



WESTSIDE SUBWAY EXTENSION

Comparative Benefits and Costs Analysis



September 2010



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Acronyms and Abbreviations

AA	Alternatives Analysis
ADA	Americans with Disabilities Act (42 USC 126)
APM	automated people mover
AR	archaeological resources
BRS	blast relief shafts
BRT	bus rapid transit
CaHL	California historic landmarks
CCTV	closed-circuit television
CSOP	control standard operating procedure
EIR	environmental impact report
EIS	environmental impact statement
Expo I	Exposition Boulevard Light Rail Phase I
Expo II	Exposition Boulevard Light Rail Phase II
FAI	fresh air intakes
FTA	Federal Transit Administration
GLAVA	Greater Los Angeles Veterans Administration
HOV	high-occupancy vehicle
HPOZ	historic preservation overlay zones
HRT	heavy rail transit
HRV	heavy rail vehicles
I-10	Interstate 10 Freeway
I-405	Interstate 405 Freeway
LADOT	Los Angeles Department of Transportation
LAWA	Los Angeles World Airports
LAX	Los Angeles Airport
LPA	Locally Preferred Alternative
LRT	light rail transit
L RTP	Long Range Transportation Plan
Metro	Los Angeles County Metropolitan Transportation Authority
MOS	minimum operable segments
mph	miles per hour
NRHP	National Register of Historic Places
O&M	operations and maintenance
O/D	origins and destinations
OTE	over track exhaust
PTEL	passenger assistance telephones
ROC	Rail Operations Center
RTP	Regional Transportation Plan



SCAG	Southern California Association of Governments
SOP	standard operating procedure
SR 90	State Route 90
TPIS	transit passenger information system
TPSS	traction power substation
TSM	transportation system management
TVM	ticket vending machines
UPE	under platform exhaust
UPRR	Union Pacific Railroad
VA	Department of Veterans Affairs
VMT	vehicle miles traveled



1.0 INTRODUCTION

This Comparative Benefits and Costs Analysis Report draws upon and summarizes other technical analyses carried out as part of the Draft EIS/EIR process for the Westside Subway Extension Project. While not introducing new analytical results, this report organizes the results of other tasks in a way intended to foster an understanding of the issues to be considered and trade-offs to be made in selecting a Locally Preferred Alternative from among the alternatives and options presented in the Draft EIS/EIR.

The report utilizes essentially the same goals, objectives and measures as were addressed in the Comparative Analysis of Alternatives report prepared in 2008 for the Alternatives Analysis (AA). There are four significant differences between the 2008 AA report and this one:

- The use of more recent information based on more detailed travel demand, engineering and environmental analyses;
- Introduction of several new evaluation measures to augment or substitute for those used in 2008;
- The evaluation is structured around a Decision Tree Framework, based on five decision “tiers” to help the reader consider the many and varied alternatives presented in the Draft EIS/EIR (mode and project concept, stations, alignment, other project elements, and phasing) and reach decisions in a logical sequence; and
- A more focused discussion of the trade-offs to be made in each tier of decision-making.

The alternatives compared in this report are described in Section 2.0, followed by a description of the evaluation methodology in Section 3.0 and the evaluation results by tier in Sections 4.0 through 8.0.



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 (EIS/EIR). 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 LRTP and the SCAG RTP. 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 LRTP.

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 (HRT) service in subway from the existing Metro Purple Line Wilshire/Western Station. HRT 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 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.

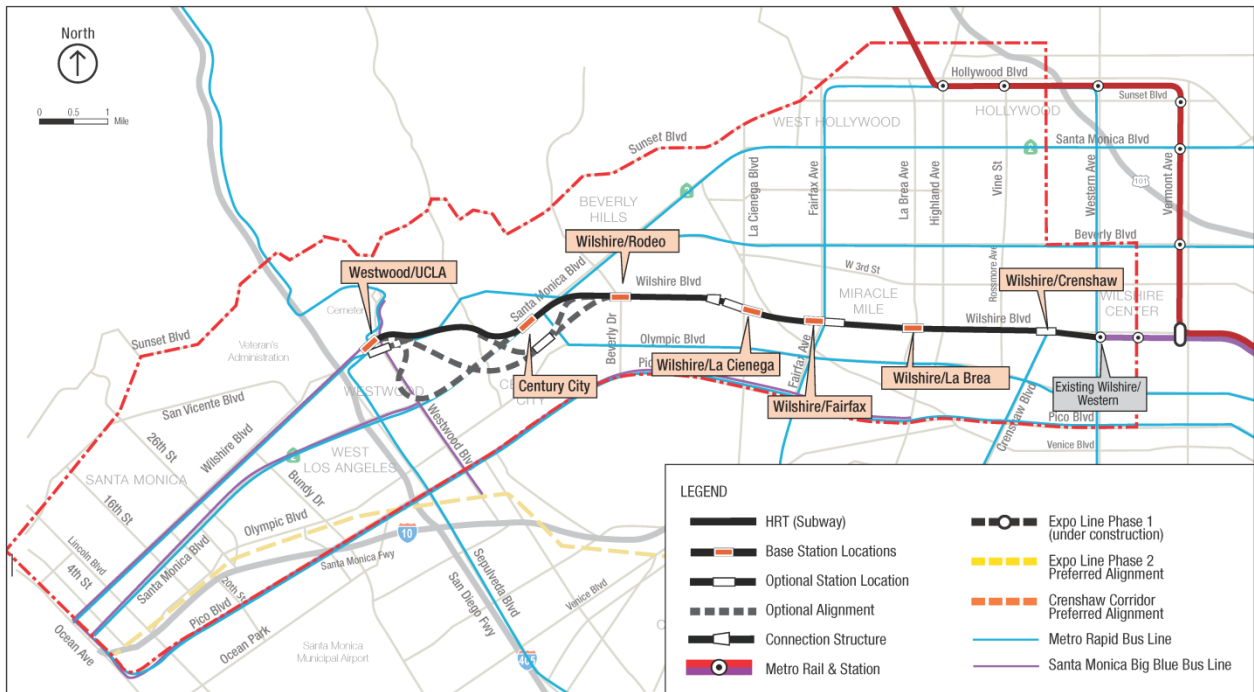


Figure 2-1. Alternative 1—Westwood/UCLA Extension

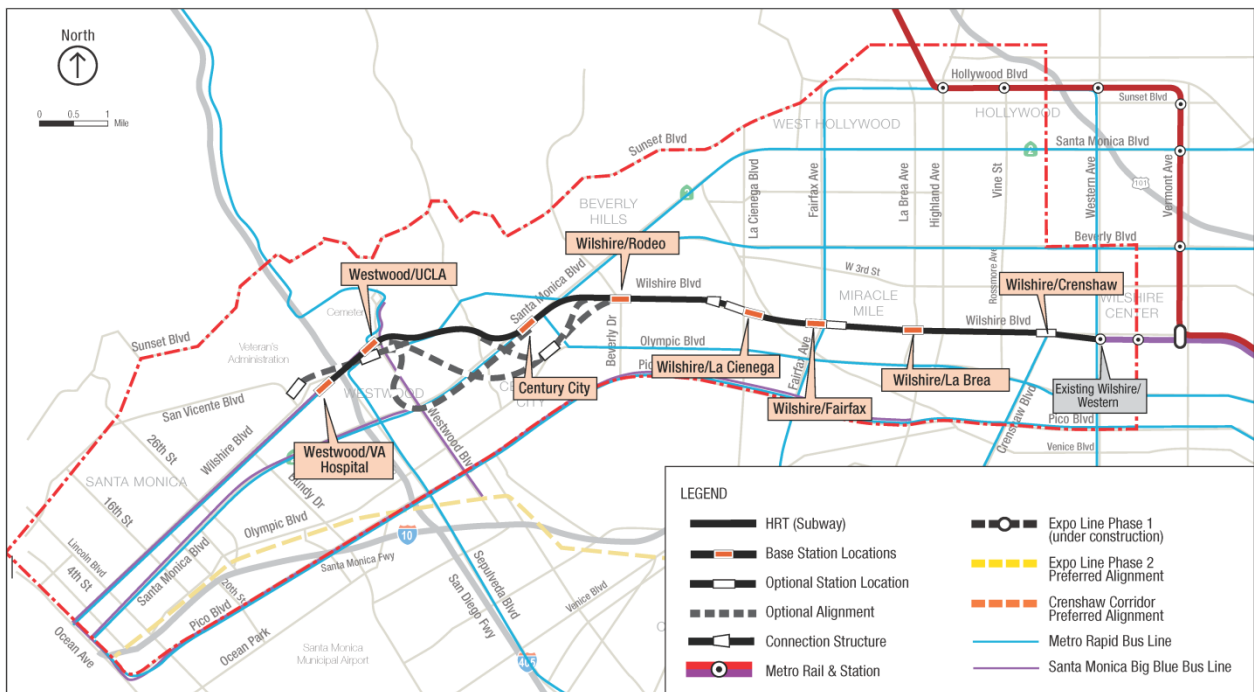


Figure 2-2. Alternative 2—Westwood/Veterans Administration (VA) Hospital Extension

WESTSIDE SUBWAY EXTENSION

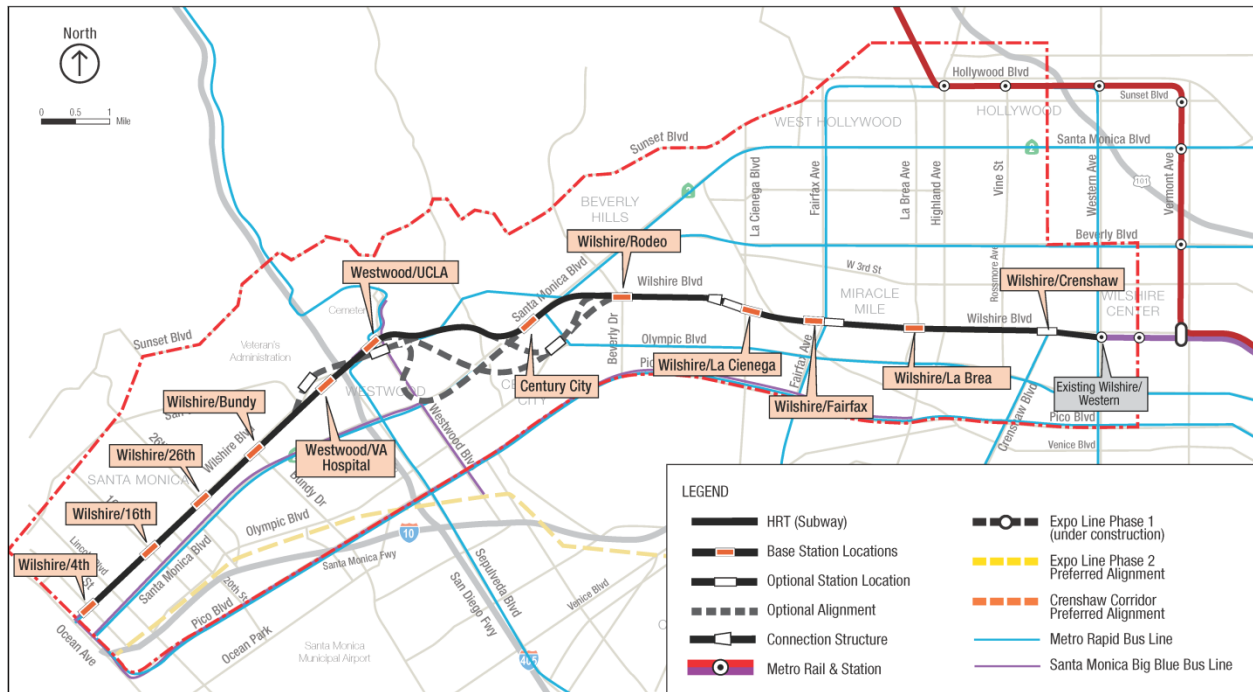


Figure 2-3. Alternative 3—Santa Monica Extension

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 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 Station is 22 minutes 36 seconds.

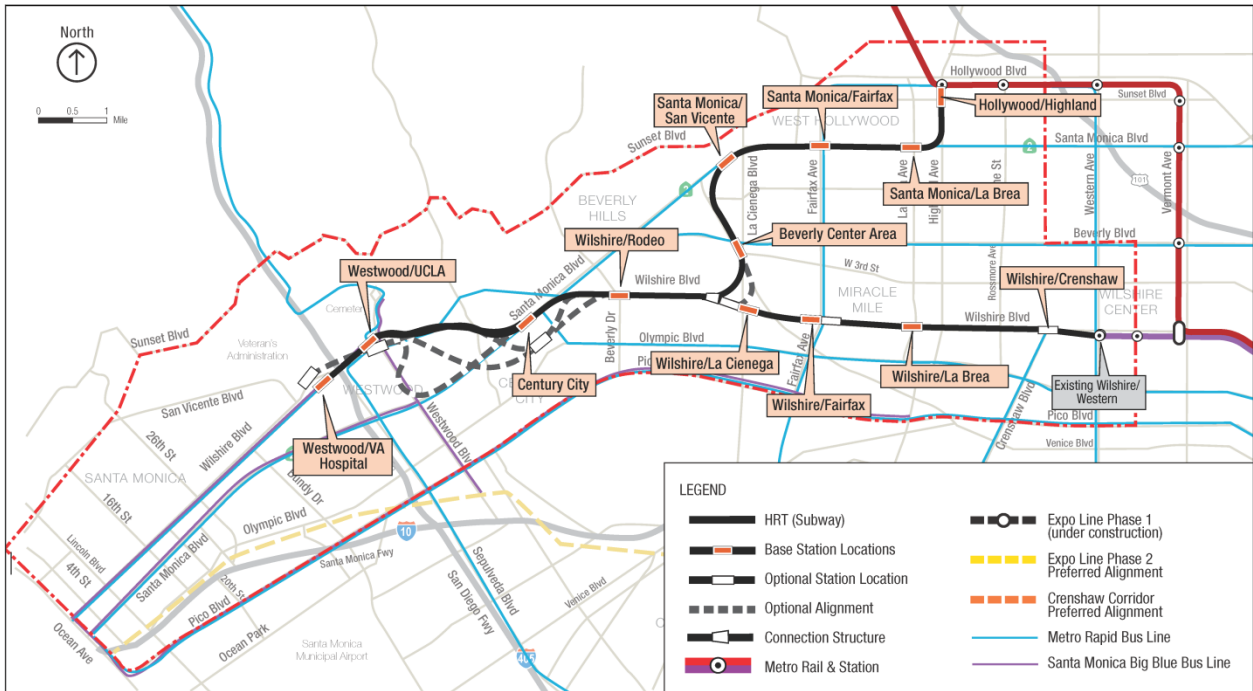


Figure 2-4. Alternative 4—Westwood/VA Hospital Extension plus West Hollywood Extension

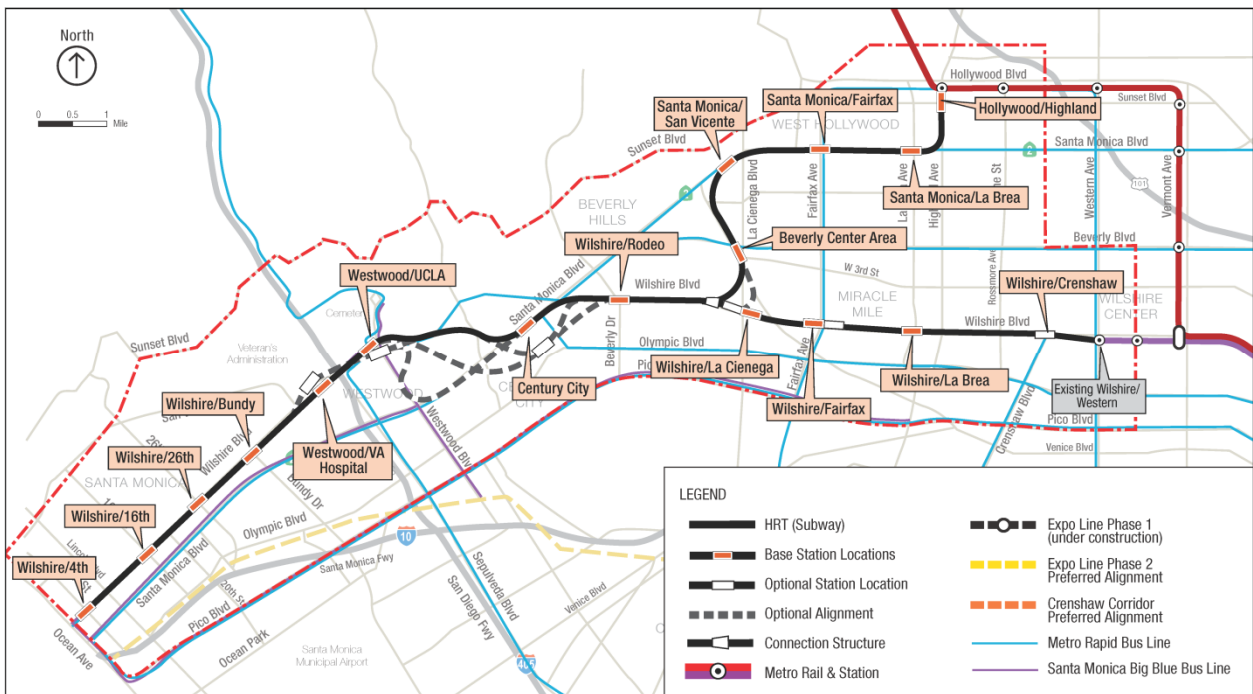


Figure 2-5. Alternative 5—Santa Monica Extension plus West Hollywood Extension



2.4 Stations and Segment Options

HRT 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		•	•	•	•



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).

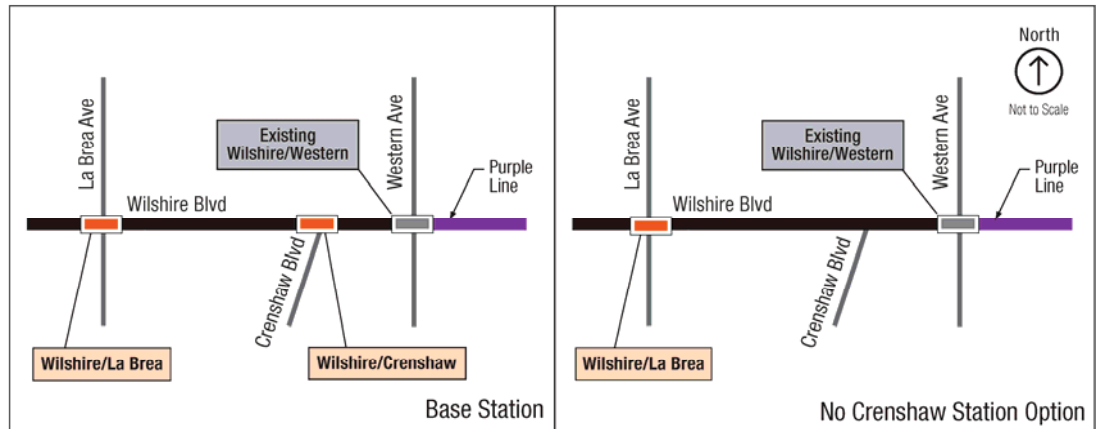


Figure 2-7. Option 1—No Wilshire/Crenshaw Station Option

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.

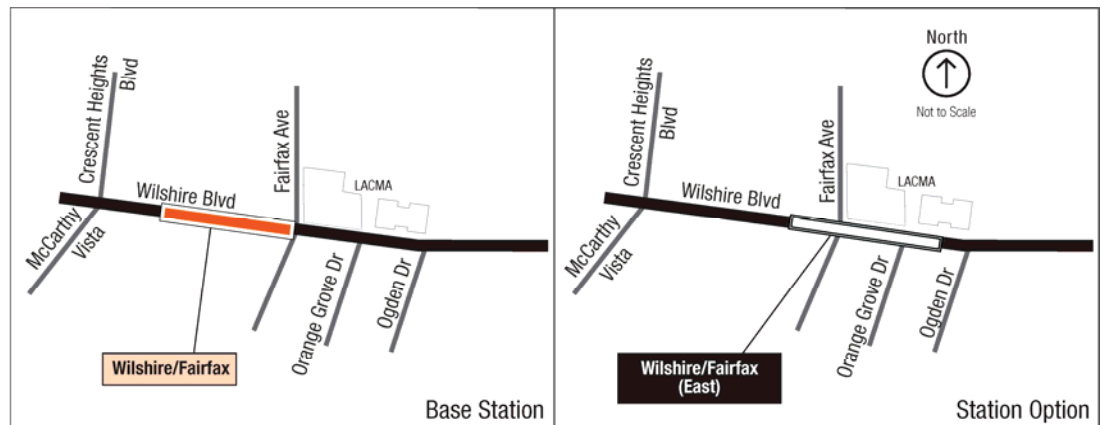


Figure 2-8. Option 2—Fairfax Station Option

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 HRT 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 HRT connection to the future West Hollywood Extension. This alignment portion of Option 3 is only applicable to Alternatives 4 and 5.

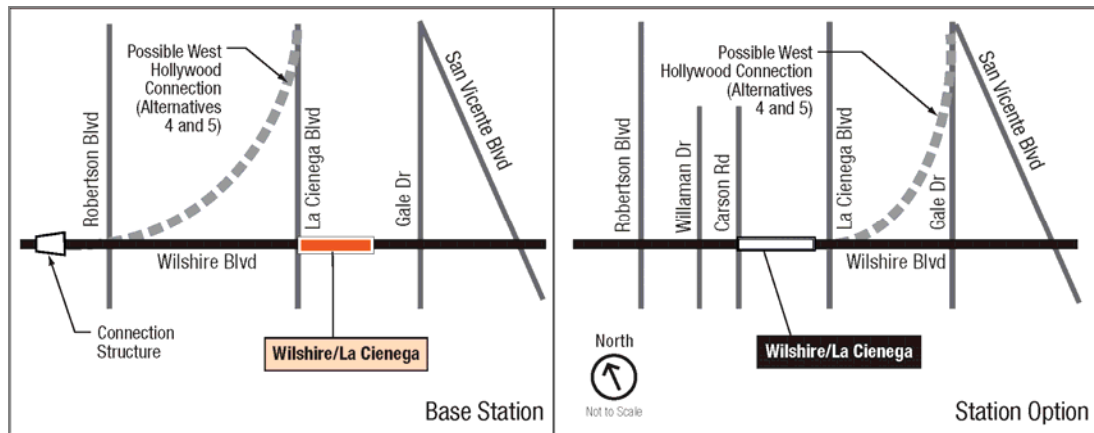


Figure 2-9. Option 3—La Cienega Station Option

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.

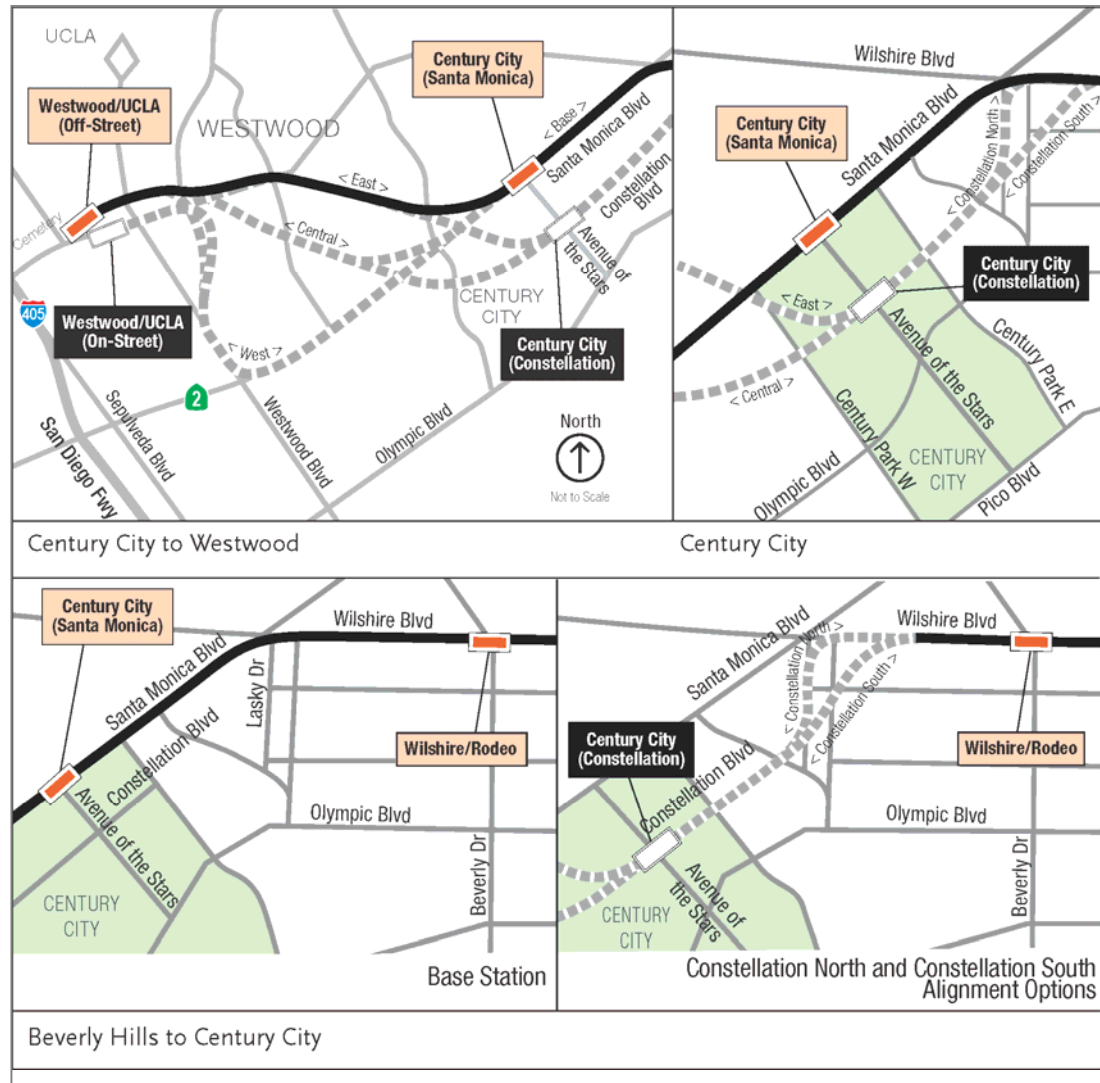


Figure 2-10. Century City Station Options

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).

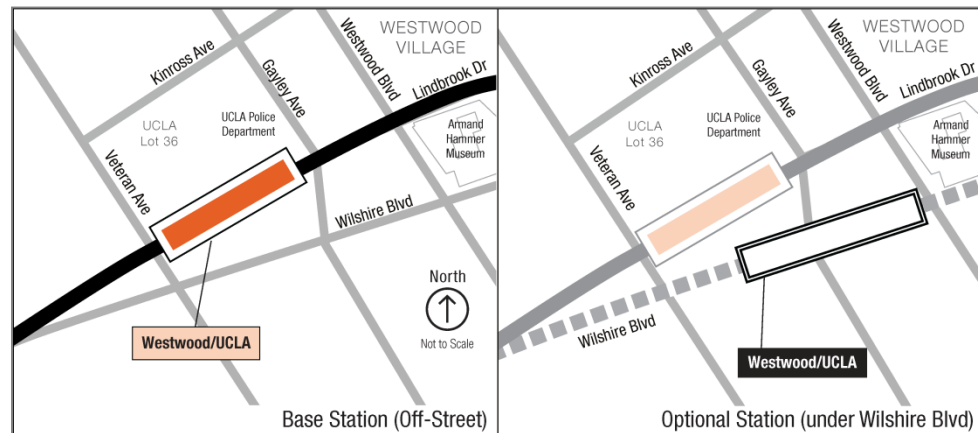


Figure 2-11. Option 5—Westwood/UCLA Station Options

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)

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.

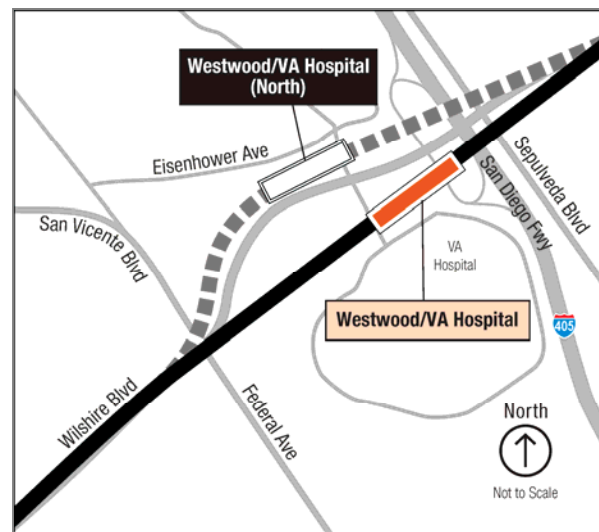


Figure 2-12. Option 6—Westwood/VA Hospital Station North

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 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 (TPSS) are required to provide traction power for the HRT 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. 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 (ROC), 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 ROC at this location.

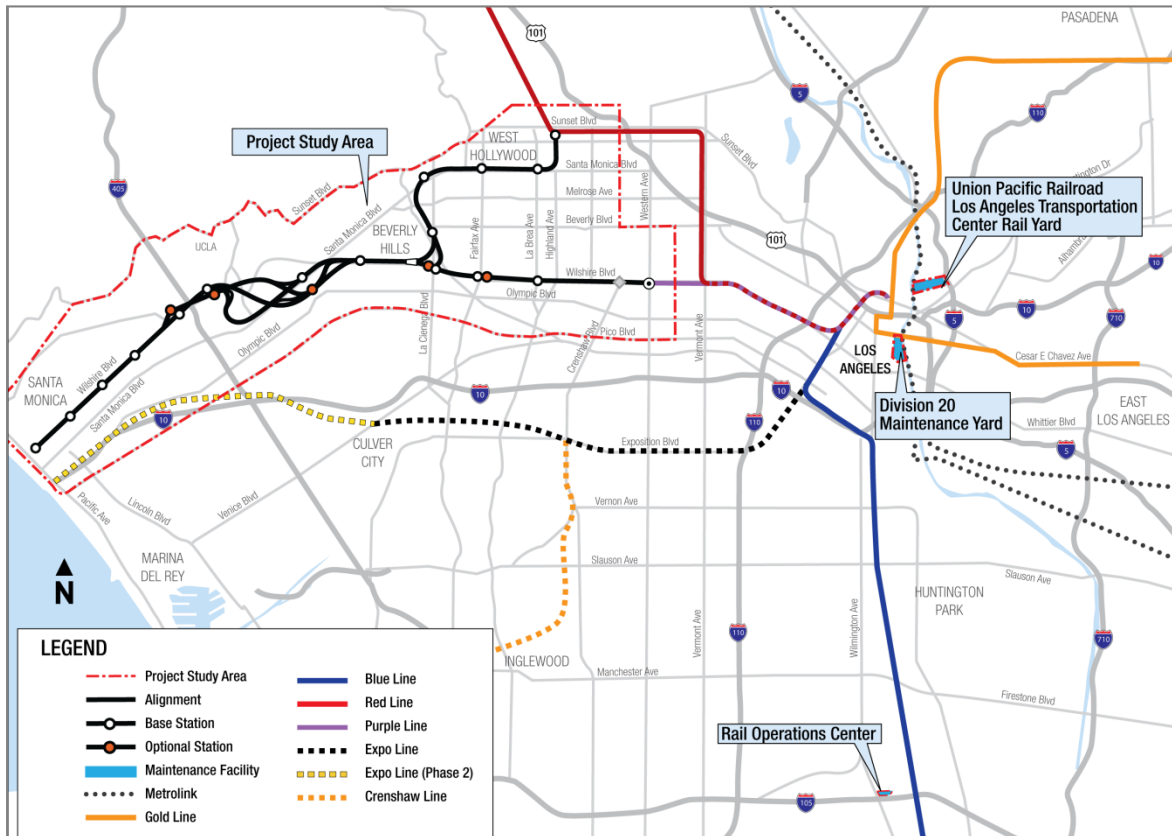


Figure 2-13. Location of the Rail Operations Center and Maintenance Yards

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:

- 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).

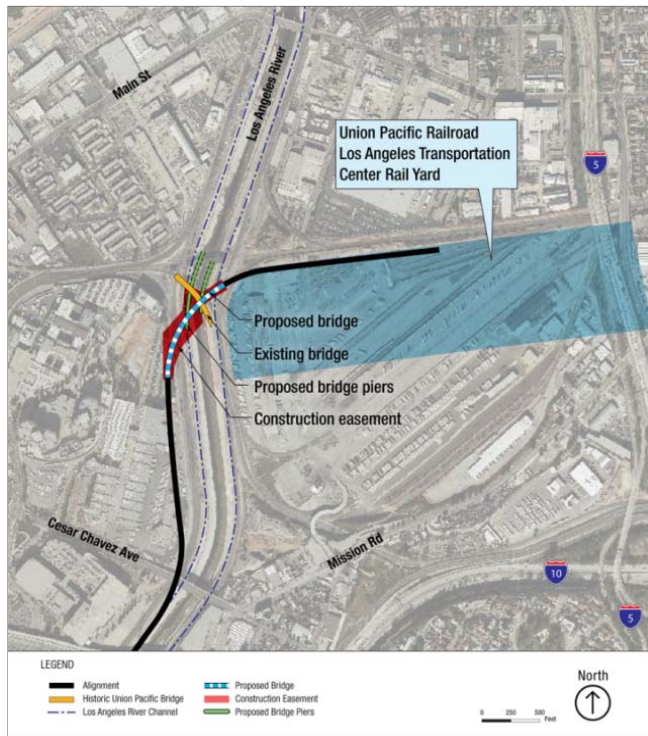


Figure 2-14. UP Railroad Rail Bridge

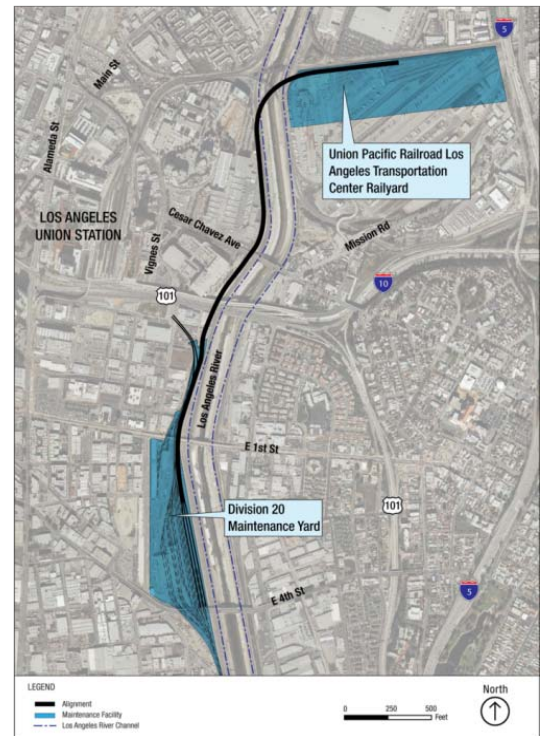


Figure 2-15. Maintenance Yard Options

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 EVALUATION METHODOLOGY

This section describes the approach taken to evaluate the alternatives presented in Section 2.0. The methodology includes, first, a set of goals, objectives and evaluation criteria for comparing the alternatives in terms of their overall effectiveness in meeting the purpose and need, their costs and feasibility, and their impacts. Second, this section presents a Decision Tree Framework that seeks to organize the decision-making process around a series of discrete choices, and to highlight significant trade-offs to be made in selecting a locally preferred alternative.

3.1 Goals, Objectives, and Evaluation Criteria

Seven goals were established in the Alternatives Analysis (AA) phase of planning and were used to both screen out alternatives and identify those alternatives to be carried forward into the DEIS/DEIR.

- **Goal A: Mobility Improvement**—The primary purpose of the project is to improve public transit service and mobility in the Westside Extension Transit Corridor. To compare the alternatives in terms of mobility improvement, the evaluation examines how well each alternative improves the ability of residents and employees to reach desired destinations through the provision of high quality, convenient, and reliable east-west transit service.
- **Goal B: Transit Supportive Land Use Policies and Conditions**—A major aspect of this goal is to locate transit alignments and stations in areas with existing land uses conducive to transit use or in those areas which have the greatest potential to develop transit supportive land uses.
- **Goal C: Cost-Effectiveness**—This goal ensures that both the capital and operating costs of the project are commensurate with its benefits.
- **Goal D: Project Feasibility**—The fourth goal is that the project be financially feasible. Specifically, this goal helps ensure that funds for the construction and operation of the alternative will be readily available and will not place undue burdens on the sources of those funds. The goal also includes minimizing risks associated with project construction.
- **Goal E: Equity**—This goal evaluates project solutions based on how fairly the costs and benefits are distributed across different population groups with particular emphasis on serving transit dependent communities.
- **Goal F: Environmental Considerations**—The sixth goal is to develop solutions which minimize adverse impacts to environmental resources and communities within the study area.
- **Goal G: Public Acceptance**—This goal aims to develop solutions that are supported by the public with special emphasis on residents and businesses within the study area.

In the 2008 Alternatives Analysis (AA), specific objectives and measures or criteria were developed and applied to assess the extent to which each alternative met each goal. The objectives and measures to be used in the Draft EIS/EIR (Table 3-1) draw upon and refine those used in the AA, reflecting current data and the more focused evaluation in the Draft EIS/EIR. Objectives and evaluation criteria added or changed since the AA are noted in the table as “NEW”. Those measures that were used in the AA but that are not considered to be



helpful in differentiating among the alternatives for this evaluation are shaded in the table. Many of these measures are nevertheless addressed in other technical reports.

Table 3-1. Goals, Objectives, and Evaluation Criteria

Objectives	Criteria
Goal A: Mobility Improvements	
1. Reduce transit travel time	a. Peak period travel times between major origin-destination pairs b. Average end-to-end transit operating speeds
2. Improve trip reliability	a. Percent of the study area’s transit passenger miles that are on a fixed guideway (NEW) b. Number of transfers between select origin-destination pairs
3. Provide sufficient transit capacity to meet 2035 transit demand and beyond (expandability)	a. Estimated maximum capacity of new east-west transit service b. Potential for capacity expansion beyond 2035
4. Maximize potential transit ridership	a. Daily new transit trips (per day in 2035) b. Change in urban rail boardings (per day in 2035) c. “New Stations” urban rail boardings (per day in 2035) d. Current population within 1/2 mile of alignment e. 2035 population within 1/2 mile of alignment f. Current population density within 1/2 mile of alignment g. 2035 population density within 1/2 mile of alignment h. Current employment within 1/2 mile of alignment i. 2035 employment within 1/2 mile of alignment j. Current employment density within 1/2 mile of alignment k. 2035 employment density within 1/2 mile of alignment l. Ability for transit to be competitive with the auto in speed for key origin-destination pairs
5. Enhance linkages to the transportation system and major trip attractors/generators	a. Ability of alternatives to continue one seat ride b. Number of direct connections within 1/8 mile walk to other lines, north-south bus routes, etc. c. Number of transfers required to access regional rail – Metrolink, Amtrak d. Number of direct connections to key activity centers within 1/8 mile walk
Goal B: Transit Supportive Land Use Policies and Conditions	
1. Provide transit service to areas with transit supportive land uses and policies	a. Number of high density mixed use activity centers within 1/2 mile of alignment
2. Integrate with local redevelopment plans and policies	a. Number of high opportunity areas for redevelopment within 1/2 mile of alignment
Goal C: Cost Effectiveness	
1. Minimize capital cost	a. Capital cost in 2009 dollars b. Capital cost in year of expenditure dollars c. Capital cost per route mile in base year dollars
2. Minimize operating and maintenance (O&M) cost	a. Year 2035 operating and maintenance (O&M) cost in 2009 dollars
3. Maximize user benefits (NEW)	a. Daily hours of transit system user benefit compared with No Build (NEW) b. Daily hours of transit system user benefit compared with TSM (NEW)
4. Maximize cost effectiveness	a. Cost per hour of user benefit compared with No Build b. Cost per hour of user benefit compared with TSM (NEW)
Goal D: Feasibility	
1. Maximize likelihood of New Starts funding	a. Expected project justification rating (NEW) b. Expected financial capacity rating (NEW)
2. Maximize consistency with Metro’s LRTP and financial direction	a. Affordability within limits of Metro’s Long Range Transportation Plan of 10/9/09 (NEW)

Objectives	Criteria
Goal E: Equity	
1. Improve transit service available to transit dependent communities	a. Number of low income residents within 1/2 mile of stations (NEW) b. Percent of residents within 1/2 mile of stations that are low income (NEW) c. Number of minority residents within 1/2 mile of stations (NEW) d. Percent of residents within 1/2 mile of stations that are minority (NEW)
2. Provide solutions that distribute both economic and environmental costs and benefits fairly across different population groups	a. Number of low income residents within 1/2 mile of stations (NEW) b. Percent of residents within 1/2 mile of stations that are low income (NEW) c. Number of minority residents within 1/2 mile of stations (NEW) d. Percent of residents within 1/2 mile of stations that are minority (NEW)
Goal F: Environmental Considerations	
1. Minimize the displacement of homes and businesses	a. Number of residences displaced (NEW) b. Number of jobs potentially displaced (NEW)
2. Minimize impacts to the traffic and circulation system	a. Lane miles of traffic lanes removed or impacted b. Lane miles of parking lanes removed or impacted
3. Minimize impacts to the character of the community	a. Estimated level of visual impacts to surrounding neighborhoods b. Potential noise and vibration impacts from operations
4. Provide for the safety and security of pedestrians and transit users	a. Ability to provide for emergency exits and evacuation b. Extent of auto/transit/pedestrian conflicts that are not fully protected
5. Minimize impacts on sensitive and protected environmental resources	a. Number of cultural or natural resources directly impacted b. Number of City of LA Historic Cultural Monuments (HCM) impacted c. City of LA Historic Period Overlay Zones (HPOZ) impacted d. Number of California Historic Landmarks (CaHL) impacted e. Number of sites on National Register of Historic Places (NRHP) impacted f. Number of archeological resources (AR) impacted
6. Reduce air pollutant emissions and non-renewable fuel consumption	a. Daily reduction in vehicle miles traveled (VMT) compared to No Build
7. Avoid significant impacts during construction	a. Severity of traffic impacts during construction
Goal G: Public Acceptance	
Narrative summarizing major themes of public and stakeholder comments.	

These goals, objectives, and measures capture, to a degree, the New Starts Criteria that the Federal Transit Administration (FTA) currently uses to rate projects for funding in the discretionary Section 5309 New Starts program. The FTA’s rating system considers projects from two perspectives – project justification and local financial commitment. Projects must receive at least a “medium” rating on both to be recommended for funding.

Under current law, regulations and policies, FTA uses six criteria to evaluate projects and arrive at an overall rating for project justification:

- Mobility improvements—20% of justification rating
- Cost effectiveness—20%
- Operating efficiencies—10%
- Environmental benefits—10%
- Transit oriented land use—20%
- Economic development—20%



Similarly, FTA uses three criteria to evaluate projects in terms of local financial commitment:

- Strength of Capital Funding—50% of financial rating
- Strength of O&M Funding—30%
- Non Section 5309 Share (local/State/Regional funds and other Federal funds)—20%

Several of the FTA criteria, such as cost-effectiveness and transit-supportive land use, are included among the measures in Table 3-1. Further, under the Project Feasibility goal, the evaluation assesses how well the alternatives are likely to fare in the FTA rating process. It should be noted, however, that FTA has not yet accepted the projections of cost and user benefits that are inputs to the cost-effectiveness indices presented in this report. Furthermore, FTA has started a rulemaking process that may significantly alter the measures FTA uses to evaluate, rate, and select projects for funding recommendations.

3.2 Decision Tree Framework

Recognizing the complexity of the Westside corridor and the large number of alternatives and options remaining, the evaluation is structured around a “decision tree” framework based on several “tiers” of decision-making, as follows:

- **Mode and Project Concept**—Compares the five Wilshire Subway Extension alternatives with each other and with the No Build and TSM alternatives in order to help the Board establish or ratify the transit mode and eventual termini.
- **Station Options**—Considers whether or not to include optional stations and compares station locations where options exist.
- **Alignment Options**—Compares alternative routes to connect the station locations.
- **Other components of the alternatives**—Covers the remaining decisions to be made based on the Draft EIS/EIR such as the location of a vehicle maintenance and storage facility.
- **Phasing**—Evaluates potential interim termini, in the event that the project is built in segments.

This sequence of decisions seeks to help the Metro Board reach the higher order decisions on mode and project concept first, in a focused way. Once these decisions are made, consideration can be given to decisions on station locations within the chosen project concept. This then leads to decisions on how to connect those station locations in Tier 3. In this way, what could otherwise be a confounding variety of possible combinations and permutations can be approached in a step-by-step manner, simplifying the decision on a locally preferred alternative.



4.0 MODE AND PROJECT CONCEPT

The first decision tier is intended to help the Metro Board decide whether to choose the No Build, TSM, or one of the HRT alternatives to serve the Westside Corridor. Five rail alternatives are presented for consideration in this initial decision tier:

- Alternative 1-Westwood/UCLA Extension
- Alternative 2-Westwood/VA Hospital Extension
- Alternative 3-Santa Monica Extension
- Alternative 4-Westwood/VA Hospital Extension plus West Hollywood Extension
- Alternative 5-Santa Monica Extension plus West Hollywood Extension

All of the goals listed in Section 3.1 are relevant to the Tier 1 decisions, and are discussed in the following sections.

4.1 Mobility Improvements

This section assesses how well each of the mode and project concept alternatives improves mobility in the Westside Transit Corridor, considering five mobility objectives:

- Reduce transit travel time
- Improve trip reliability
- Provide sufficient transit capacity to meet 2035 transit demand and beyond (expandability)
- Maximize potential transit ridership
- Enhance linkages to the transportation system and major trip attractors/generators

4.1.1 Transit Travel Time

Table 4-1 compares the alternatives in terms of the peak travel times between various origin and destination (O/D) pairs. All five of the HRT alternatives would have faster travel times than the No Build and TSM alternatives for all O/D pairs. The longer HRT alternatives – Alternatives 3 and 5 in particular – provide faster travel to and from Santa Monica. Trips going between the study area and the San Fernando Valley are represented here by the Reseda Station on the Orange Line. For these trips, Alternatives 4 and 5 would be 7 to 10 minutes faster than Alternatives 1, 2 and 3, reflecting the additional linkage to the existing Red Line in West Hollywood. New links between the Build alternatives and other transit lines would improve travel time for residents throughout the County. Each of the alternatives has been assigned a rating – from low to high – reflecting its relative benefit on this measure.

Table 4-1. Peak Period Travel Times (AM Peak, minutes) between Major Origin-Destination Pairs

Relevant Goals, Objectives, Criteria	No Build	TSM	Wilshire HRT			Combined HRT (Wilshire Plus West Hollywood)	
			Alt. 1	Alt. 2	Alt.3	Alt. 4	Alt. 5
A1a—Transit Peak Period Travel Time (AM Peak) (minutes)- Between Del Mar Station (Gold Line) and:							
Century City	77.3	76.4	48.8	48.8	48.8	48.8	48.8
Santa Monica/ San Vicente (WeHo)	81.7	81.7	63.7	63.7	63.7	56.5	56.5
Wilshire/ Beverly (BH)	74	73.1	46.9	46.9	46.9	46.9	46.9
Wilshire/ Westwood (UCLA)	83.5	83.5	51.1	51.1	51.1	51.1	51.1
4 th /Wilshire (Santa Monica)	83.2	83.2	73.1	73.1	57.9	73.1	57.9
A1a—Transit Peak Period Travel Time (AM Peak) (minutes)- Between Pershing Square Station (Red Line) and:							
Century City	50.3	49.4	21.8	21.8	21.8	21.8	21.8
Santa Monica/ San Vicente (WeHo)	54.7	54.7	36.7	36.7	36.7	29.5	29.5
Wilshire/ Beverly (BH)	47	46.1	19.9	19.9	19.9	19.9	19.9
Wilshire/ Westwood (UCLA)	55	55	24.1	24.1	24.1	24.1	24.1
4 th /Wilshire (Santa Monica)	54.7	54.7	46.1	46.1	30.9	46.1	30.9
A1a—Transit Peak Period Travel Time (AM Peak) (minutes)- Between Florence Station (Blue Line) and:							
Century City	67.3	66.4	38.8	38.8	38.8	38.8	38.8
Santa Monica/ San Vicente (WeHo)	71.7	71.7	53.7	53.7	53.7	46.5	46.5
Wilshire/ Beverly (BH)	64	63.1	36.9	36.9	36.9	36.9	36.9
Wilshire/ Westwood (UCLA)	65.4	65.4	41.1	41.1	41.1	41.1	41.1
4 th /Wilshire (Santa Monica)	65.1	65.1	63.1	63.1	47.9	63.1	47.9
A1a—Transit Peak Period Travel Time (AM Peak) (minutes)- Between Reseda Station (Orange Line) and:							
Century City	85.4	85.4	69.2	69.2	69.2	57.8	57.8
Santa Monica/ San Vicente (WeHo)	73.3	73.3	73.3	73.3	73.3	49.8	49.8
Wilshire/ Beverly (BH)	84.2	83.3	67.3	67.3	67.3	56.9	56.9
Wilshire/ Westwood (UCLA)	93	93	71.5	71.5	71.5	60.1	60.1
4 th /Wilshire (Santa Monica)	108	108	93.5	93.5	78.3	82.1	66.9
A1a—Transit Peak Period Travel Time (AM Peak) (minutes)- Between Covina Station (Metrolink) and:							
Century City	95.4	94.5	66.9	66.9	66.9	66.9	66.9
Santa Monica/ San Vicente (WeHo)	99.8	99.8	81.8	81.8	81.8	74.6	74.6
Wilshire/ Beverly (BH)	92.1	91.2	65	65	65	65	65
Wilshire/ Westwood (UCLA)	100.1	100.1	69.2	69.2	69.2	69.2	69.2
4 th /Wilshire (Santa Monica)	99.8	99.8	91.2	91.2	76	91.2	76
A1a—Transit Peak Period Travel Time (AM Peak) (minutes)- Between Wilshire/Western Station (Purple Line) and:							
Century City	35.4	34.5	11.8	11.8	11.8	11.8	11.8
Santa Monica/ San Vicente (WeHo)	47.2	46.3	26.7	26.7	26.7	19.5	19.5
Wilshire/ Beverly (BH)	32.1	31.2	9.9	9.9	9.9	9.9	9.9
Wilshire/ Westwood (UCLA)	46.7	45.8	14.1	14.1	14.1	14.1	14.1
4 th /Wilshire (Santa Monica)	65.2	64.3	36.1	36.1	20.9	36.1	20.9
A1a—Transit Peak Period Travel Time (AM Peak) (minutes)- Between North Hollywood Station (Red Line) and:							
Century City	55	55	38.8	38.8	38.8	27.4	27.4
Santa Monica/ San Vicente (WeHo)	42.9	42.9	42.9	42.9	42.9	19.4	19.4
Wilshire/ Beverly (BH)	53.8	52.9	36.9	36.9	36.9	26.5	26.5
Wilshire/ Westwood (UCLA)	68.4	67.5	41.1	41.1	41.1	29.7	29.7
4 th /Wilshire (Santa Monica)	77.6	77.6	63.1	63.1	47.9	51.7	36.5
Average Travel Time for Select O/D Pairs							
Minutes	70.0	69.6	49.6	49.6	46.6	44.7	41.6
Relative Rating	Low	Low	Medium	Medium	Med-High	Med-High	High



Table 4-2 displays the average end-to-end transit operating speeds anticipated in 2035. The HRT alternatives, operating in an exclusive guideway that is fully separated from roadway traffic, would achieve much higher speeds than would be possible with buses, even with the priority treatments assumed in the No Build and TSM alternatives.

Table 4-2. Average End-to-End Transit Operating Speeds (mph)

Relevant Goals, Objectives, Criteria	Today	No Build (2035)	TSM (2035)	Wilshire HRT (2035)			Combined HRT (Wilshire Plus West Hollywood) (2035)		
				Alt. 1	Alt. 2	Alt.3	Alt. 4	Alt. 5	
A1b	Average speed	14.3	13.5	13.5	31.1	30.8	31.8	32	33
	Relative Rating	Low	Low	Low	High	High	High	High	High

Because of its higher operating speeds, the rail alternatives offer a travel mode that is more competitive with the automobile. During peak periods, rail operating speeds are faster than speeds for a comparable auto trip. Competitiveness is greatest for the alternatives with the greatest mileage of rail, as the difference in speed becomes more apparent to potential riders for trips covering longer distances and reaching the more congested parts of the study area. By providing a direct connection from Century City and Westwood to West Hollywood and the San Fernando Valley, Alternatives 4 and 5 have the greatest potential to shorten transit travel time and, thus, would be most competitive with the auto. Table 4-3 offers a relative rating for each of the alternatives in terms of its competitiveness with auto speeds.

Table 4-3. Competitiveness with Auto Speed

Relevant Goals, Objectives, Criteria	Today	No Build	TSM	Wilshire HRT			Combined HRT (Wilshire Plus West Hollywood)		
				Alt. 1	Alt. 2	Alt.3	Alt. 4	Alt. 5	
A4I	Ability for transit to be competitive with auto speed for key origin-destination pairs	Low	Low	Low	Low-Medium	Medium	Medium-High	High	High

4.1.2 Reliability, Comfort and Convenience

Transit vehicles operating in mixed flow traffic not only operate more slowly, but also have less reliable travel time, as buses can be affected by traffic congestion, incidents or other adverse road conditions. The bunching of buses can lead to irregular headways and uncertain wait and travel times for customers. In the HRT alternatives, transit would operate on its own exclusive guideway and would not be affected by roadway conditions. Arrival times and trip times would be extremely reliable.

Table 4-4 compares the alternatives in terms of the percentage of all transit passenger miles that would occur on an exclusive fixed guideway facility. The percentage grows significantly with all of the HRT alternatives, and exceeds 50 percent with Alternatives 3 and 5. The remaining transit passenger miles would occur in buses operating in mixed traffic or bus lanes subject to various traffic delays.



Table 4-4. Percentage of Transit Passenger Miles on a Fixed Guideway Transit Facility

Relevant Goals, Objectives, Criteria	No Build	TSM	Wilshire HRT			Combined HRT (Wilshire Plus West Hollywood)	
			Alt. 1	Alt. 2	Alt.3	Alt. 4	Alt. 5
A2a Percent of the study area's transit passenger miles that are on a fixed guideway	4.7%	4.6%	39.2%	42.0%	51.6%	44.0%	53.9%
Relative Rating	Low	Low	Medium-High	Medium-High	High	Medium-High	High

In the No Build and TSM Alternatives, given the extent of bus service involving mixed operations with general-purpose traffic, passengers would continue to be subject to delays and long travel times to reach Study Area destinations. Under the HRT alternatives, subway service would provide frequent and reliable service no matter the traffic conditions on Study Area streets and highways.

Another measure of transit travel time, and of convenience to passengers, is the number of transfers a traveler must make to get from their origin to their destination. Riders generally consider out-of-vehicle travel time – i.e., the time spent waiting for a bus or train to arrive – as being more onerous than time spent moving in a vehicle. Table 4-5 displays the number of transfers required to travel between selected O/D pairs, and provides a relative rating for the alternatives in terms of this measure.

Table 4-5. Number of Transfers between Select Origin-Destination Pairs

Relevant Goals, Objectives, Criteria	Today	No Build	TSM	Wilshire HRT			Combined HRT (Wilshire Plus West Hollywood)	
				Alt. 1	Alt. 2	Alt.3	Alt. 4	Alt. 5
A2b—Transfers Required (AM Peak) – Between Del Mar Station (Gold Line) and:								
Century City	2	2	2	1	1	1	1	1
Santa Monica/ San Vicente (WeHo)	2	2	2	2	2	2	2	2
Wilshire/ Beverly (BH)	2	2	2	1	1	1	1	1
Wilshire/ Westwood (UCLA)	2	2	2	1	1	1	1	1
4 th /Wilshire (Santa Monica)	2	2	2	2	2	1	2	1
A2b—Transfers Required (AM Peak) – Between Pershing Square Station (Red Line) and:								
Century City	1	1	1	0	0	0	0	0
Santa Monica/ San Vicente (WeHo)	1	1	1	1	1	1	1	1
Wilshire/ Beverly (BH)	1	1	1	0	0	0	0	0
Wilshire/ Westwood (UCLA)	2	2	2	0	0	0	0	0
4 th /Wilshire (Santa Monica)	2	2	2	1	1	0	1	0
A2b—Transfers Required (AM Peak) – Between Florence Station (Blue Line) and:								
Century City	2	2	2	1	1	1	1	1
Santa Monica/ San Vicente (WeHo)	3	3	3	3	3	3	2	2
Wilshire/ Beverly (BH)	2	2	2	1	1	1	1	1
Wilshire/ Westwood (UCLA)	2	2	2	1	1	1	1	1
4 th /Wilshire (Santa Monica)	2	2	2	2	2	1	2	1
A2b—Transfers Required (AM Peak) – Between Reseda Station (Orange Line) and:								
Century City	3	3	3	2	2	2	2	2
Santa Monica/ San Vicente (WeHo)	3	3	3	3	3	3	2	2
Wilshire/ Beverly (BH)	3	3	3	2	2	2	2	2
Wilshire/ Westwood (UCLA)	1	1	1	2	2	2	2	2
4 th /Wilshire (Santa Monica)	3	3	3	3	3	2	3	2
A2b—Transfers Required (AM Peak) – Between Covina Station (Metrolink) and:								
Century City	2	2	2	1	1	1	1	1
Santa Monica/ San Vicente (WeHo)	2	2	2	2	2	2	2	2
Wilshire/ Beverly (BH)	2	2	2	1	1	1	1	1
Wilshire/ Westwood (UCLA)	3	3	3	1	1	1	1	1
4 th /Wilshire (Santa Monica)	3	3	3	2	2	1	2	1
A2b—Transfers Required (AM Peak) – Between Wilshire/Western Station (Purple Line) and:								
Century City	0	0	0	0	0	0	0	0
Santa Monica/ San Vicente (WeHo)	1	1	1	1	1	1	1	1
Wilshire/ Beverly (BH)	0	0	0	0	0	0	0	0
Wilshire/ Westwood (UCLA)	0	0	0	0	0	0	0	0
4 th /Wilshire (Santa Monica)	0	0	0	1	1	0	1	0
A2b—Transfers Required (AM Peak) – Between North Hollywood Station (Red Line) and:								
Century City	2	2	2	1	1	1	1	1
Santa Monica/ San Vicente(WeHo)	2	2	2	2	2	2	1	1
Wilshire/ Beverly (BH)	2	2	2	1	1	1	1	1
Wilshire/ Westwood (UCLA)	2	2	2	1	1	1	1	1
4 th /Wilshire (Santa Monica)	2	2	2	2	2	1	2	1
Total Transfers for Select O/D Pairs								
Number	63	63	63	44	44	37	42	35
Relative Rating	Low	Low	Low	Med-High	Med-High	High	Med-High	High



All of the rail alternatives would lead to a significant reduction in the number of transfers, compared with today and the No Build and TSM alternatives. Among the HRT alternatives, Alternatives 3 and 5 (which would extend HRT to Santa Monica) tend to require the fewest transfers for these select trips.

For riders who need to stand, subway service would provide increased comfort and safety compared to frequent stop-and-go travel that occurs on buses operating in mixed traffic or uneven road surfaces. Because station platforms will be at the same level as subway vehicles, they will accommodate quick and easy boardings and alightings for all passengers, including those in wheelchairs or with strollers.

4.1.3 Capacity and Expandability

Transit capacity reflects the ability of each alternative to accommodate the projected demand. Since each alternative has been equilibrated to balance capacity with demand, capacity alone is not a particularly meaningful measure for evaluating performance. Each of the alternatives is assumed to offer sufficient capacity to accommodate the projected demand in 2035. However, the transit capacity comparison in Table 4-6 is meaningful in the context of continued growth in population, employment, and travel demand after 2035, or in the event of unforeseen changes (such as higher fuel prices) that may lead to greater transit ridership. The rail alternatives offer far greater ability to accommodate increased ridership over time.

Table 4-6. Transit Capacity

Relevant Goals, Objectives, Criteria	Today	No Build	TSM	Wilshire HRT			Combined HRT (Wilshire Plus West Hollywood)		
				Alt. 1	Alt. 2	Alt.3	Alt. 4	Alt. 5	
A3a	Maximum Capacity*	N.A.	3000	3000	18,000	18,000	18,000	18,000	18,000
A3b	Potential for Expansion	Low	N.A.	N.A.	High	High	High	High	High

*Estimated maximum capacity of new East-West transit service in passengers per hour, assuming a maximum of 18 trains per hour or 30 buses per hour

4.1.4 Transit Ridership

Transit ridership is a particularly useful metric for comparing alternatives. Alternatives that attract the highest number of riders are those that offer the best service to the greatest number of people. Projected increases in transit ridership are also indicative of the extent to which an alternative can be expected to reduce vehicle miles of travel and congestion on the highway system, reduce air pollutant emissions, and reduce the use of gasoline. Three measures of transit ridership are provided in Table 4-7:

- New transit trips compared with the No Build Alternative – where trips are measured in terms of linked trips. A trip that uses transit for some part of the distance from an origin to a destination is counted as a single linked trip, regardless of the number of transfers made during that trip.



- Change in urban rail boardings – where a boarding occurs whenever a passenger enters a bus or rail vehicle. Thus, trips that entail one or more transfers are counted as two or more boardings (although they would be counted as a single linked trip).
- Boardings at “new stations” that would be built as part of a Westside Subway Extension.

Table 4-7. Ridership

Relevant Goals, Objectives, Criteria		No Build	TSM	Wilshire HRT			Combined HRT (Wilshire Plus West Hollywood)	
				Alt. 1	Alt. 2	Alt.3	Alt. 4	Alt. 5
A4a	New Transit Trips (per day in 2035, compared with No Build)	Base	2,115	24,142	27,615	35,235	31,224	40,123
A4b	Change in Urban Rail Boardings (thousands)	Base	538	63,156	70,751	87,005	80,847	99,545
A4c	“New Stations” Urban Rail Boardings	NA	NA	46,075	52,665	70,936	68,013	89,680
	Relative Rating		Low	Medium	Medium	Medium-High	Medium-High	High

Source: Parsons Brinckerhoff, Draft Transit Impact Assessment Report (244B), March 5, 2010.

As shown in the table, Alternative 5 would lead to the largest increase in transit ridership. (For the purpose of this measure, the number of linked trips is used as the measure of ridership.) By covering the largest service area, as well as making connections in West Hollywood between the Red Line and the Purple Line, Alternative 5 offers the greatest level of transit service. Alternative 3 has the second highest increase in transit ridership. Several findings are of particular note:

- A comparison between Alternatives 5 and 3, and between Alternatives 4 and 2, shows the benefits of the West Hollywood connection. The connection would result in about 3600 to 4900 new daily transit trips per day, an increase of approximately 13 percent.
- The one-station extension from Westwood/UCLA (Alternative 1) to the Westwood/VA Hospital (Alternative 2) results in 3500 new transit trips, an increase of close to 15 percent.
- The benefits of extending the line from Westwood to Santa Monica are shown by comparing Alternatives 3 and 2, and Alternatives 5 and 4. The Santa Monica extension would increase the number of new daily transit trips by 7500 to 8900, or approximately 28 percent.
- The TSM Alternative is least effective, attracting no more than 5 to 10 percent of the new transit trips attracted by the rail alternatives.

The rail alternatives lead to an even more significant increase in urban rail boardings and boardings at new rail stations. (Metrics that use boardings count each link or segment of a transit trip separately. Thus a trip that involves a feeder bus ride followed by a transfer to rail would count as two trips. The new trips measure uses linked trips, so for that measure this same trip bus/rail trip with two boardings would count as one linked trip.) Again, Alternative 5 is expected to lead to the greatest increase in boardings, followed by Alternative 3.



4.1.5 Linkages to the transportation system

Two measures are used to compare the alternative project concepts in terms of their ability to enhance linkages to other parts of the regional transit system, and thus to major trip attractors/generators outside the study area. One is the number of direct connections to other rail lines, and to north-south bus routes, with no more than a 1/8 mile walk. Alternative 5 performs best on this measure, followed by Alternatives 3 and 4. A second measure is the number of transfers required to access Metrolink and Amtrak. Under each of the alternatives, riders from the study area can make these connections with just one transfer at Union Station.

Table 4-8. Linkages to Transportation System

Relevant Goals, Objectives, Criteria		No Build	TSM	Wilshire HRT			Combined HRT (Wilshire Plus West Hollywood)	
				Alt. 1	Alt. 2	Alt.3	Alt. 4	Alt. 5
A5b	Number of direct connections within 1/8 mile walk to other lines, north-south bus routes, etc.	N.A.	N.A.	7	7	11	10	14
A5c	Number of transfers required to access regional rail – Metrolink, Amtrak	2	2	1	1	1	1	1

4.2 Transit Supportive Land Use Policies and Conditions

The City of Los Angeles *Land Use/Transportation Policy* (Metro 1993), adopted in November 1993, is a joint effort of Metro and the City to coordinate land use and transportation investment decisions. The Policy seeks to establish transit centers and station areas as focal points for the future growth of Los Angeles, and to foster development of higher density, mixed-use projects within 1/4-mile of rail and major bus facilities. Similarly, the cities of West Hollywood, Beverly Hills, and Santa Monica each have adopted plans that encourage transit oriented development.

The extent to which each of the Tier 1 alternatives meets these land use goals can be measured by the number of high density mixed use activity centers within one-half mile of the alignment, and by the number of high opportunity areas for redevelopment within one-half mile of the alignment. Eleven activity centers – defined as locations with major commercial activity and mixed uses – are identified for this comparison (Figure 4-1):

- Hollywood area (includes Highland Avenue from Hollywood to Santa Monica Boulevards in Los Angeles)
- Sunset Strip
- The Grove/Farmer’s Market
- Wilshire Center
- Miracle Mile



- Century City (includes Westfield Shopping Center)
- Westwood/UCLA
- West Los Angeles
- Downtown Santa Monica
- West Hollywood
- Beverly Center/ Cedars Sinai
- Beverly Hills/Rodeo Drive

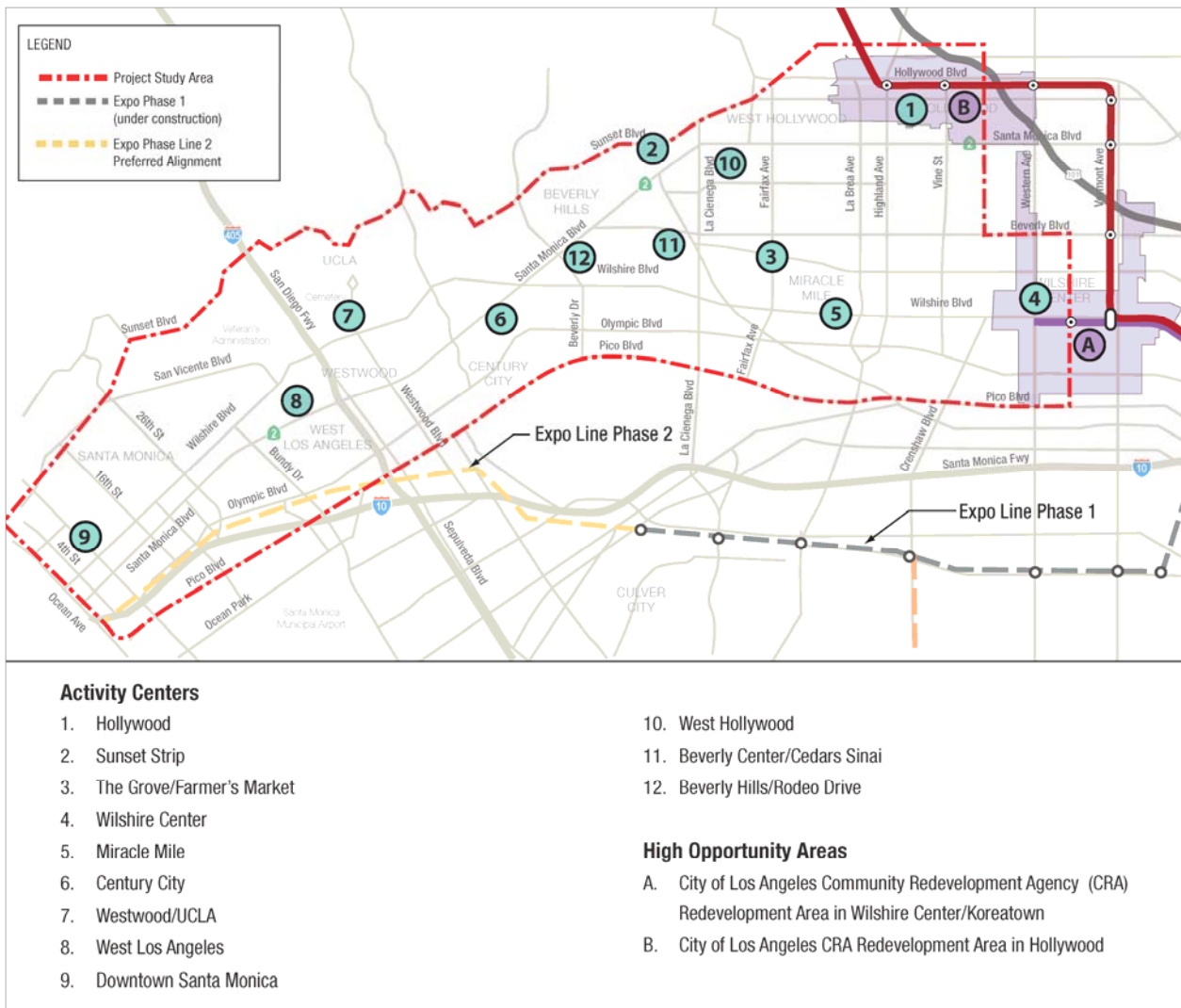


Figure 4-1: Activity Centers and Opportunity Areas Served by Tier 1 Alternatives

Two high opportunity areas are also identified:

- City of Los Angeles Community Redevelopment Agency (CRA) Redevelopment Area in Wilshire Center/Koreatown
- City of Los Angeles CRA Redevelopment Area in Hollywood



Table 4-9 shows the activity centers and opportunity areas served by each of the Tier 1 mode and project concept alternatives.

Table 4-9. Activity Centers and Opportunity Areas Served by Tier 1 Alternatives

Relevant Goals, Objectives, Criteria	No Build	TSM	Wilshire HRT			Combined HRT (Wilshire Plus West Hollywood)		
			Alt. 1	Alt. 2	Alt.3	Alt. 4	Alt. 5	
			B1a	High density mixed use activity centers within 1/2 mile of alignment	N.A.	N.A.	3,4,5, 6, 7, 12	3,4,5, 6, 7, 8, 12
B2a	High opportunity areas for redevelopment within 1/2 mile of alignment	N.A.	N.A.	A	A	A	A,B	A,B

All of the alternatives were developed to serve these activity centers and opportunity areas. The extent to which they are served is a function of each alternative’s length and number of stations. Alternatives 4 and 5 thus serve more activity centers and opportunity areas than the other alternatives.

Transit supportive land use is also a critical aspect of the FTA’s rating of projects that are seeking discretionary New Starts funds, as discussed in Section 3.1. FTA’s current measure for land use focuses on the extent to which existing development is transit oriented, while its measure for economic development focuses on land use plans and policies. A total of 40% of the project justification rating is a function of transit-oriented land use.

4.3 Cost-Effectiveness

Whereas Sections 4.1 and 4.2 compared the alternatives in terms of their effectiveness in meeting mobility and land use goals, this section addresses the cost effectiveness goal, comparing the benefits of each alternative with the cost of achieving them. The HRT alternatives are significantly more expensive to build than the No Build and TSM alternatives. In 2009 dollars, the rail alternatives range in cost from \$3.7 to \$8.4 billion (Table 4-10). The cost is largely a function of project length.

The rail alternatives are also more costly to operate and maintain than the No Build and TSM alternatives. Alternative 5, the highest cost alternative to operate and maintain, would increase Metro’s system-wide operating budget by close to \$120 million per year or 7 percent. Alternatives 1 and 2 would increase the operating budget by around \$40 million per year or 2 percent.

Table 4-10. Cost and Cost Effectiveness

Relevant Goals, Objectives, Criteria	No Build	TSM	Wilshire HRT			Combined HRT (Wilshire Plus West Hollywood)		
			Alt. 1	Alt. 2	Alt.3	Alt. 4	Alt. 5	
C1a	Capital cost in million 2009 dollars	Base	\$42	\$4,036	\$4,358	\$6,116	\$6,985	\$8,747
C2a	Year 2035 system-wide O&M cost in million 2009 year dollars	\$1,742	\$1,746	\$1,778	\$1,782	\$1,804	\$1,831	\$1,861
C3a	Daily Hours of Transit System User Benefits Compared to No Build	Base	2,722	31,174	35,812	46,248	40,526	52,567
C3b	Daily Hours of Transit System User Benefits Compared to TSM	NA	Base	28,452	33,090	43,526	37,804	49,845
C4a	Cost per hour of user benefit compared with No Build	Base	\$8.96	NA	NA	NA	NA	NA
C4b	Cost per hour of user benefit compared with TSM (NEW)	NA	Base	\$35.98	\$33.58	\$36.31	\$49.50	\$47.55

Table 4-11 presents two measures of cost-effectiveness:

- Cost per hour of transit system user benefit compared with the No Build
- Cost per hour of user benefit compared with the TSM Alternative.

Both measures are derived by annualizing each alternative’s capital cost, adding that to the annual O&M cost for 2035 service levels, and dividing the sum by the alternative’s annual transit system user benefits. User benefits refer primarily to travel time savings.

Existing transit riders (i.e., those people who would use transit even without an HRT extension) would receive user benefits because of the faster operating speed of HRT. New riders (i.e., those who are attracted to use transit because of these faster speeds, but who would not otherwise use the transit system) also receive benefits, which are calculated using a consumer surplus approach in accordance with FTA guidance and using FTA’s Summit software. In sum, the HRT alternatives would save transit riders between 31,000 and 52,000 hours of equivalent travel time (transit system user benefits) on an average weekday in 2035, depending on which HRT alternative is implemented.

The first of these two measures shows that the TSM alternative, while offering relatively few mobility benefits, is very cost effective. With a cost per hour of benefit of just over \$9, compared with the No Build, the return on an investment in improved bus service would be relatively high.



The latter of these measures, using the TSM Alternative as the baseline, is the “cost effectiveness index” (CEI) used by FTA in its rating of projects seeking New Starts funds. By using the TSM Alternative as the baseline for measuring costs and benefits, the CEI looks at the additional costs and benefits associated with a more capital intensive investment in rail. The measure currently counts as 20% of the FTA’s project justification rating for New Starts, which uses the following thresholds:

- High—≤ \$12.49 per hour of user benefit
- Medium-high—\$12.50 to \$16.49 per hour
- Medium—\$16.50 to \$24.99 per hour
- Medium-low—\$25.00 to \$31.49
- Low—\$31.50 and over

This analysis using this measure reveals that:

- Alternatives 1, 2 and 3 are significantly more cost effective than Alternatives 4 and 5. In other words, while Alternatives 4 and 5 tend to have more benefits than Alternatives 1 through 3, they achieve these benefits at a higher incremental cost. The rate of return from investing in the West Hollywood connection is less than the rate of return from investing in the Wilshire HRT alone.
- The CEIs for Alternatives 1, 2 and 3 are similar. The added investment of extending the line to Santa Monica has roughly the same cost per hour as a shorter extension to Westwood.

All of the alternatives have CEIs exceeding \$31.50, and thus are likely to receive a “low” cost effectiveness rating from FTA (Figure 4-2).

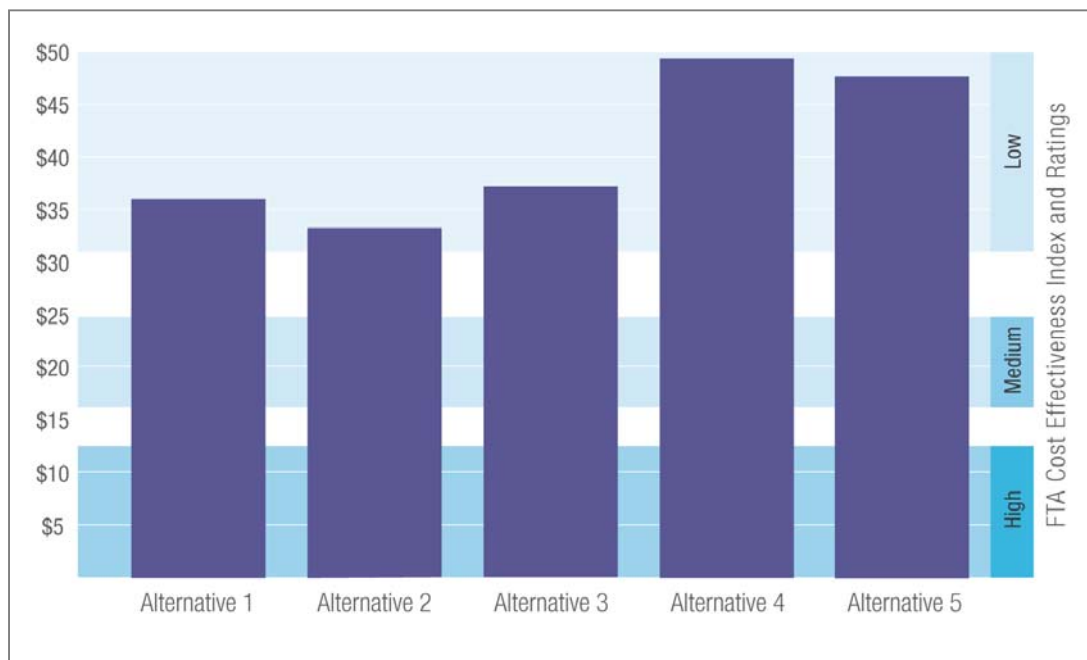


Figure 4-2: Cost-Effectiveness Indices



The CEIs shown here will be refined by further modeling and cost estimating, and will ultimately be confirmed by FTA’s review and acceptance. With a “low” or “medium-low” rating, under current rules and guidelines, FTA would only recommend New Starts funding if the project performs very well on FTA’s other project justification criteria, such as transit supportive land use and economic development.

The CEI results provided here are revisited in the Sections 5.0, 6.0, and 7.0, which describe how the cost- effectiveness ratings might change based on certain station, alignment, yard and shop and phasing decisions. There may be further opportunities to refine the ridership forecasts and transit system user benefits forecasts as the locally preferred alternative is advanced.

Of note, FTA has recently undertaken a rulemaking process that will reconsider how cost effectiveness is measured. Future Federal legislation to reauthorize the FTA program may also address the criteria that FTA uses to evaluate and rate New Starts projects. In other words, the above discussion relates to how the alternatives might perform under the existing FTA criteria, which may or may not change in the future.

4.4 Project Feasibility

This section addresses the financial feasibility of the five rail alternatives. It draws upon the transit supportive land use and cost effectiveness results reported in Sections 4.2 and 4.3, as well as the Costs and Financial Analysis Technical Report. As noted in that report, the Westside Subway Extension depends upon funding from the Measure R sales tax and Federal New Starts funding. Metro’s Measure R Ordinance and its fiscally constrained Long Range Transportation Plan (LRTP) dated October 9, 2009 set aside \$2.7 billion (in 2009 dollars) for a Westside Subway Extension Project. In addition, the LRTP assumed \$1.37 billion (2009 dollars) in New Starts funds.

The financial feasibility of each alternative depends upon:

- How well the alternative is likely to compete for New Starts funds, where the ratings process considers both project justification and local financial commitment.
- Whether the alternative’s capital cost is affordable within the financial assumptions of the fiscally constrained LRTP.

Considering both land use and cost-effectiveness, Alternatives 1 through 3 are expected to receive at least a medium rating for project justification, making these alternatives eligible for a New Starts funding recommendation. Alternatives 4 and 5 may have a greater challenge given that their CEIs are well above the normal competitive range.

Comparing the capital funding requirements of each alternative with the Measure R funds set aside for the Westside project in the LRTP, and assuming that the project is competitive for New Starts funds, shows that:

- The TSM Alternative and Alternatives 1 and 2 are financially feasible
- Alternatives 3, 4, and 5 are not currently financially feasible. Implementation of Alternative 1 or Alternative 2 would not preclude a future extension to Santa Monica or a future subway connection to West Hollywood. However, additional local funding would need to be identified.



It is important to note that Metro may seek additional sources of Federal funding possibly including funding or loans from new programs or a larger share of project cost from New Starts. Other non-Federal funding support may also be identified for the Westside Subway Extension. Table 4-11 HRT Alternatives 1, 2 and 3 are expected to achieve a “medium” justification rating from FTA. While the cost effectiveness indices suggest that Alternatives 1 through 3 would receive a “low” (or potentially “low-medium”) rating on this one metric, the region’s air quality designation and current and planned land uses in the study area are likely to offset that rating and raise the overall justification rating to at least “medium”. This would make these alternatives eligible for a New Starts funding recommendation. It is likely that Alternatives 4 and 5 would have a greater challenge in achieving a “medium” justification rating, given that their cost effectiveness indices are well above the normal competitive range.

Table 4-11. Project Feasibility

Relevant Goals, Objectives, Criteria		No Build	TSM	Wilshire HRT			Combined HRT (Wilshire Plus West Hollywood)	
				Alt. 1	Alt. 2	Alt.3	Alt. 4	Alt. 5
D1a	Expected project justification rating (NEW)	NA	NA	Medium	Medium	Medium	Low-Medium	Low-Medium
D1b	Expected financial capacity rating (NEW)	NA	NA	Medium-High	Medium-High	Low	Low	Low
D2a	Consistency of cost estimate with fiscally constrained LRTP (NEW)	No	No	Yes	Yes	No	No	No

A New Starts funding recommendation also requires that FTA give the project at least a “medium” rating for local financial commitment. The local funds needed to build Alternatives 1 and 2 are guaranteed by Measure R. A “low” financial rating is likely for Alternatives 3 through 5, however, unless a new local funding source is identified and adopted into the financial plan. Measure R revenues are insufficient to fund either a longer extension to Santa Monica or the connection to West Hollywood.

4.5 Equity

This section discusses and describes the degree to which each alternative improves mobility for transit-dependent communities, and the extent to which each alternative distributes impacts fairly across different population groups in the corridor. Four measures are used to compare the Tier 1 alternatives:

- The number of low income residents within one-half mile of the rail alignment
- The percentage of residents within one-half mile of the alignment that are low income
- The number of minority (Black, Asian, and Hispanic) residents within one-half mile of the alignment
- The percentage of residents within one-half mile of the alignment that are minority.

As shown in Table 4-12, the number of low income and minority residents living in close proximity to the project increases with the project scope and number of stations. However,



the percentage of residents within one-half mile that are low income or minority varies little across the alternatives.

Table 4-12. Equity

Relevant Goals, Objectives, Criteria	No Build	TSM	Wilshire HRT			Combined HRT (Wilshire Plus West Hollywood)	
			Alt. 1	Alt. 2	Alt.3	Alt. 4	Alt. 5
E1a E2a	0	0	25,707	27,180	32,114	38,799	43,733
E1b E2b	0	0	17.3%	17.1%	15.6%	16.4%	15.4%
E1c E2c	0	0	71,939	74,236	83,491	93,688	102,943
E1d E2d	0	0	47.0%	45.5%	39.5%	38.9%	35.6%

Source: 2000 Census

Those alternatives with the larger number of stations will provide better mobility to a larger number of low income and minority people. Similarly, alternatives with a larger scope and number of stations will expose more low income and minority residents to short term construction impacts.

4.6 Environmental Considerations

This section identifies environmental impacts and consequences that are considered to be most relevant to decisions on project mode and concept. It includes those impact categories where there are significant differences among the Tier 1 alternatives, as well as those categories where significant public interest has been expressed.

Noteworthy findings are:

- The five Build alternatives are completely in subway. Thus, the potential for environmental impacts occurs mostly at stations, where portals are built on the surface. Vent shafts would also be located on the surface.
- Each of the five Westside Subway Extension alternatives would displace one or more properties in order to construct station portals and provide for construction staging areas. Some business displacements would occur. The total number of jobs displaced would depend on which portal location is selected at each station. Several hundred jobs have been identified for potential displacement, but only a small percentage would actually be displaced.
- The five HRT alternatives would all lead to a reduction in vehicle miles of travel (VMT) on the highway system, with attendant reductions in congestion, pollutant emissions and energy consumption. The decrease is small in relation to total VMT in the study area.

Each of the alternatives would also cause impacts during construction. Construction impacts would include traffic and access disruptions near station sites, construction noise and



emissions (NOx and PM10), temporary removal of parking, visual effects, and haul trucks removing material excavated from the tunnel and station boxes. The amount of impact would generally be a function of the length of the subway and the number of stations. Metro will mitigate these construction impacts as described in the EIS.

Table 4-13. Environmental Considerations

Relevant Goals, Objectives, Criteria	No Build	TSM	Wilshire HRT			Combined HRT (Wilshire Plus West Hollywood)	
			Alt. 1	Alt. 2	Alt.3	Alt. 4	Alt. 5
			F1a	0	0	1	1
F1b	0	0	276	276	387	337	448
F3b	None	None	None	None	None	None	None
F6a	--	0	23,810	23,508	34,498	32,477	41,643

4.7 Public Acceptance

Through the Alternatives Analysis Study and the Scoping process, the overwhelming majority of stakeholders supported the need for a transit improvement in the Westside Subway Extension study area. They identified a Wilshire Boulevard subway as the most favored route and mode. Following Scoping, public support has tended to favor the Combined Wilshire/West Hollywood connection (Alternatives 4 and 5). Of those supporting the West Hollywood connection alternatives, most wanted both the Wilshire and West Hollywood alignments to be constructed, though many recognized that an extension of the Metro Purple Line from Wilshire Boulevard/Western Avenue along the Wilshire alignment would need to precede any connections from the Metro Red Line via Hollywood and West Hollywood. There was minimal support for the No Build and Transportation Systems Management (TSM) alternatives.

4.8 Trade-offs

In summary, considering the Tier 1 alternatives in terms of all of the goals:

- All of the HRT Alternatives are far more effective than the TSM Alternative in terms of enhancing mobility, serving development opportunities, and addressing other aspects of Purpose and Need. Alternatives 3, 4, and 5 tend to be more effective than Alternatives 1 and 2.
- While offering few mobility benefits, the TSM alternative is the most cost-effective due to its low cost. Alternatives 1, 2, and 3 have similar cost-effectiveness indices and are more cost-effective than Alternatives 4 and 5.
- Alternatives 1 and 2 are expected to be most competitive for New Starts funds and can be built with available Measure R and other identified funds. Alternatives 3, 4, and 5 are not financially feasible without a new source of revenues.
- Alternative 2, which extends the subway beyond Westwood/UCLA to the VA Hospital, adds riders and benefits at a reasonable cost and is financially feasible.



5.0 STATION OPTIONS

This second tier of decisions focuses on alternative station options. Six station decisions are to be made:

- Wilshire/Crenshaw – Include or Remove (Option A)
- Wilshire/Fairfax – West or East (Option B)
- Wilshire/La Cienega – East or West (Option C)
- Century City – Santa Monica Boulevard or Constellation Boulevard (Option D)
- Westwood/UCLA – Off Street or On Street (Option E)
- Westwood/VA Hospital – South or North (Option F)

While all seven goals are potentially relevant to this decision tier, not all of the objectives and measures under each goal are meaningful. This section focuses on those objectives and measures considered to be most relevant to decisions on stations.

5.1 Mobility Improvements

A person's propensity to use transit is significantly affected by the ease of getting to and from stations at either end of the trip. Shifts in station location can affect the number of people who live or work within a reasonable walking distance. For several of the station options considered here, pedestrian access differences between the choices are small. For several of the stations, a small shift in location would not have a noteworthy effect on mobility, but differences would exist at the following stations:

- Wilshire/Crenshaw – Removal of this station would reduce transit access for some of those residents and jobs within one-half mile of the proposed Crenshaw station. While perhaps a third of those living or working east of Crenshaw would be able to walk to and from the Wilshire/Western station, that station is over one-half mile away, and would be a significant distance to walk for many of those who might otherwise access the system at Wilshire/Crenshaw. Similarly, another third would walk to the LaBrea station. The remaining third of the residents of the station area and workers with jobs in the station area would be dependent on the bus system for the *"last mile"* to their homes and jobs. Due to the slower speeds on buses, and the possible need for an additional transfer, they would be less likely to use transit. Removal of the Wilshire/Crenshaw station would also speed travel for those other users of the system who would not be using the station.
- Wilshire/La Cienega – The West station option (Option C) creates the opportunity for transfers between the Wilshire HRT and the West Hollywood line Alternatives 4 and 5 at the Wilshire/La Cienega station. With the East station, transfers would be possible at the Wilshire/Rodeo Station but would require out-of-direction travel and added travel time for riders transferring between the West Hollywood line and Wilshire stations east of Rodeo. The East station site offers better access to residences and jobs east of La Cienega.
- Westwood/VA Hospital – The South station site is situated less than 300 feet from the hospital, while the North option is more than 1000 feet away on the other side of Wilshire. Thus, the South option offers much better pedestrian access to the VA Hospital for employees, patients and visitors once the project is completed.



5.2 Cost-Effectiveness

The various station options can affect the capital cost of the project, as well as its cost-effectiveness. Table 5-1 presents the capital cost of each of these station options, in comparison to the base case. Deleting the Crenshaw Station offers the opportunity to reduce project capital costs by \$151.9 million.

Moving the Westwood/VA Hospital Station to the north side of Wilshire Boulevard would increase project cost by \$92.6 million, but would avoid construction impacts near the VA Hospital, and help overcome security concerns related to locating the tunnel near the Federal Building. However, a station on the north side would have a greater potential to adversely affect cultural resources. Moving the Wilshire/LaCienega Station to the west would save \$18.9 million. At other locations, the cost differences between station options are more modest.

Table 5-1. Cost of Station Options

		Wilshire/ Crenshaw		Wilshire/ Fairfax		Wilshire/ LaCienega		Century City		Westwood Village		VA Hospital	
Relevant Goals, Objectives, Criteria		Include	Remove (Option A)	West	East (Option B)	East	West (Option C)	Santa Monica	Constellation (Option D)	Off Street	On Street (Option E)	South	North (Option F)
C1a	Capital cost in base year dollars	In base cost	Cost saving of \$153.4M	In base cost	No change from base	In base cost	Cost saving of \$18.9M	In base cost	Cost saving of \$4.1M	In base cost	Cost increase of \$10.2M	In base cost	Cost increase of \$92.6M

Several runs of the travel demand forecasting models were made to assess how the removal of the Crenshaw station and selection of the Constellation station would affect user benefits. These were then combined with the adjusted cost estimates, and CEIs were calculated. (See Section 4.3 for further explanation of user benefits and the CEI.) As shown in

below, deleting the Crenshaw Station and moving the Century City Station to Constellation would enhance the CEI, potentially improving FTA’s cost effectiveness rating for Alternatives 1, 2, and 3.

Table 5-2. Impact of Moving Century City Station to Constellation and Removing Crenshaw Station on Cost Effectiveness Index

		Alt. 1	Alt. 2	Alt. 3	Alt. 4
C3b	CEI with Crenshaw Station	\$35.98	\$33.58	\$ \$36.31	\$49.50
C3b	CEI without Crenshaw Station	\$34.40	\$31.96	\$35.16	
C3b	CEI with Constellation Station and without Crenshaw Station		\$31.29		

5.3 Project Feasibility

The cost savings or increases associated with the station options do not affect the overall financial feasibility of the HRT alternatives. Assuming that New Starts funds can be secured, Alternatives 1 and 2 are financially feasible with existing sources regardless of the station options chosen. Alternatives 3, 4, and 5 are only feasible if new funding sources are identified.

With one possible exception, each of the station options is feasible in the sense that there are no fatal flaws precluding construction. The one exception is in Century City. There, the feasibility of the Santa Monica Boulevard station site is compromised by its close proximity to the Santa Monica fault. The Constellation site (Option D) is farther from the fault and would have a lower seismic risk.

5.4 Environmental Considerations

This section highlights environmental impacts that are relevant to decisions on stations. In general, the station alternatives do not raise significant environmental differentiators. Noteworthy considerations are

- Wilshire/Fairfax – The East option (Option B) closer to the LaBrea Tar Pits has greater potential to encounter paleontological remains and gassy soils. Option B also straddles the Wilshire/Fairfax intersection, and thus has potentially greater traffic impacts during construction.
- Westwood/UCLA – Construction of a cut-and-cover station beneath Wilshire Boulevard would severely disrupt traffic on this heavily-used arterial. Moving the station off-street to the UCLA parking lot (Option E) would avoid these impacts. While this would displace some 700 off-street parking spaces, UCLA intends to redevelop the site and add 1000 spaces in the area. Temporary parking disruptions are possible with Option E.
- Westwood/VA Hospital – The North option (Option F) has greater potential to affect a historic district subject to the requirements of Sections 106 and 4(f). Option F is in close proximity to two historic resources, the Wadsworth Theater and a church. The South site is adjacent to a potential historic district and cultural landscape.

5.5 Public Acceptance

This section summarizes public and other stakeholder comments affecting station decisions.

- Wilshire/Crenshaw – Stakeholders and the public have expressed support for a Wilshire/Crenshaw Station as well as the option to remove the station. Those advocating



for a Crenshaw/Wilshire Station felt that it would provide important transit options and would serve east-west travel needs. Those opposing the station cited its potential for inducing growth and increasing density of commercial and service-oriented development that could change the character of this residential area

- Wilshire /Fairfax – Public comments focused on connecting the station to the east side of Fairfax Avenue. There was strong preference for the East site (Option B) in order to locate the station closer to activity centers, such as Los Angeles County Museum of Art (LACMA).
- Century City - There is substantial support for a station in the heart of Century City (Option D) along Constellation as this site would bring commuters closer to their jobs and residences. Fewer people supported a Santa Monica Boulevard Station, noting that this site is on the northern edge of Century City.
- Westwood/UCLA - Stakeholders did not show a clear preference for either station location option. During the community meetings, the public did express concern about the construction impacts for the On-street Station, but also expressed interest in how the options would affect access to Westwood Village and the Wilshire/Westwood intersection.
- Westwood/VA Hospital - Many of the public comments suggested that the Westwood/VA Hospital Station should be located in close proximity to the hospital building (the South site). However, the Department of Veterans Affairs (VA) has expressed concerns about the impact of this station site. In addition, the General Services Administration (GSA) has raised security concerns, as the South station option at the VA hospital would require a subway alignment close to the Federal office building. The feasibility of this station depends upon further consultation with VA and GSA.

5.6 Trade-offs

- Wilshire/Crenshaw - Deleting this station would save \$151.9 million and respond to community concerns about development pressures that could change the character of this residential area. This cost savings leads to an improved CEI, even though the number of residents and jobs within walking distance of a station is reduced.
- Wilshire/Fairfax - At this stage of analysis, differences between the two potential station locations appear to be small. The East option offers a station portal that more directly serves the Los Angeles County Museum of Art. However, it has somewhat greater potential to encounter paleontological remains and gassy soils, and may cause more traffic impacts during construction.
- Wilshire/La Cienega - The West option reduces project cost by \$18.1 million, and provides for a transfer to the West Hollywood line (if built) at the Wilshire/La Cienega station.
- Century City - Relocating the station to Constellation saves \$4.1 million in station costs and reduces the seismic hazard that compromises the feasibility of the Santa Monica Boulevard location. Because it increases the length of the alignment, however, a station at Constellation would increase project cost by \$60.4 million.



- Westwood/UCLA - The on-street option under Wilshire Boulevard increases project costs by \$10.1 million and would disrupt roadway traffic during the construction period. The off-street site could temporarily displace parking.
- Westwood/VA Hospital - Moving the station to the north side of Wilshire Boulevard would save \$73 million, avoid construction impacts near the VA Hospital, and overcome security concerns related to locating the tunnel in close proximity to the Federal building. However, a station on the north side would provide poorer pedestrian access between the station and the hospital, and would have a larger potential to adversely affect cultural resources.



6.0 ALIGNMENT OPTIONS

The choice of station locations helps to establish the alignment, but there are several alignment options for connecting the station locations once chosen. This section evaluates the available alignment variations. Mobility improvements, cost effectiveness, and environmental considerations are the key factors in comparing these options.

If the Century City station is located at Constellation, there are two alignment options for connecting to the Wilshire/Rodeo station, the Constellation North option and the Constellation South option. If the Century City station is located on Santa Monica Boulevard, the alignment between Century City and Wilshire/Rodeo would follow Santa Monica Boulevard.

Regardless of the site selected for the Century City station, there are three alignment options for connecting the station to the Westwood/UCLA station – the East (Base), Central, and West alignments.

6.1 Mobility Improvements

Table 6-2 and Table 6-3 compare the alignment options in terms of the travel time to traverse each segment. The alignment options between Wilshire/Rodeo and Century City would not have a significant impact on transit travel time, but the alignment options between Century City and Westwood/UCLA would.

Table 6-1. Transit Travel Time for Alignment Options between Wilshire/Rodeo and Century City

Relevant Goals, Objectives, Criteria		Constellation South Alignment to Constellation Station	Constellation North Alignment to Constellation Station	Santa Monica Boulevard Alignment to Santa Monica Boulevard Station (Base)
A1a	Peak period travel time (in minutes, this segment)	1.82	1.82	1.89

In that segment, the West alignment is longer than the other two, and would increase travel time between Century City and Westwood by more than two minutes. This, in turn, would lead to somewhat lower ridership and user benefits, and to fewer air quality and energy conservation benefits.

Table 6-2. Impact of Alignment Options between Century City (Santa Monica Boulevard Station) and Westwood/UCLA on Mobility

Relevant Goals, Objectives, Criteria		East Alignment to Westwood/UCLA Off-Street Station (Base)	East Alignment to Westwood/UCLA On-Street Station	Central Alignment to UCLA Off-Street Station	Central Alignment to UCLA On-Street Station	West Alignment to UCLA Off-Street Station	West Alignment to UCLA On-Street Station
A1a	Peak period travel time (in minutes, this segment)	2.34	2.34	2.34	2.34	4.9	4.9

Table 6-3. Impact of Alignment Options between Century City (Constellation Station) and Westwood/UCLA on Mobility

Relevant Goals, Objectives, Criteria		East Alignment to Westwood/UCLA Off-Street Station	East Alignment to Westwood/UCLA Off-Street Station	Central Alignment to UCLA Off-Street Station	Central Alignment to UCLA On-Street Station	West Alignment to UCLA Off-Street Station	West Alignment to UCLA On-Street Station
ATa	Peak period travel time (in minutes, this segment)	2.49	2.49	2.49	2.49	4.9	4.9

6.2 Cost Effectiveness

Table 6-4 and Table 6-5 compare the alignment options in terms of their capital cost. The West alignment between Century City and Westwood/UCLA would increase capital cost by more than \$120 million compared with the Base. A longer alignment would also increase operating and maintenance costs. These higher costs combined with longer trip times would lead to a higher CEI, making the project less competitive for FTA New Starts funds.

Table 6-4. Impact of Alignment Options between Century City (Santa Monica Boulevard Station) and Westwood/UCLA on Capital Cost

Relevant Goals, Objectives, Criteria		East Alignment to Westwood/UCLA Off-Street Station (Base)	East Alignment to Westwood/UCLA On-Street Station	Central Alignment to UCLA Off-Street Station	Central Alignment to UCLA On-Street Station	West Alignment to UCLA Off-Street Station	West Alignment to UCLA On-Street Station
C1a	Capital cost in million 2009 dollars	Base	\$9M less than Base	\$6M more than Base	\$3M more than Base	\$135M more than Base	\$122 M more than Base

Table 6-5. Impact of Alignment Options between Century City (Constellation Station) and Westwood/UCLA on Capital Cost

Relevant Goals, Objectives, Criteria		East Alignment to Westwood/UCLA Off-Street Station	East Alignment to Westwood/UCLA Off-Street Station	Central Alignment to UCLA Off-Street Station	Central Alignment to UCLA On-Street Station	West Alignment to UCLA Off-Street Station	West Alignment to UCLA On-Street Station
C1a	Capital cost in million 2009 dollars	\$23.5M more than Base	\$24.8M more than Base	\$32.2M more than Base	\$35.7M more than Base	\$138.5M more than Base	\$142.5M more than Base

6.3 Environmental Considerations

Noise and vibration are key environmental concerns for alignment options between Beverly Hills and Westwood. Residents worry that subway operations could cause vibration that would be felt by properties above the tunnel. The analysis has shown, however, that vibration impacts would not be significant.



The number of subsurface easements required and number of residential units located above the subway serves as proxies for this concern. The West alignment options between Century City and Westwood/UCLA tend to require fewer subsurface easements and cross under fewer residential units. Due to their longer length, however, this option would tend to reduce ridership, leading to higher VMT, pollutant emissions, and fuel consumption.

Table 6-6. Impact of Alignment Options between Century City (Santa Monica Boulevard Station) and Westwood/UCLA on Environmental Considerations

	Relevant Goals, Objectives, Criteria	East Alignment to Westwood/UCLA Off-Street Station (Base)	East Alignment to Westwood/UCLA On-Street Station	Central Alignment to UCLA Off-Street Station	Central Alignment to UCLA On-Street Station	West Alignment to UCLA Off-Street Station	West Alignment to UCLA On-Street Station
F3b	Number of Subsurface Easements (Residential)	200	176	346	250	130	126
F3b	Number of Subsurface Easements (Commercial & Other)	12	5	12	8	22	17

Table 6-7. Impact of Alignment Options between Century City (Constellation Station) and Westwood/UCLA on Environmental Considerations

	Relevant Goals, Objectives, Criteria	East Alignment to Westwood/UCLA Off-Street Station	East Alignment to Westwood/UCLA Off-Street Station	Central Alignment to UCLA Off-Street Station	Central Alignment to UCLA On-Street Station	West Alignment to UCLA Off-Street Station	West Alignment to UCLA On-Street Station
F3b	Number of Subsurface Easements (Residential)	222	198	441	345	206	202
F3b	Number of Subsurface Easements (Commercial & Other)	14	13	10	6	23	18

6.4 Public Acceptance

The public has not expressed a preference for any of the alignment options between Beverly Hills to Century City or Century City to Westwood. Stakeholders have shown a preference for alignment options that would minimize subsurface easements under residential properties.

6.5 Trade-offs

Alignment options that include the Westwood Loop increase transit travel time between Beverly Hills and Westwood, leading to lower ridership and user benefits, as well as higher air pollutant emissions and energy consumption. These alignment options would also increase project cost by more than \$140 million, and would be less cost effective.



6.6 Phasing

This decision tier is intended to inform decisions on the best terminus for an initial phase of implementation, under the assumption that the project concept may be built in phases over time. Two Minimum Operable Segment (MOS) alternatives are evaluated in this section to illustrate potential implementation phasing options:

- MOS-1 Interim terminus at Fairfax
- MOS-2 Interim terminus at Century City

The five HRT alternatives, as well as the No Build and TSM Alternatives, are also presented in this section for comparative purposes.

Four goals are considered to be most relevant to a decision on phasing – cost effectiveness, project feasibility, equity, and public acceptance.

6.7 Cost-Effectiveness

In the short term the two MOS’s are less costly to build than the longer rail alternatives. However, the MOS’s simply defer the investment required to complete the Westside Subway Extension. By phasing the construction, the ultimate cost to complete the ultimate project may increase, in year of expenditure dollars, as the cost of materials and labor is likely to escalate over time.

The MOS’s are less cost-effective than the full length alternatives. MOS-1 has a projected CEI of over \$65 per hour of user benefit. This indicates a relatively low rate of return for this initial phase of construction, if looked at in isolation from the rest of the project. This initial phase, if offered to FTA for consideration as a stand-alone New Starts project, is expected to receive a “low” rating for cost-effectiveness, and may not be competitive for funding on its own. Similarly, MOS-2 would be less cost-effective than Alternatives 1 through 3.

Table 6-8. Cost Effectiveness of Phasing Options

		No Build	TSM	MOS-1	MOS-2	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5
C1a	Capital cost in million 2009 dollars	Base	\$42	\$1,852	\$3,263	\$4,036	\$4,358	\$6,116	\$6,985	\$8,747
C2a	Annual O&M cost in million 2009 dollars	\$1,742	\$1,746	\$1,767	\$1,764	\$1,778	\$1,782	\$1,804	\$1,831	\$1,861
C3b	Cost per hour of user benefit compared with TSM (NEW)	NA	Base	\$65.55	\$37.43	\$35.98	\$33.58	\$36.31	\$49.50	\$47.55

6.8 Project Feasibility

This section addresses the financial feasibility of the MOS’s. It draws upon the transit supportive land use and cost effectiveness results reported previously, as well as the financial analysis reported in the Task 14.1.22 Cost and Financial Analysis Technical Report.



MOS-1 is apt to receive a “low” project justification rating from FTA if the segment is presented as a stand-alone candidate for New Starts funds. This initial phase has a very high CEI. Since MOS-1 does not extend to the denser parts of the study area (Beverly Hills, Century City and Westwood), opportunities to offset a “low” cost effectiveness rating with a “high” or “medium-high” rating on land use and economic development are limited. The opportunity for securing New Starts funds for MOS-1 hinges on considering the full project to Westwood or beyond as one project.

Table 6-9. Feasibility of Phasing Options

Relevant Goals, Objectives, Criteria		No Build	TSM	MOS-1	MOS-2	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5
D1a	Expected project justification rating (NEW)	NA	NA	Low	Low-Medium	Medium	Medium	Medium	Low-Medium	Low-Medium
D1b	Expected financial capacity rating (NEW)	NA	NA	High	High	Medium-High	Medium-High	Low	Low	Low
D2a	Inclusion in fiscally constrained LRTP (NEW)	NA	NA	Yes	Yes	Yes	Yes	No	No	No
D2b	Consistency between project cost and budget in LRTP (NEW)	NA	NA	Yes	Yes	Yes	Yes	No	No	No

MOS-2 might receive a higher project justification rating than MOS-1. The CEI for MOS-2 is closer to the competitive range, although still “low”. Moreover, by extending into Century City, MOS-2 should receive a higher rating for land use and economic development than MOS-1, helping to offset the “low” rating for cost-effectiveness.

In terms of financial capacity, just as FTA is likely to give a “medium-high” or better rating to Alternatives 1 and 2, it is likely that FTA would give a “medium-high” or better rating to Metro’s capacity to fund MOS-1 and MOS-2. Local funds necessary to pay for the non-Federal share are in place.

6.9 Equity

This section outlines the equity considerations that are relevant to a decision on project phasing. Four measures are used to evaluate the Tier 2 alternatives:

- The number of low income residents within one-half mile of the rail alignment
- The percentage of residents within one-half mile of the alignment that are low income
- The number of minority (Black, Asian, and Hispanic) residents within one-half mile of the alignment
- The percentage of residents within one-half mile of the alignment that are minority.

Results of this comparison are found in Table 6-10.



Table 6-10. Equity Implications of Phasing Options

Relevant Goals, Objectives, Criteria		No Build	TSM	MOS-1	MOS-2	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5
E1a E2a	Number of low income residents within 1/2 mile of alignment	NA	NA	17,254	21,382	25,707	27,180	32,114	38,799	43,733
E1b E2b	Percentage of total residents that are low income	NA	NA	20.1%	16.6%	17.3%	17.1%	15.6%	16.4%	15.4%
E1c E2c	Number of minority residents within 1/2 mile of alignment	NA	NA	58,936	64,954	71,939	74,236	83,491	93,688	102,943
E1d E2d	Percentage of total residents that are minority	NA	NA	68.3%	50.3%	47.0%	45.5%	39.5%	38.9%	35.6%

Source: 2000 Census

Compared with the more extensive alternatives, MOS-1 serves a part of the study area that has a larger percentage of residents who are low income or minority.

6.10 Public Acceptance

In general, public and stakeholder comments on construction phasing centered on the length of time needed for station construction and finding ways to get more of the project segments built faster.

6.11 Trade-offs

MOS-1 and MOS-2 would reduce the investment required in the near term, but would not save money long term and could lead to increased costs and delayed benefits.

MOS-1 is not likely to compete well for FTA New Starts funds as a stand-alone project. Securing New Starts funding may hinge on considering MOS-1 as part of a longer range project extending at least to Westwood. Otherwise, MOS-1 may not be recommended for New Starts funding and would require an increased amount of Measure R or other local funds.



7.0 OTHER COMPONENTS OF THE BUILD ALTERNATIVES

Within each alignment, there are options for other elements of the project not previously addressed, such as the location of the storage and maintenance facility. This section evaluates the available locations for these project elements.

7.1 Vehicle Storage and Maintenance Facility

The Division 20 Maintenance and Storage Facility with the planned No Build enhancements cannot accommodate Metro’s fleet requirements for any of the five HRT Alternatives. Two options for providing this expanded capacity are:

- Additional storage immediately south of the Division 20 Maintenance and Storage Facility between the 4th and 6th Street Bridges, which would accommodate Metro’s requirements for Alternatives 1 and 2
- Satellite facility at the Union Pacific Los Angeles Transportation Center Rail Yard that is connected by yard lead tracks to the Division 20 Maintenance and Storage Facility, which would accommodate Metro’s requirements for all five HRT Alternatives.

Cost effectiveness and environment are the most relevant goals to this decision. Use of the UP Los Angeles Transportation Center Rail Yard site would require a new bridge crossing of the Los Angeles River, adding to the capital cost and potentially requiring permits and approvals by others. An existing historic bridge would be affected, triggering Section 106 and 4(f) requirements. Railroad approval would be required, and railroad land would need to be acquired.

Table 7-1. Cost-Effectiveness of Maintenance and Storage Facility Options

Relevant Goals, Objectives, Criteria		Expanded Red Line Yard plus added storage south of Division 20 Facility (Alternatives 1 2 and 3)	Expanded Red Line Yard plus added storage south of Division 20 and Satellite Facility at UP Rail Yard (Alternatives 4 and 5)
C1a	Capital cost in million 2009 dollars	\$146 (Burdened Cost less right-of-way cost)	\$278 (Burdened Cost less right-of-way cost)