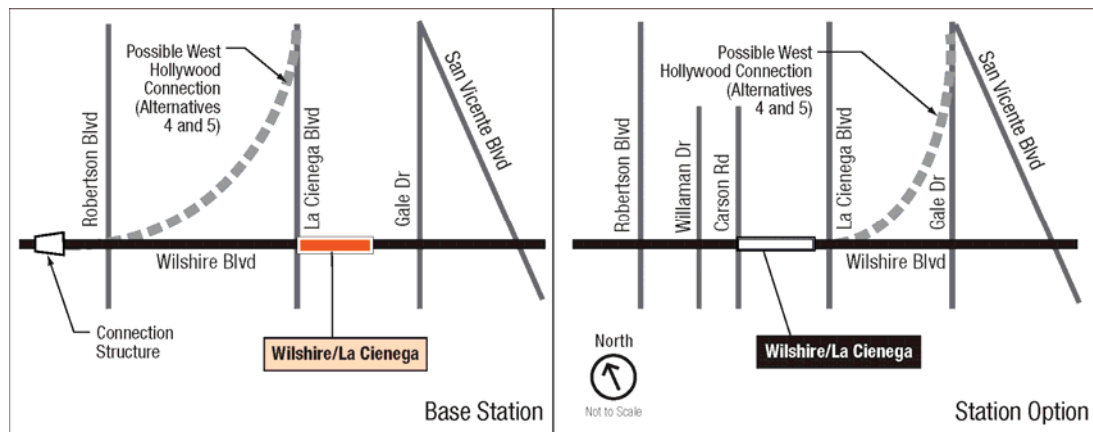


Figure 2-9. Option 3—La Cienega Station Option

2.4.4 Option 4—Century City Station and Segment Options

2.4.4.1 Century City Station and Beverly Hills to Century City Segment Options

- Base Station: Century City (Santa Monica) Station**—The base station would be under Santa Monica Boulevard, centered on Avenue of the Stars.
- Station Option: Century City (Constellation) Station**—With Option 4, the Century City Station has a location option on Constellation Boulevard (Figure 2-10), straddling Avenue of the Stars and extending westward to east of MGM Drive.
- Segment Options**—Two route options are proposed to connect the Wilshire/Rodeo Station to Century City (Constellation) Station: Constellation North and Constellation South. As shown in Figure 2-10, the base segment to the base Century City (Santa Monica) Station is shown in the solid black line and the segment options to Century City (Constellation) Station are shown in the dashed grey lines.



2.4.4.2 Century City to Westwood Segment Options

Three route options considered for connecting the Century City and Westwood stations include: East, Central, and West. As shown in Figure 2-10, each of these three segments would be accessed from both Century City Stations and both Westwood/UCLA Stations. The base segment is shown in the solid black line and the options are shown in the dashed grey lines.

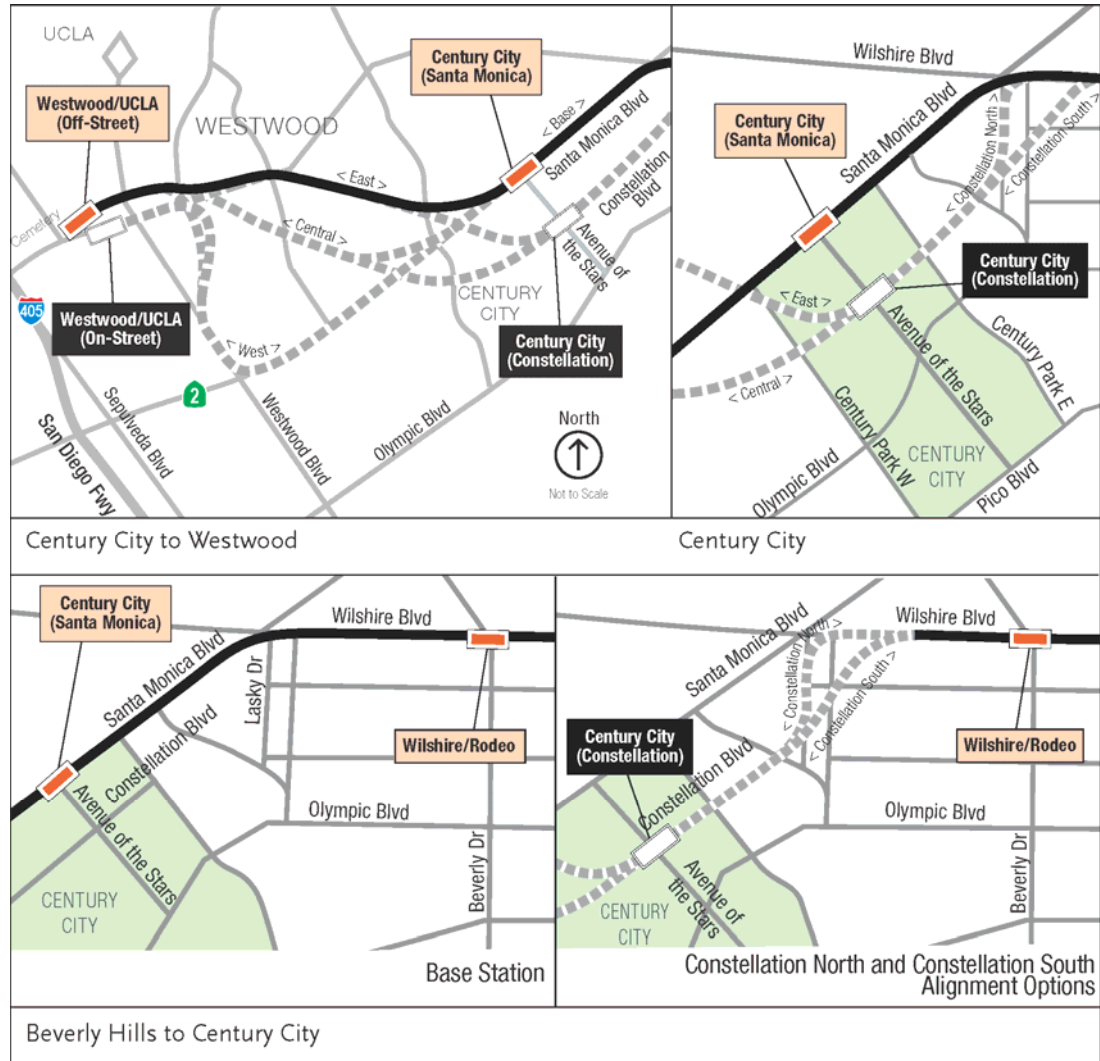


Figure 2-10. Century City Station Options

2.4.5 Option 5—Westwood/UCLA Station Options

- **Base Station: Westwood/UCLA Station Off-Street Station Option**—The base station is located under the UCLA Lot 36 on the north side of Wilshire Boulevard between Gayley and Veteran Avenues.
- **Station Option: Westwood/UCLA On-Street Station Option**—This station option would be located under the center of Wilshire Boulevard, immediately west of Westwood Boulevard (Figure 2-11).

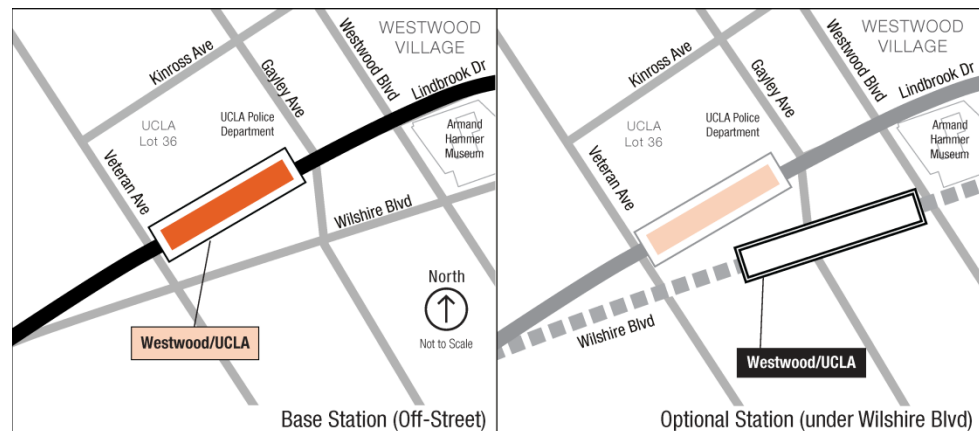


Figure 2-11. Option 5—Westwood/UCLA Station Options

2.4.6 Option 6—Westwood/VA Hospital Station Option

- **Base Station: Westwood/VA Hospital**—The base station would be below the VA Hospital parking lot on the south side of Wilshire Boulevard in between the I-405 exit ramp and Bonsall Avenue.
- **Station Option: Westwood/VA Hospital North Station**—This station option would locate the Westwood/VA Hospital Station on the north side of Wilshire Boulevard between Bonsall Avenue and Wadsworth Theater. (Shown in Figure 2-12)

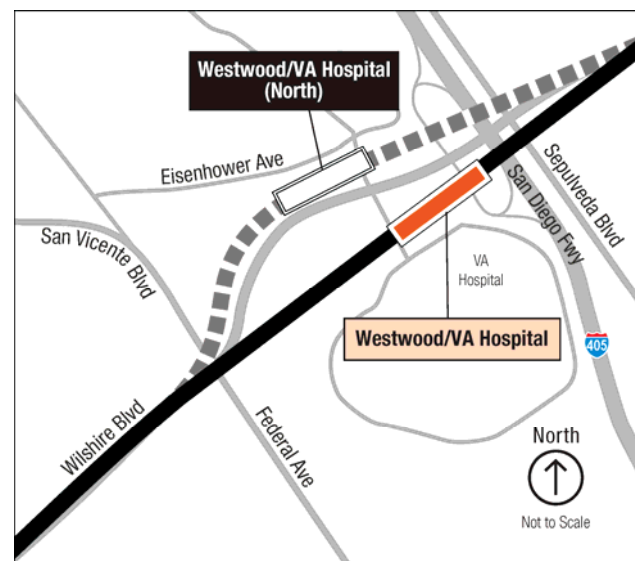


Figure 2-12. Option 6—Westwood/VA Hospital Station North

To access the Westwood/VA Hospital Station North, the alignment would extend westerly from the Westwood/UCLA Station under Veteran Avenue, the Federal Building property, the I-405 Freeway, and under the Veterans Administration property just east of Bonsall Avenue.

2.5 Base Stations

The remaining stations (those without options) are described below.

- **Wilshire/La Brea Station**—This station would be located between La Brea and Cloverdale Avenues.
- **Wilshire/Rodeo Station**—This station would be under the center of Wilshire Boulevard, beginning just west of South Canon Drive and extending to El Camino Drive.



- **Wilshire/Bundy Station**—This station would be under Wilshire Boulevard, east of Bundy Drive, extending just east of Saltair Avenue.
- **Wilshire/26th Station**—This station would be under Wilshire Boulevard, with the eastern end east of 26th Street and the western end west of 25th Street, midway between 25th Street and Chelsea Avenue.
- **Wilshire/16th Station**—This station would be under Wilshire Boulevard with the eastern end just west of 16th Street and the western end west of 15th Street.
- **Wilshire/4th Street Station**—This station would be under Wilshire Boulevard and 4th Street in Santa Monica.
- **Hollywood/Highland Station**—This station would be located under Highland Avenue and would provide a transfer option to the existing Metro Red Line Hollywood/Highland Station under Hollywood Boulevard.
- **Santa Monica/La Brea Station**—This station would be under Santa Monica Boulevard, just west of La Brea Avenue, and would extend westward to the center of the Santa Monica Boulevard/Formosa Avenue.
- **Santa Monica/Fairfax Station**—This station is under Santa Monica Boulevard and would extend from just east of Fairfax Avenue to just east of Ogden Drive.
- **Santa Monica/San Vicente Station**—This station would be under Santa Monica Boulevard and would extend from just west of Hancock Avenue on the west to just east of Westmount Drive on the east.
- **Beverly Center Area Station**—This station would be under San Vicente Boulevard, extending from just south of Gracie Allen Drive to south of 3rd Street.

2.6 Other Components of the Build Alternatives

2.6.1 Traction Power Substations

Traction power substations are required to provide traction power for the heavy rail transit system. Substations would be located in the station box or in a box located with the crossover tracks and would be located in a room that is about 50 feet by 100 feet in a below grade structure.

2.6.2 Emergency Generators

Stations at which the emergency generators would be located are Wilshire/La Brea, Wilshire/La Cienega, Westwood/UCLA, Westwood/VA Hospital, Wilshire/26th, Highland/Hollywood, Santa Monica/La Brea, and Santa Monica/San Vicente. The emergency generators would require approximately 50 feet by 100 feet of property in an off-street location. All would require property acquisition, except for the one at the Wilshire/La Brea Station which uses Metro's property.

2.6.3 Mid-Tunnel Vent Shaft

Each alternative would require mid-tunnel ventilation shafts (Table 2-2). The vent shafts are emergency ventilation shafts with dampers, fans, and sound attenuators generally placed at both ends of a station box to exhaust smoke. In addition, emergency vent shafts could be



used for station cooling and gas mitigation. The vent shafts are also required in tunnel segments with more than 6,000 feet between stations to meet fire/life safety requirements. There would be a connecting corridor between the two tunnels (one for each direction of train movement) to provide emergency egress and fire-fighting ingress. A vent shaft is approximately 150 square feet; with the opening of the shaft located in a sidewalk and covered with a grate about 200 square feet.

Table 2-2. Mid-Tunnel Vent Shaft Locations

Alternative/Option	Location
Alternatives 1 through 5, MOS 2	Part of the connection structure on Wilshire Boulevard, west of Robertson Boulevard
Alternatives 2 through 5	West of the Westwood/VA Hospital Station on Army Reserve property at Federal Avenue and Wilshire Boulevard
Option 4 via East route	At Wilshire Boulevard/Manning Avenue intersection
Option 4 to Westwood/UCLA Off-Street Station via Central route	On Santa Monica Boulevard just west of Beverly Glen Boulevard
Option 4 to Westwood/UCLA On-Street Station via Central route	At Santa Monica Boulevard/Beverly Glen Boulevard intersection
Options 4 via West route	At Santa Monica Boulevard/Glendon Avenue intersection
Options 4 from Constellation Station via Central route	On Santa Monica Boulevard between Thayer and Pandora Avenues
Option from Constellation Station via West route	On Santa Monica Boulevard just east of Glendon Avenue

2.6.4 Trackwork Options

Each Build Alternative requires special trackwork for operational efficiency and safety (Table 2-3):

- Tail tracks—a track, or tracks, that extends beyond a terminal station (the last station on a line)
- Pocket tracks—an additional track, or tracks, adjacent to the mainline tracks generally at terminal stations
- Crossovers—a pair of turnouts that connect two parallel rail tracks, allowing a train on one track to cross over to the other
- Double crossovers—when two sets of crossovers are installed with a diamond allowing trains to cross over to another track

Table 2-3. Special Trackwork Locations

Station	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
	Westwood/ UCLA Extension	Westwood/ VA Hospital Extension	Santa Monica Extension	Westwood/VA Hospital Extension Plus West Hollywood Extension	Santa Monica Extension Plus West Hollywood Extension
Special Trackwork Locations—Base Trackwork Alternatives					
Wilshire/Crenshaw	None	None	None	None	None
Wilshire/La Brea	Double Crossover	Double Crossover	Double Crossover	Double Crossover	Double Crossover
Wilshire/Fairfax	None <i>MOS 1 Only: Terminus Station with Tail tracks</i>	None <i>MOS 1 Only: Terminus Station with Tail tracks</i>	None <i>MOS 1 Only: Terminus Station with Tail tracks</i>	None <i>MOS 1 Only: Terminus Station with Tail tracks</i>	None <i>MOS 1 Only: Terminus Station with Tail tracks</i>
Wilshire/La Cienega	None	None	None	None	None
<i>Station Option 3 - Wilshire/La Cienega West</i>	Turnouts	Turnouts	Turnouts		
Wilshire/Robertson Connection Structure	Equilateral Turnouts—for future West Hollywood connection	Equilateral Turnouts—for future West Hollywood connection	Equilateral Turnouts—for future West Hollywood connection	Equilateral Turnouts	Equilateral Turnouts
Wilshire/Rodeo	None	None	None	None	None
Century City	Double Crossover <i>MOS 2 Only: Terminus Station with Double Crossover and tail tracks</i>	Double Crossover <i>MOS 2 Only: Terminus Station with Double Crossover and tail tracks</i>	Double Crossover <i>MOS 2 Only: Terminus Station with Double Crossover and tail tracks</i>	Double Crossover <i>MOS 2 Only: Terminus Station with Double Crossover and tail tracks</i>	Double Crossover <i>MOS 2 Only: Terminus Station with Double Crossover and tail tracks</i>
Westwood/UCLA	End Terminal with Double Crossover and tail tracks	Double Crossover	Double Crossover	Double Crossover	Double Crossover
Westwood/VA Hospital	N/A	End Terminal with Turnouts and tail tracks	Turnouts	End Terminal with Turnouts and tail tracks	Turnouts
Wilshire/Bundy	N/A	N/A	None	N/A	None
Wilshire/26th	N/A	N/A	None	N/A	None
Wilshire/16th	N/A	N/A	None	N/A	None
Wilshire/4th	N/A	N/A	End Terminal with Double Crossover. Pocket Track with Double Crossover, Equilateral Turnouts and tail tracks	N/A	End Terminal with Double Crossover, Pocket Track with Double Crossover, Equilateral Turnouts and tail tracks
Hollywood/ Highland	N/A	N/A	N/A	Double Crossover and tail tracks	Double Crossover and tail tracks
Santa Monica/La Brea	N/A	N/A	N/A	None	None
Santa Monica/Fairfax	N/A	N/A	N/A	None	None
Santa Monica/ San Vicente	N/A	N/A	N/A	Double Crossover	Double Crossover
Beverly Center	N/A	N/A	N/A	None	None
Additional Special Trackwork Location (Optional Trackwork)					
Wilshire/Fairfax	Double Crossover	Double Crossover	Double Crossover	Double Crossover	Double Crossover
Wilshire/La Cienega	Double Crossover	Double Crossover	Double Crossover	Double Crossover	Double Crossover
Wilshire/ Rodeo	Pocket Track	Pocket Track	Pocket Track	Pocket Track	Pocket Track
Wilshire/26th	N/A	N/A	Double Crossover	N/A	Double Crossover



2.6.5 Rail Operations Center

The existing Rail Operations Center, shown on the figure below, located in Los Angeles near the intersection of Imperial Highway and the Metro Blue Line does not have sufficient room to accommodate the new transit corridors and line extensions in Metro’s expansion program. The Build Alternatives assume an expanded Rail Operations Center at this location.

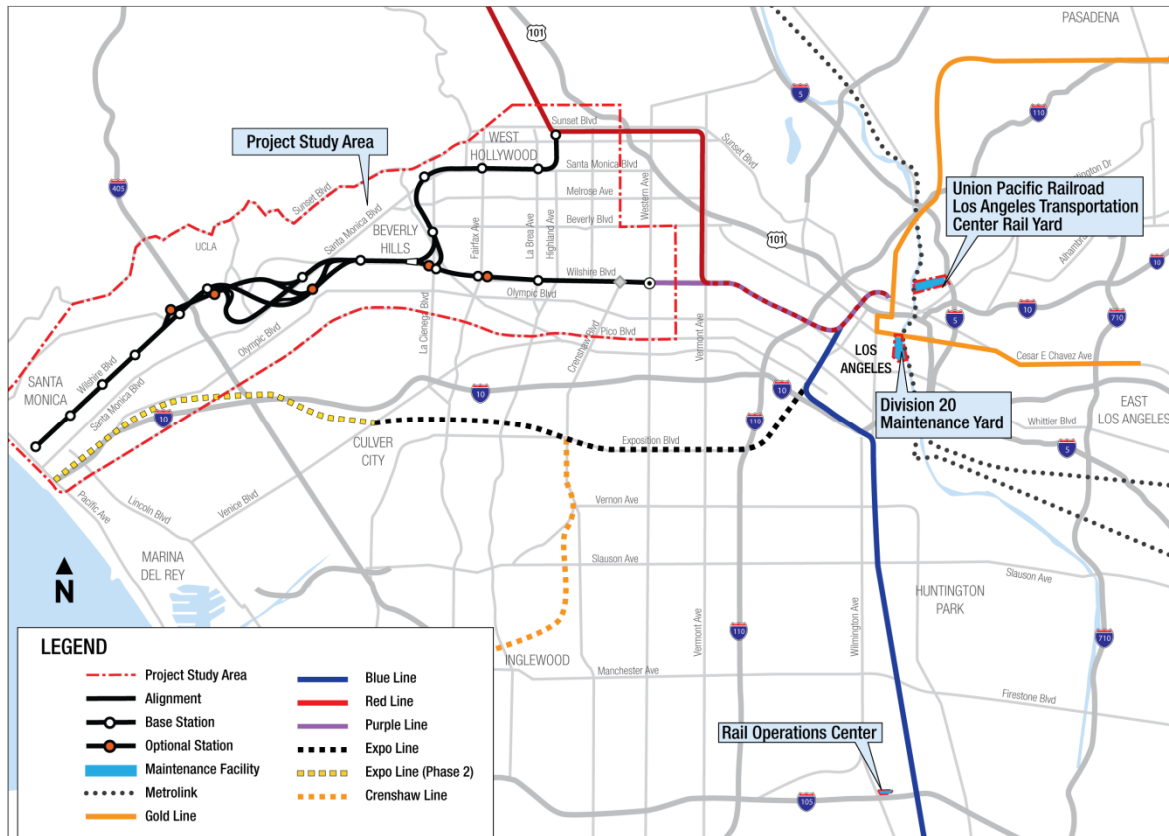


Figure 2-13: Location of the Rail Operations Center and Maintenance Yards

2.6.6 Maintenance Yards

If any of the Build Alternatives are chosen, additional storage capacity would be needed. Two options for providing this expanded capacity are as follows (see Figure 2-15):

- The first option requires purchasing 3.9 acres of vacant private property abutting the southern boundary of the Division 20 Maintenance and Storage Facility, which is located between the 4th and 6th Street Bridges. Additional maintenance and storage tracks would accommodate up to 102 vehicles, sufficient for Alternatives 1 and 2.
- The second option is a satellite facility at the Union Pacific (UP) Los Angeles Transportation Center Rail Yard. This site would be sufficient to accommodate the vehicle fleet for all five Build Alternatives. An additional 1.3 miles of yard lead tracks from the Division 20 Maintenance and Storage Facility and a new bridge over the Los Angeles River would be constructed to reach this yard.

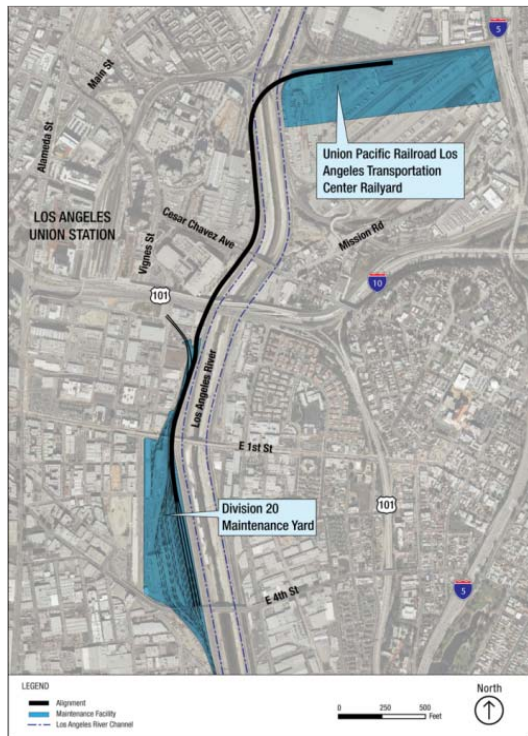


Figure 2-14. Maintenance Yard Options

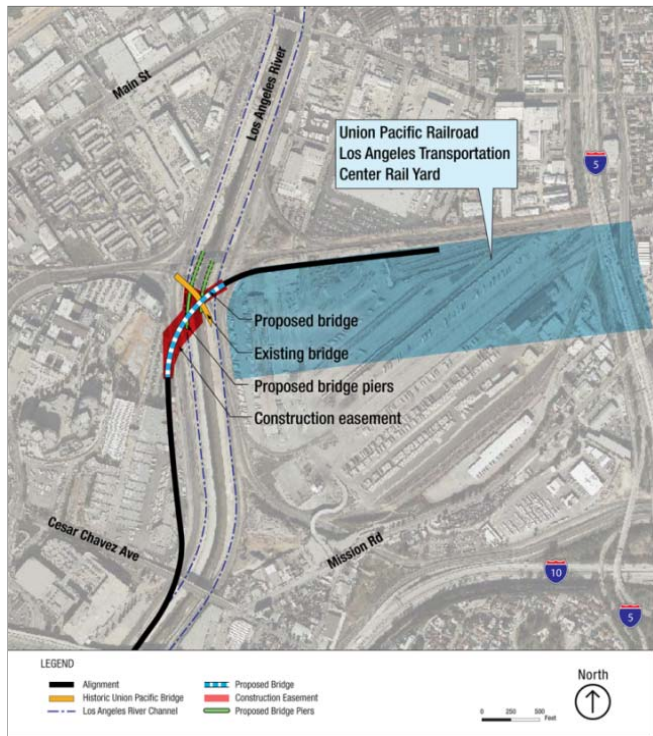


Figure 2-15. UP Railroad Rail Bridge

2.7 Minimum Operable Segments

Due to funding constraints, it may be necessary to construct the Westside Subway Extension in shorter segments. A Minimum Operable Segment (MOS) is a phasing option that could be applied to any of the Build Alternatives.

2.7.1 MOS 1—Fairfax Extension

MOS 1 follows the same alignment as Alternative 1, but terminates at the Wilshire/Fairfax Station rather than extending to a Westwood/UCLA Station. A double crossover for MOS 1 is located on the west end of the Wilshire/La Brea Station box, west of Cloverdale Avenue. The alignment is 3.10 miles in length.

2.7.2 MOS 2—Century City Extension

MOS 2 follows the same alignment as Alternative 1, but terminates at a Century City Station rather than extending to a Westwood/UCLA Station. The alignment is 6.61 miles from the Wilshire/Western Station.



3.0 REGULATORY FRAMEWORK

A discussion of the regulatory framework governing energy use and resources in the study area and larger region is presented below.

The California Energy Commission is the State's primary energy policy and planning agency. Created by the legislature in 1974, the commission has six major responsibilities: (1) forecasting future energy needs and keeping historical energy data, (2) licensing thermal power plants 50 megawatts or larger, (3) promoting energy efficiency through appliance and building standards, (4) developing energy technologies and supporting renewable energy, (5) planning for and directing the State's response to energy emergency, and (6) implementing the State's alternative and renewable fuel and vehicle technology program.

The commission published the 2007 Integrated Energy Policy Report in October 2007. The 2007 Integrated Energy Policy Report was prepared in response to Senate Bill 1389, Chapter 568, Statutes of 2002, which requires that the commission prepare a biennial integrated energy policy report. This report contains an integrated assessment of major energy trends and issues facing the State's electricity, natural gas, and transportation fuel sectors and provides policy recommendations to conserve resources; protect the environment; ensure reliable, secure, and diverse energy supplies; enhance the State's economy; and protect public health and safety. The 2007 Integrated Energy Policy Report fulfills the requirement of Senate Bill 1389.

The Southern California Association of Governments is required by state and federal mandates to prepare a regional transportation plan every three years. The 2008 Regional Transportation Plan is a long-range regional transportation plan that provides a blueprint to help achieve a coordinated and balanced regional transportation system. The Southern California Association of Governments 2008 Regional Transportation Plan describes energy production and consumption throughout the South Coast Air Basin and provides vehicle miles traveled by county. The South Coast Air Basin is a subregion of the South Coast Air Quality Management District, the agency principally responsible for comprehensive air pollution control in the State, and covers an area of 6,745 square miles. The South Coast Air Basin includes all of Orange County and the non-desert portions of Los Angeles, Riverside, and San Bernardino Counties. Vehicle miles traveled is an indicator of the extent to which vehicles are used, providing a valuable factor in calculating the amount of energy consumed by transportation.

Metro has adopted an Energy and Sustainability Policy to control energy consumption and embrace energy efficiency, energy conservation, and sustainability. The purpose of the Energy and Sustainability Policy is to control energy consumption and embrace energy efficiency, energy conservation, and sustainability to avoid unnecessary expenditure; help in protecting the environment; improve cost effectiveness, productivity, and working conditions; and prolong the useful life of fossil fuels by using resources more efficiently. Adoption of the Energy and Sustainability Policy will help to immediately lower electrical and water bills, and will provide the baseline and business case to further Metro's sustainability goals. Metro's general long-term objectives are to:



- Buy fuels and electricity at the most economic cost
- Reduce, whenever possible, Metro's use of fossil fuels through the use of ambient and renewable energy sources
- Use fuels and electricity as efficiently as possible
- Reduce the amount of emissions, especially carbon dioxide, caused by Metro's required consumption

The above general objectives are included in the *Energy and Sustainability Policy*. The following long-term objective is specific to the Westside Subway Extension.

- Metro will design and operate the Westside Subway Extension and its supporting transit feeder network, bike facilities and pedestrian connections so as to help ensure that less operating energy is consumed than would be the case if the project was not built.



4.0 AFFECTED ENVIRONMENT

4.1 Energy Requirements

The proposed alternatives' energy needs are measured in petroleum and equivalent British Thermal Units. A British thermal unit is the quantity of heat required to raise the temperature of water one degree Fahrenheit at sea level. Other units of energy can all be converted into equivalent British Thermal Units and thus, British Thermal Units is used as the basis for comparing energy consumption associated with different resources. Table 4-1

Table 4-1. Energy Comparisons

Energy Type	Energy Unit	Equivalent British Thermal Units
Electrical	Kilowatt-Hour	3,412
Natural Gas	Cubic-Foot	1,034
Crude Oil	Barrel (42 Gallons)	5,800,000
Gasoline	Gallon	125,000

Source: California Energy Commission, 2009

shows comparisons of various types of energy and their equivalent British Thermal Units.

Energy resources for transportation include petroleum, natural gas, electricity, liquefied petroleum gas, hydrogen, and biofuels such as ethanol. Currently, California's gasoline and diesel markets are characterized by increasing demands, tight supplies, and volatile prices. California imports more than 50 percent of its crude oil and over 15 percent of its refined products. The State's dependence on this increasingly expensive energy resource continues

to grow. Moreover, fossil fuel based transportation of products and people are a major contributor of carbon dioxide, the principal catalyst to climate change. Changes in energy supply and demand are affected by factors such as energy prices, United States' economic growth, advances in technologies, changes in weather patterns, and future public policy decisions.

United States transportation-related energy consumption is anticipated to grow annually by 0.7 percent from 2008 to 2035. Energy consumption in California continues to be dominated by growth in passenger vehicles, where 40 percent of all energy consumed in the State is used for transportation. California is the second largest consumer of transportation fuels in the world (behind the United States as a whole); more than 16 billion gallons of gasoline and four billion gallons of diesel fuels are consumed each year. California's population is estimated to exceed 44 million by 2020, which would result in substantial increases in transportation fuel demand for the State. Table 4-2 outlines the 149 million barrel increase in transportation fuel demand through 2020. California must address its petroleum infrastructure problems to secure transportation fuels to meet the needs of a growing

Table 4-2. California Transportation Fuel Demand

Year	Barrels (Million/year)
2005	553
2010	617
2015	661
2020	702

Source: California Energy Commission, 2007
Integrated Energy Policy Report, 2007.

population by adjusting choices of transportation, land use policies, and alternative fuels.

Transportation energy consumption reflects the types and numbers of vehicles, the extent of their use (vehicle miles traveled), and their fuel economy (miles per gallon). Implementation of the proposed alternatives is expected to result in changing the dynamics of all vehicle classes with regard to vehicle miles traveled. Changes in vehicle miles traveled, in turn, would affect energy consumption.



Vehicle miles traveled is also important in determining the demand for infrastructure improvements. Urban growth patterns have caused California’s vehicle miles traveled to increase at a rate of over three percent a year between 1975 and 2004. In 2005, Southern California Association of Governments data showed automobile vehicle miles traveled in California at 372 million, which is equivalent to 2.14 trillion British Thermal Units or 368,966 barrels of oil.

Southern California Association of Governments estimates the vehicle miles traveled for transportation plans. Southern California Association of Governments projections show a 29 percent increase in vehicle miles traveled from 2008 to 2035. Vehicle miles traveled is directly related to energy use and is the main contributor to air quality pollutants in the Southern California Association of Governments region. A reduction in vehicle miles traveled through alternative modes of transportation would lower energy needs and reduce pollutant emissions.

Table 4-3 displays the energy requirements for various modes of transportation including automobile, bus, and rail transit as provided by the Oak Ridge National Laboratory. The Oak Ridge National Laboratory has only provided one level of energy intensity for transit buses regardless of the fuel type (e.g., compressed natural gas or diesel). Urban rail projects (such as the Westside Subway Extension) have a lower British Thermal Units per passenger mile rate compared to automobiles and buses.

Table 4-3. Transportation Energy Intensity

Transport Mode	British Thermal Units/Passenger-Mile	British Thermal Units/Vehicle-Mile
Automobile	3,514	5,517
Transit Bus (all vehicle types)	4,315	39,048
Commuter Rail	2,638	90,328
Urban Rail	2,577	62,833

Source: Oak Ridge National Laboratory, *Transportation Energy Data Book: Edition 28-2009, 2009*

Table 4-4 shows the energy usage associated with transportation within the Southern Association of Governments area. Currently, energy use is approximately 950 trillion British Thermal Units. Energy usage associated with transportation could approach 1,383 trillion British Thermal Units by 2035. Table 4-4 also shows regional vehicle miles traveled and vehicle miles traveled per British thermal unit

Table 4-4. Annual Motor Vehicle Energy Usage within the SCAG Region

Scenario	Billion British Thermal Units	Vehicle Miles Traveled	Vehicle Miles Traveled per British Thermal Unit
2008 Existing	949,680	429,178,401	452
2035 Future No Project	1,383,126	551,600,000	399

Source: Southern California Association of Governments, *Draft 2008 Regional Transportation Plan Program Environmental Impact Report, January 2008* and Terry A. Hayes Associates LLC, *November 2009*.



4.2 Energy Implications

Transportation sources account for roughly half of the energy consumed in California. The Westside Subway Extension would be expected to remove passenger cars from the regional roadway network, easing the increase in vehicle miles traveled and the usage of fuels. The Westside Subway Extension may also reduce regional energy consumption depending on ridership forecasts for the various modes of transportation.



5.0 ENVIRONMENTAL CONSEQUENCES

5.1 Methodology

Operational energy use for each alternative was calculated based on the British Thermal Units per vehicle-mile rate. These rates are shown in Table 4-3. The miles for each alternative were obtained from the transportation analysis completed by Parsons Brinckerhoff. Table 5-1 shows the number of vehicle-miles that would be either added or subtracted from the region when compared to the No Build Scenario (conditions without the project). For example, Alternative 5 would add 37,078 rail vehicle-miles to the region while removing 369,744 automobile vehicle-miles.

Table 5-1. 2035 Regional Vehicle-Miles by Transportation Mode

Alternative	Automobile	Rail	Bus
No Build vs. TSM	(28,770)	0	1,472
No Build vs. Alternative 1	(357,083)	14,950	(8,390)
No Build vs. Alternative 2	(360,000)	15,714	(8,390)
No Build vs. Alternative 3	(365,868)	21,059	(8,390)
No Build vs. Alternative 4	(362,887)	27,457	(8,390)
No Build vs. Alternative 5	(369,744)	37,078	(8,390)
No Build vs. MOS 1	(343,337)	6,872	0
No Build vs. MOS 2	(352,205)	12,218	(3,410)

Source: Parsons Brinckerhoff. 2010

Construction energy use for each alternative was calculated based on equipment hours and gallons of diesel per hour of equipment use. Construction energy use is compared to total energy consumption for the State. Total energy consumption was estimated using a population of 36,756,666 people (U.S. Census Bureau, 2008 data, accessed March 2010) and a per capita consumption rate of 233.4 million British Thermal Units (U.S. Energy Information Administration).

5.2 Operational Impacts

The assessment of operational impacts is based on the British Thermal Units consumption information presented in Table 5-2. The analysis of station energy was based on a Federal Transit Administration annual rate of 175 million British Thermal Units per station.



Table 5-2. Estimated Mobile Source Energy Consumption

Alternative	Change in Energy Consumption (Million British Thermal Units/Year)
No Build vs. TSM	(36,761)
No Build vs. Alternative 1	(496,877)
No Build vs. Alternative 2	(485,229)
No Build vs. Alternative 3	(374,463)
No Build vs. Alternative 4	(221,728)
No Build vs. Alternative 5	(14,888)
No Build vs. MOS 1	(533,777)
No Build vs. MOS 2	(478,078)

Source: Terry A. Hayes Associates LLC, 2010

5.2.1 No Build Alternative

The No Build Alternative provides a comparison of what future conditions would be like if the Project were not built. The No Build Alternative includes all existing highway and transit services and facilities, and the committed highway and transit projects in the Metro Long Range Transportation Plan and the Southern California Association of Governments Regional Transportation Plan. Under the No Build Alternative, no new transportation infrastructure would be built within the Study Area, aside from projects currently under construction or projects funded for construction, environmentally cleared, planned to be in operation by 2035, and identified in the adopted Metro Long Range Transportation Plan.

No portion of the Westside Subway Extension would be operated under the No Build Alternative. The No Build Alternative would not consume operational energy to power the Westside Subway Extension, and would not have an adverse energy impact.

5.2.2 Transportation System Management Alternative

The TSM Alternative emphasizes more frequent bus service than the No Build Alternative to reduce delay and enhance mobility. The TSM Alternative contains all elements of the highway, transit, Metro Rail, and bus service described under the No Build Alternative. In addition, the TSM Alternative increases the frequency of service for Metro Bus Line 720 (Santa Monica–Commerce via Wilshire Boulevard and Whittier Boulevard) to between three and four minutes during the peak period.

The TSM Alternative would decrease automobile vehicle miles traveled and increase rail and bus vehicle miles traveled. Table 5-2 shows that mobile source British Thermal Units consumption would decrease by approximately 37 billion British Thermal Units per year because of decreased system-wide vehicle-miles. The TSM Alternative would result in less energy consumption than baseline conditions and would result in a beneficial energy impact.

5.2.3 Alternative 1—Westwood/UCLA Extension

This alternative extends heavy rail transit, in subway, from the existing Metro Purple Line Wilshire/Western Station to a Westwood/UCLA Station. The alignment is approximately 8.60 miles in length.



From the Wilshire/Western Station, Alternative 1 travels westerly beneath Wilshire Boulevard to the Wilshire/Rodeo Station and then southwesterly toward a Century City Station. Alternative 1 then extends from Century City and terminates at a Westwood/UCLA Station.

Alternative 1 would operate in each direction at 3.3-minute headways during morning and evening peak periods and at 10-minute headways during midday. Service frequencies on other Metro Rail lines and bus routes in the corridor would be the same as for the No Build Alternative. The estimated one-way running time is 12 minutes 39 seconds from the Wilshire/Western Station.

Energy required for train travel would be the primary source of energy use for the project. Alternative 1 would increase rail vehicle miles traveled and decrease automobile and bus vehicle miles traveled. Table 5-2 shows that mobile source British Thermal Units consumption would decrease by approximately 497 billion British Thermal Units per year because of decreased system-wide vehicle-miles.

Alternative 1 would also consume energy to operate seven stations. This energy would be used to provide lighting and to power electronic equipment. Each of the seven stations would use approximately 175 million British Thermal Units per year during operational activity (e.g., lighting). The total energy consumption associated with all seven stations would be approximately 1.2 billion British Thermal Units per year. The five station options associated with this alternative are discussed separately later in this analysis.

Alternative 1 would result in less energy consumption than baseline conditions and would result in a beneficial energy impact.

5.2.4 Alternative 2—Westwood/VA Hospital Extension

This alternative extends heavy rail transit, in subway, from the existing Metro Purple Line Wilshire/Western Station to a Westwood/VA Hospital Station. This alignment is 8.96 miles in length from the Wilshire/Western Station.

Similar to Alternative 1, from the Wilshire/Western Station, Alternative 2 travels westerly beneath Wilshire Boulevard to the Wilshire/Rodeo Station and then southwesterly toward a Century City Station, then toward a Westwood/UCLA Station.

Alternative 2 then travels westerly under Veteran Avenue and continues west under the I-405 Freeway, terminating at a Westwood/VA Hospital Station.

Alternative 2 would operate in each direction at 3.3-minute headways during the morning and evening peak periods and at 10-minute headways during the midday, off-peak period. Service frequencies on other Metro Rail lines and bus routes in the corridor would be the same as for the No Build Alternative. The estimated one-way running time is 13 minutes 53 seconds from the Wilshire/Western Station.

As with Alternative 1, the primary source of energy use for Alternative 2 would be train travel. Alternative 2 would increase rail vehicle miles traveled and decrease automobile and bus vehicle miles traveled. Table 5-2 shows that mobile source British Thermal Units consumption would decrease by approximately 485 billion British Thermal Units per year.



Alternative 2 would include eight stations. Each of the eight stations would use approximately 175 million British Thermal Units per year during operational activity. The total energy consumption associated with all eight stations would be approximately 1.4 billion British Thermal Units per year. The six station options associated with this alternative are discussed separately later in this analysis.

Alternative 2 includes significant decreased system-wide vehicle-miles which results in less energy consumption than baseline conditions. This Alternative would result in a beneficial energy impact.

5.2.5 Alternative 3—Santa Monica Extension

This alternative extends heavy rail transit, in subway, from the existing Metro Purple Line Wilshire/Western Station to the Wilshire/4th Street Station in Santa Monica. The alignment is 12.38 miles in length from the Wilshire/Western Station.

Similar to Alternative 1, from the Wilshire/Western Station, Alternative 3 travels westerly beneath Wilshire Boulevard to the Wilshire/Rodeo Station and then southwesterly toward a Century City Station, then toward a Westwood/UCLA Station. Alternative 2 travels westerly under Veteran Avenue and continues west under the I-405 Freeway to a Westwood/VA Hospital Station. Alternative 3 would then continue westerly under Wilshire Boulevard, terminating at the Wilshire/4th Street Station between 4th and 5th Streets.

Alternative 3 would operate in each direction at 3.3-minute headways during the morning and evening peak periods and operate with 10-minute headways during the midday, off-peak period. The estimated one-way running time is 19 minutes 27 seconds from the Wilshire/Western Station.

Alternative 3 would increase rail vehicle miles traveled and decrease automobile and bus vehicle miles traveled. The decrease in automobile and bus vehicle miles traveled would decrease regional energy consumption associated with automobiles and buses. Table 5-2 shows that mobile source British Thermal Units consumption would decrease by approximately 374 billion British Thermal Units per year.

Alternative 3 would include 12 stations and associated stationary energy consumption. Each of the 12 stations would use approximately 175 million British Thermal Units per year during operational activity. The total energy consumption associated with all 12 stations would be approximately 2.1 billion British Thermal Units per year. The six station options associated with this alternative are discussed separately later in this analysis.

Alternative 3 would result in less energy consumption than baseline conditions and would result in a beneficial energy impact.

5.2.6 Alternative 4—Westwood/VA Hospital Extension Plus West Hollywood Extension

Similar to Alternative 2, this alternative extends heavy rail transit, in subway, from the existing Metro Purple Line Wilshire/Western Station to a Westwood/VA Hospital Station but also adds a West Hollywood Extension (Figure 2-16). The West Hollywood branch extends from the existing Metro Red Line Hollywood/Highland Station to the track connection structure near Robertson and Wilshire Boulevards. The alignment is 14.06 miles in length.



From a new station at Hollywood/Highland, the West Hollywood Line extends south under Highland Avenue to just north of Fountain Avenue where the alignment curves southwest. At Orange Drive, the alignment turns westerly under Santa Monica Boulevard.

At the Sycamore Avenue/Santa Monica Boulevard intersection, the alignment continues westerly under Santa Monica Boulevard to just east of the Santa Monica/San Vicente Boulevard intersection. The alignment turns south at Larrabee Street, under San Vicente Boulevard to Ashcroft Avenue.

At Ashcroft Avenue, the alignment continues south between Sherbourne Drive and San Vicente Boulevard, crossing under Beverly Boulevard, and is then under San Vicente Boulevard to just north of 3rd Street. Near 4th Street, the alignment begins to curve under Burton Way. At Colgate Avenue, the alignment turns southwesterly, crossing under Clifton Way, Le Doux Road, and Stanley Drive. West of Stanley Drive, the alignment curves westerly under Carson Road, Hamel Drive, and Amaz Drive, and then connects into the alignment of Alternative 2 at a track connection structure at Robertson and Wilshire Boulevards.

Alternative 4 would operate from Wilshire/Western to the Westwood/VA Hospital Station in each direction at 3.3-minute headways during morning and evening peak periods and 10-minute headways during the midday off-peak period. The West Hollywood branch of Alternative 4 would operate at 5-minute headways during peak periods and 10-minute headways during the midday, off-peak period. The estimated one-way running time for the Metro Purple Line extension is 13 minutes 53 seconds, and the running time for the West Hollywood from Hollywood/Highland to Westwood/VA Hospital is 17 minutes and 2 seconds.

As shown in Table 5-1, Alternative 4 would increase rail vehicle miles traveled and decrease automobile and bus vehicle miles traveled. Table 5-2 shows that mobile source British Thermal Units consumption would decrease by 222 billion British Thermal Units per year because of decreased system-wide vehicle-miles.

Alternative 4 would include 13 stations. Each of the 13 stations would use approximately 175 million British Thermal Units per year during operational activity (e.g., lighting). The total energy consumption associated with all 13 stations would be approximately 2.1 billion British Thermal Units per year. This does not include energy used for train travel. Train travel energy is analyzed in Table 5-2. The six station options associated with this alternative are discussed separately later in this analysis.

Alternative 4 would result in less energy consumption than baseline conditions and would result in a beneficial energy impact.

5.2.7 Alternative 5—Santa Monica Extension Plus West Hollywood Extension

Similar to Alternative 3, this alternative extends heavy rail transit, in subway, from the existing Metro Purple Line Wilshire/Western Station to the Wilshire/4th Street Station and adds a West Hollywood Extension similar to the extension described in Alternative 4. The alignment is 17.49 miles in length.

Alternative 5 is comprised of two elements: a Metro Purple Line extension to Santa Monica plus a West Hollywood branch to Santa Monica. The Metro Purple Line extension would



operate in each direction at 3.3-minute headways during the morning and evening peak periods and 10-minute headways during the midday, off-peak period. The West Hollywood branch would operate in each direction at 5-minute headways during peak periods and 10-minute headways during the midday, off-peak period. The estimated one-way running time for the Metro Purple Line extension is 19 minutes 27 seconds, and the running time for the West Hollywood Line from the Hollywood/Highland Station to the Wilshire/4th Street Station is 22 minutes 36 seconds.

Alternative 5 would increase rail vehicle miles traveled and decrease automobile and bus vehicle miles traveled. Table 5-2 shows that mobile source British Thermal Units consumption would decrease by approximately 15 billion British Thermal Units per year because of decreased system-wide vehicle-miles.

Alternative 5 would include 17 stations. Each of the 17 stations would use approximately 175 million British Thermal Units per year during operational activity (e.g., lighting). The total energy consumption associated with all 17 stations would be approximately 3 billion British Thermal Units per year. This does not include energy used for train travel. Train travel energy is analyzed in Table 5-2. The six station options associated with this alternative are discussed separately later in this analysis.

Alternative 5 would result in less energy consumption than baseline conditions and would result in a beneficial energy impact.

5.2.8 MOS 1—Fairfax Station Terminus

MOS 1 Alternative follows the same alignment as Alternative 1 (see description above), but terminates at the Wilshire/Fairfax Station. The alignment is 3.10 miles in length. MOS 1 Alternative would increase rail vehicle miles traveled and decrease automobile and bus vehicle miles traveled. Table 5-2 shows that mobile source British Thermal Units consumption would increase by approximately 25 trillion British Thermal Units per year.

MOS 1 Alternative would include three stations. Each of the three stations would use approximately 175 million British Thermal Units per year during operational activity (e.g., lighting). The total energy consumption associated with all three stations would be approximately 525 million British Thermal Units per year. This does not include energy used for train travel. Train travel energy is analyzed in Table 5-2. The two station options associated with this alternative are discussed separately later in this analysis.

MOS 1 Alternative includes significant increased system-wide passenger-miles which results in more energy consumption than baseline conditions. As such, MOS 1 Alternative would result in an adverse energy impact.

5.2.9 MOS 2—Century City Station Terminus

MOS 2 is the same alignment as MOS 1 but extends to a Century City Station. The alignment is 6.61 miles from the Wilshire /Western Station. MOS 2 Alternative would increase rail vehicle miles traveled and decrease automobile and bus vehicle miles traveled. Table 5-2 shows that mobile source British Thermal Units consumption would increase by approximately 104 trillion British Thermal Units per year.



MOS 2 Alternative would include six stations. Each of the six stations would use approximately 175 million British Thermal Units per year during operational activity (e.g., lighting). The total energy consumption associated with all six stations would be approximately 1.0 billion British Thermal Units per year. This does not include energy used for train travel. Train travel energy is analyzed in Table 5-2. The four station options associated with this alternative are discussed separately later in this analysis.

MOS 2 Alternative includes significant increased system-wide passenger-miles which results in more energy consumption than baseline conditions. As such, MOS 2 Alternative would result in an adverse energy impact.

5.2.10 Build Options

5.2.10.1 Option 1—Wilshire/Crenshaw Station Option

Option 1 would remove the Wilshire/Crenshaw Station from each of the alternatives. This would reduce the annual energy consumption for each scenario by approximately 175 million British Thermal Units. This would further reduce the energy consumption shown Table 5-2 for each of the Alternatives. All of the Alternatives would still result in beneficial energy impacts.

5.2.10.2 Option 2—Wilshire/Fairfax Station East Option

Option 2 would locate the Wilshire/Fairfax Station farther east of Fairfax Avenue, with the station underneath the Wilshire/Fairfax intersection. Option 2 would not change the total number of stations for any alternative, and would not increase or decrease energy consumption of the alternatives. All of the Alternatives would still result in beneficial energy impacts.

5.2.10.3 Option 3—Wilshire/La Cienega Station Option

Option 3 would be located west of La Cienega Boulevard, with the station box extending from the Wilshire/Le Doux Road intersection to just west of the Wilshire/Carson Road intersection. The station option also contains an alignment option that would provide an alternate connection to the future West Hollywood Extension. Option 3 would not change the total number of stations for any alternative. The alternate alignment option would marginally affect the vehicle miles traveled, which is the basis of the mobile source energy analysis. Option 3 would not substantially alter the energy consumption of the alternatives, and all of the Alternatives would still result in beneficial energy impacts.

5.2.10.4 Option 4—Century City Station and Segment Options

Option 4 includes multiple sites for subway stations in Century City and multiple connecting routes between the different stations. Option 4 would not change the total number of stations for any alternative. The alternate alignment options would marginally affect the vehicle miles traveled, which is the basis of the mobile source energy analysis. Option 4 would not substantially alter the energy consumption of the alternatives, and all of the Alternatives would still result in beneficial energy impacts.

5.2.10.5 Option 5—Westwood/UCLA Station Options

Option 5 would locate the Westwood/UCLA Station under the center of Wilshire Boulevard, immediately west of Westwood Boulevard. Option 5 would not change the total number of stations for any alternative, and would not increase or decrease energy consumption of the alternatives. All of the Alternatives would still result in beneficial energy impacts.

**5.2.10.6 Option 6—Westwood/Veterans Administration Hospital Station Option**

Option 6 would locate the Westwood/Veteran Administration Hospital Station on the north side of Wilshire Boulevard. Option 6 would not change the total number of stations for any alternative, and would not increase or decrease energy consumption of the alternatives. All of the Alternatives would still result in beneficial energy impacts.

5.2.11 Maintenance and Operation Facility Sites

Metro currently has a fleet size of 104 heavy rail vehicles to operate the existing Metro Red/Metro Purple Lines. Increased service for the No Build Alternative would require an additional 42 heavy rail vehicles, for a total fleet of 146 vehicles. Heavy rail vehicles required for the Build Alternatives range from 196 (MOS 1) to 336 (Alternative 5). The number of additional vehicles over the No Build Alternative ranges from 50 (MOS 1) to 190 heavy rail vehicles (Alternative 5).

Currently, Metro stores and maintains its Red Line/Purple Line vehicle fleet at the existing Division 20 Maintenance and Storage Facility at the site bounded by 1st Avenue on the north, the Los Angeles River on the east, 4th Street on the south, and Santa Fe Avenue on the west. With a capacity to accommodate up to 200 heavy rail vehicles, the yard currently has sufficient capacity to store 96 additional heavy rail vehicles.

Several enhancements to the facility are planned and assumed in the No Build Alternative. One is a turnback to allow trains to change direction more efficiently. In addition, since more frequent train service systemwide would put more mileage on Metro's heavy rail vehicles, more frequent maintenance would be necessary. Planned improvements would increase capacity at Division 20 for major repairs, wheel truing, service and inspection, and blow down operations.

If any of the heavy rail transit Build Alternatives are chosen, additional storage capacity would be needed. Two options for providing this expanded capacity are as follows:

- Additional storage immediately south of the Division 20 Maintenance and Storage Facility between the 4th and 6th Street Bridges. This option would require purchasing 3.9 acres of vacant private property abutting the southern boundary of the existing facility, and the construction of additional maintenance and storage tracks. This would accommodate up to 102 vehicles, sufficient added capacity for Alternatives 1 and 2.
- In the event that the existing Metro Red Line Rail Storage and Maintenance Yards could not be expanded to accommodate the Westside Subway Extension Project, a satellite facility could be built at the Union Pacific Los Angeles Transportation Center Rail Yard, connected by yard lead tracks to the Division 20 Maintenance and Storage Facility. This site has more than 123 acres, of which approximately 53 acres could be needed for the facility sufficient to accommodate the vehicle fleet for all five heavy rail transit alternatives. An additional 1.3 miles of track and a new bridge over the Los Angeles River would be constructed for vehicles to reach this yard.

The California Department of Transportation has estimated that maintenance and storage facilities use approximately 8.7 billion British Thermal Units per year. The energy would be consumed for purposes that include lighting, repair activity, and cleaning. When compared to mobile source energy consumption shown in Table 5-2, this represents a small percentage of total operational energy consumption. Energy use associated with the maintenance yards



would not substantially affect overall energy use. All of the Alternatives would result in beneficial energy impacts.

5.3 Construction Impacts (Construction Equipment Energy Consumption)

5.3.1 No Build Alternative

No portion of the Westside Subway Extension would be constructed under the No Build Alternative. The No Build Alternative would not consume energy to construct the Westside Subway Extension, and would not have an adverse energy impact.

5.3.2 Transportation System Management Alternative

The TSM Alternative enhances the No Build Alternative by expanding the Metro Rapid bus services operating in the Westside Transit Corridor. This alternative emphasizes more frequent service to reduce delay and enhance mobility. The TSM Alternative would not include any physical changes to the study area. This alternative would not result in new construction activity and would not have an adverse energy impact.

5.3.3 Alternative 1—Westwood/UCLA Extension

Alternative 1 extends from the existing Metro Purple Line Wilshire/Western Station to a Westwood/UCLA Station. The alignment is 8.60 miles in length and would include the construction of seven stations. As shown in Table 5-3, approximately 2.0 trillion British Thermal Units would be consumed during construction of Alternative 1. This represents approximately 0.02 percent of the total energy consumed per year in the State of California.

Table 5-3. Estimated Construction Energy Consumption

Alternative	Energy Consumption (Billion British Thermal Units)
Alternative 1	2,020
Alternative 2	2,309
Alternative 3	3,463
Alternative 4	3,752
Alternative 5	4,906
MOS 1 vs. No Build	866
MOS 2 vs. No Build	1,732
Maintenance Facility	5

Source: Terry A. Hayes Associates LLC, 2010

Metro would require the construction contractor to implement energy conserving Best Management Practices in accordance with Metro’s Energy and Sustainability Policy. Best Management Practices would include, but are not limited to, implementing a construction energy conservation plan, using energy-efficient equipment, consolidating material delivery to ensure efficient vehicle utilization, scheduling delivery of materials during non-rush hours to maximize vehicle fuel efficiency, encouraging construction workers to carpool, and maintaining equipment and machinery in good working condition. With implementation of these measures, Alternative 1 would not lead to a wasteful, inefficient, or unnecessary usage



of fuel or energy. Construction of Alternative 1 would not result in an adverse energy impact.

5.3.4 Alternative 2—Westwood/VA Hospital Extension

Alternative 2 extends from the existing Metro Purple Line Wilshire/Western Station to a Westwood/Veterans Administration Hospital Station. The alignment is 8.96 miles in length and would include the construction of eight stations. As shown in Table 5-3, approximately 2.3 trillion British Thermal Units would be consumed during construction of Alternative 2. This represents less than 0.03 percent of the total energy consumed per year in the State of California. With implementation of Best Management Practices, Alternative 2 would not lead to a wasteful, inefficient, or unnecessary usage of fuel or energy. Construction of Alternative 2 would not result in an adverse energy impact.

5.3.5 Alternative 3—Santa Monica Extension

Alternative 3 extends from the existing Metro Purple Line Wilshire/Western Station to the Wilshire/4th Street Station in Santa Monica. The alignment is 12.38 miles in length and would include the construction of 12 stations. As shown in Table 5-3, approximately 3.5 trillion British thermal units would be consumed during construction of Alternative 3. This represents approximately 0.04 percent of the total energy consumed per year in the State of California. With implementation of Best Management Practices, Alternative 3 would not lead to a wasteful, inefficient, or unnecessary usage of fuel or energy. Construction of Alternative 3 would not result in an adverse energy impact.

5.3.6 Alternative 4—Westwood/VA Hospital Extension Plus West Hollywood Extension

Similar to Alternative 2, Alternative 4 extends from the existing Metro Purple Line Wilshire/Western Station to a Westwood/Veterans Administration Hospital Station but also adds a West Hollywood Extension. The alignment is 14.06 miles in length and would include the construction of 13 stations. As shown in Table 5-3, approximately 3.8 trillion British Thermal Units would be consumed during construction of Alternative 4. This represents approximately 0.04 percent of the total energy consumed per year in the State of California. With implementation of Best Management Practices, Alternative 4 would not lead to a wasteful, inefficient, or unnecessary usage of fuel or energy. Construction of Alternative 4 would not result in an adverse energy impact.

5.3.7 Alternative 5—Santa Monica Extension Plus West Hollywood Extension

Similar to Alternative 3, Alternative 5 extends from the existing Metro Purple Line Wilshire/Western Station to the Wilshire/4th Street Station and adds a West Hollywood Extension. The alignment is 17.49 miles in length and would include the construction of 17 stations. As shown in Table 5-3, approximately 4.9 trillion British Thermal Units would be consumed during construction of Alternative 5. This represents less than 0.06 percent of the total energy consumed per year in the State of California. With implementation of Best Management Practices, Alternative 5 would not lead to a wasteful, inefficient, or unnecessary usage of fuel or energy. Construction of Alternative 5 would not result in an adverse energy impact.

**5.3.8 MOS 1—Fairfax Station Terminus**

The MOS 1 Alternative follows the same alignment as Alternative 1 (see description above), but terminates at the Wilshire/Fairfax Station rather than extending to the Westwood/UCLA Station. The alignment is 3.10 miles in length and would include the construction of three stations. As shown in Table 5-3, approximately 866 billion British Thermal Units would be consumed during construction of the MOS 1 Alternative. This represents less than 0.01 percent of the total energy consumed per year in the State of California. With implementation of Best Management Practices, the MOS 1 Alternative would not lead to a wasteful, inefficient, or unnecessary usage of fuel or energy. Construction of the MOS 1 Alternative would not result in an adverse energy impact.

5.3.9 MOS 2—Century City Station Terminus

The MOS 2 Alternative follows the same alignment as Alternative 1 (see description above) but extends to a Century City Station. The alignment is 6.61 miles in length and would include the construction of six stations. As shown in Table 5-3, approximately 1.7 trillion British Thermal Units would be consumed during construction of the MOS 2 Alternative. This represents less than 0.02 percent of the total energy consumed per year in the State of California. With implementation of Best Management Practices, the MOS 2 Alternative would not lead to a wasteful, inefficient, or unnecessary usage of fuel or energy. Construction of the MOS 2 Alternative would not result in an adverse energy impact.

5.3.10 Build Options**5.3.10.1 Option 1—Wilshire/Crenshaw Station Option**

Option 1 would remove the Wilshire/Crenshaw Station from each of the alternatives. This would reduce the construction energy consumption for each scenario by approximately 2.4 billion British Thermal Units. This relatively small amount of energy consumption would not substantially alter the total energy consumption for the alternatives, and Option 1 would not result in an adverse construction energy impact.

5.3.10.2 Option 2—Wilshire/Fairfax Station East Option

Option 2 would locate the Wilshire/Fairfax Station farther east of Fairfax Avenue, with the station underneath the Wilshire/Fairfax intersection. It would not change the total number of stations for any alternative. Option 2 would not increase or decrease construction energy consumption of the alternatives, and would not result in an adverse construction energy impact.

5.3.10.3 Option 3—Wilshire/La Cienega Station Option

Option 3 would be located west of La Cienega Boulevard, with the station box extending from the Wilshire/Le Doux Road intersection to just west of the Wilshire/Carson Road intersection. The station option also contains an alignment option that would provide an alternate connection to the future West Hollywood Extension. Option 3 would not increase or decrease construction energy consumption of the alternatives, and would not result in an adverse construction energy impact.

5.3.10.4 Option 4—Century City Station and Segment Options

Option 4 includes multiple sites for subway stations in Century City and multiple connecting routes between the different stations. It would not change the total number of stations for any alternative. Option 4 would not increase or decrease construction energy



consumption of the alternatives, and would not result in an adverse construction energy impact.

5.3.10.5 Option 5—Westwood/UCLA Station Options

Option 5 would locate the Westwood/UCLA Station under the center of Wilshire Boulevard, immediately west of Westwood Boulevard. It would not change the total number of stations for any alternative. Option 5 would not increase or decrease construction energy consumption of the alternatives, and would not result in an adverse construction energy impact.

5.3.10.6 Option 6—Westwood/Veterans Administration Hospital Station Option

Option 6 would locate the Westwood/Veteran Administration Hospital Station on the north side of Wilshire Boulevard. It would not change the total number of stations for any alternative, and would not increase or decrease energy consumption of the alternatives. Option 6 would not increase or decrease construction energy consumption of the alternatives, and would not result in an adverse construction energy impact.

5.3.10.7 Option A—Remove Crenshaw Option

Option A would remove the Wilshire Crenshaw Station from each of the alternatives. This would reduce the construction energy consumption for each scenario by approximately 2.4 billion British Thermal Units. This relatively small amount of energy consumption would not substantially alter the total energy consumption for the alternatives, and Option A would not result in an adverse construction energy impact.

5.3.10.8 Options B, C, D, E, and F—Fairfax Station East (On-Street)

These options involve alternate station locations. The options would not increase or decrease the total number of stations for any alternative. Options B, C, D, E, and F would not increase or decrease construction energy consumption of the alternatives, and would not result in an adverse construction energy impact.

5.3.10.9 Options G through V

These options involve alternate alignments. The options would not increase or decrease the total number of stations for any alternative and the alternate alignments options would marginally affect the alignment length. Options G through V would not substantially alter the construction energy consumption of the alternatives, and would not result in an adverse construction energy impact.

5.3.11 Maintenance and Operation Facility Sites

The project alternatives would include the expansion of existing Metro maintenance and operation facilities and may include the construction of new facilities. Detailed maintenance facility information was not available when this analysis was completed. Therefore, generalized construction assumptions were utilized to obtain construction energy use. As shown in Table 5-3, approximately 5.1 billion British Thermal Units would be consumed during construction of each maintenance facility. This represents approximately 0.0001 percent of the total energy consumed per year in the State of California. With implementation of Best Management Practices, the proposed project would not lead to a wasteful, inefficient, or unnecessary usage of fuel or energy. Construction of maintenance facilities would not result in an adverse energy impact.



6.0 MITIGATION MEASURES

6.1 Mitigation for Operational Impacts

As shown in Table 5-2, operational activity associated with each Alternative would decrease regional energy consumption. Operational activity would result in beneficial energy impacts, and mitigation measures are not required.

6.2 Mitigation for Construction Impacts

Metro would require the construction contractor to implement energy conserving Best Management Practices in accordance with Metro’s Energy and Sustainability Policy. Construction activity would not result in an adverse energy impact with implementation of Best Management Practices. Mitigation measures are not required.

6.3 California Environmental Quality Act Determination

The above analysis demonstrated compliance with the National Environmental Policy Act. The following analysis demonstrates compliance with the California Environmental Quality Act. The energy calculations provided for the NEPA analysis also represent the energy use for the California Environmental Quality Act analysis. Table 5-3 shows energy consumption during the construction process. Metro would require the construction contractor to implement energy conserving Best Management Practices in accordance with Metro’s Energy and Sustainability Policy. None of the alternatives would lead to wasteful, inefficient, or unnecessary usage of fuel or energy with implementation of these measures. Construction energy use would result in a less-than-significant impact under the California Environmental Quality Act. Operational energy consumption is shown in Table 5-2. Each Alternative would decrease regional energy consumption and would result in a beneficial energy impact.

6.4 Impacts Remaining After Mitigation

Construction and operational activity would not result in adverse energy impacts, and mitigation measures are not required.



7.0 CUMULATIVE IMPACTS

The proposed project would utilize energy during construction and operational activity. The energy expended to construct the project, regardless of which alternative is implemented, is a temporary consumption impact that is not considered adverse. Alternatives 1, 4, and 5 would decrease regional energy consumption and would result in a beneficial energy impacts. These alternatives would not contribute to a cumulatively considerable impact.

Operational activity associated with each of the Alternatives would reduce automobile vehicle-miles of travel and associated fossil-fuel based energy consumption. The reduction in automobile travel also reduces vehicle congestion, which reduces energy consumption associated with vehicle idling and vehicle travel at slower speeds. These changes achieve a major public policy objective by shifting the source of energy away from gasoline and toward grid power plants where the energy sources are more diverse and are not entirely limited to fossil fuels. All of the Alternatives would result in beneficial energy impacts, and would not contribute to a cumulatively considerable impact.



8.0 SHORT-TERM USES AND LONG-TERM PRODUCTIVITY

NEPA requires an analysis that considers the relationship between short-term uses of the environment and the impacts that such uses may have on the maintenance and enhancement of long-term productivity of the affected environment. Short-term construction activity would utilize finite energy resources. These resources would be utilized to construct a mass transit system to link regional transportation networks. Each of the alignments analyzed in this report would decrease regional energy consumption and would result in a beneficial energy impacts. The impacted alternatives would be consistent with Metro's Long Range Transportation Plan by removing passenger vehicles from regional roadways and increasing use of mass transportation.



9.0 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

All construction activities supporting the implementation of the proposed action would consume fuel, mostly in the form of diesel. Table 5-3 shows the British Thermal Units utilized to construct each alternative. This would be an irreversible use of nonrenewable fossil fuels. Operation of trains on the proposed rail line would also require an irreversible commitment of fuel resources. Electricity used to power the Westside Subway Extension would be generated from a variety of sources, including nonrenewable and renewable resources. The State of California and the Los Angeles region are currently increasing energy generation from renewable sources. As more energy is generated by renewable sources, less energy will be result in an irreversible use of nonrenewable resources. Table 5-2 shows operational energy consumption based on estimated British Thermal Units consumption. As previously discussed, each of the Alternatives would decrease regional energy consumption and result in a beneficial energy impacts. This would slow the current irreversible and irretrievable commitment of regional energy resources.

REFERENCES

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