Metro Purple Line to Airport Metro Connector Station at Los Angeles International Airport

Alternatives Analysis Study

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0.Executive Summary

The Los Angeles County Metropolitan Transportation Authority (Metro) has undertaken an Alternatives Analysis (AA) to study a new HRT rail with one track in each direction extending from the future station along the Purple Line Extension at Wilshire/ Westwood and the Crenshaw Line at the Airport Metro Connector Station at Los Angeles International Airport. The purpose of an Alternatives Analysis is to define and recommend alternatives to be studied as part of a Draft Environmental Impact Statement/Environmental Report (DEIS/DEIR).

This project will enable LA Metro to evaluate the feasibility of building new line in the West of Los Angeles that can provide access to LAX and accommodate future population growth and transit demand. Also, the alternatives have to be compatible with existing land uses and future development. The study considered the future Purple Line Extension and the proposed The Airport Metro Connector (AMC) Project. Both of these projects will be linked by the proposed alternatives. The proposed alternatives will connect Wilshire/ Westwood Station, elevated, with the underground AMC Station which is going to provide convenient connection for passengers to Los Angeles International Airport (LAX). Also, the Alternative proposes three more stations, two elevated and one at grade, at Westwood/Santa Monica, Westwood/ Rancho Park, and Fox Hills.

The Study Area for the potential routes is located in western Los Angeles County and encompasses approximately 18 square miles. It is North-South oriented and includes portions of three jurisdictions: City of Los Angeles, Culver City, as well as portions of unincorporated Los Angeles County. This report analyses the first alternative which 30 ft above the ground at the future Wilshire/ Westwood Station in Westwood and continues Southeast along Westwood Boulevard and Sepulveda Boulevard till it meets with AMC Station. The second alternative, which considers the same requirements for the track, has been proposed by Engineer Rishab Patil in a separated report. It is proposed between the Wilshire/Westwood to the LAX Airport Connector Station, and it passes through Westwood Blvd, Overland Ave, Venice Blvd and San Diego freeway. Both of the alternatives have been designed taking into account the Prerequisite Requirements.

1.Introduction

Rail network in the city of Los Angeles has been an integral element of transportation planning for the city. The city works to provide better transit services through improving the existing infrastructure and expanding covered areas. This vision will be implemented by building new extensions to cover more districts and constructing new rail lines that can improve network mobility. One of the future lines that LA Metro plans to devolve is a new 8-mile-long rail line extending from the future station along the Purple Line Extension at Wilshire/ Westwood and the Crenshaw Line at the Airport Metro Connector Station at Los Angeles International Airport. Since several possible routes can link the terminuses, this report comes to study the feasible routes and establish a preferred route for further environmental study.

1.1. Study Area Location and Demographics

The Study Area for the potential routes is located in western Los Angeles County and encompasses approximately 18 square miles. The Study Area is North-South oriented and includes portions of three jurisdictions: City of Los Angeles, Culver City, as well as portions of unincorporated Los Angeles County. Generally, the boundaries of the Study Area extend north to the future purple line extension along Wilshire Boulevard, east to Overland Ave and La Cienega Blvd, south to Wilshire Blvd, and west to Centinela Ave. The land use for the study area is diverse which includes both residential and industrial areas. It incorporates a variety of land uses which include neighborhood and regional commercial uses; several shopping malls; government services such as Culver City DMV; major health institutions at Fox Hills; and medium/ high-density residential areas. The approximate number of people who are potentially going to benefit from the project can be high since the study area is going to cover densely populated cities. For the two cities, the total population of Los Angeles, and Culver City is around four million, and the number is expected to be higher in the next few years. On the other side, there are many educational, commercial, local, and federal instructions present in the study area which generate a tremendous number of daily trips. For instance, University of Los Angeles is only 0.5 miles from Wilshire/ Westwood station. Therefore, the socio-economic characteristics and the high population make the Study Area one of the densest areas in Los Angeles County to either live or work in.

1.2. Alternatives Considered

The alternatives will be evaluated based on many variables not only the Demographics of the city. This will narrow down the gap and will lead to finding the optimum route in which can help to improve transit services within Westside of Los Angeles. To achieve this goal, the route should be integrated with transportation projects that currently under construction or funded for future implementations. For instance, a connecting station should be placed connecting the Expo Line which is going enhance the performance of the network. Also, the alternative will favor less footprint by minimizing the constriction work to mitigate the environmental impact and reduce the cost of the project.

2.Alternatives Analysis Report purpose and structure

The AA is the first phase out of five phases, environmental studies, engineering, construction, and in operation that guide the ongoing public participation. The process starts by defining the purpose and need for the project then identifies possible alternatives to be narrowed down based on a set of evaluation criteria and performance measures developed for the project. The examination of the alternatives considers the project's impact and benefits of increasing connectivity and accessibility of the railroad. Also, the social and economic impact are marked to obtain the best outcomes. The plans are to compare each one of the routes based on a set of criteria, including effectiveness, efficiency, financial feasibility, and the community's response.

2.1. Goals and Objectives

The primary purpose of the project is to provide better public transit service and improve mobility in the Westside of the city through building a new line that offers direct access for Purple, and Expo lines riders to the future Airport Metro Connector Station. Los Angeles Metropolitan Transportation Authority is planning a new 8-mile-long rail line extending from the future station along the Purple Line Extension at Wilshire/ Westwood and the Crenshaw Line at AMC Station at Los Angeles International Airport. Several of the primary goals were established at the project outset to assess the feasibility of each alternative route to attain the primary purpose, as well as secondary targets.

Goal A – Mobility Improvement: The primary purpose of the project is to improve public transit service and mobility in the Westside of Los Angeles by improving the connection Metro's regional rail system. While the Airport Metro Connector Transit Station (near Aviation Blvd/96th St) will provide a link to a future Wilshire/ Westwood Station and Expo line, The AMC Station is envisioned to be the new transit "Gateway" for travelers.

Goal B – Transit Supportive Land Use Policies: this goal aims to locate transit alignments, and stations in areas which have more potential to devolve transit facilities by using existing land use conducive to transit use.

Goal C – Cost Effectiveness: This goal ensures that project is financially feasible, so the capital, operating, and maintenance costs of the project are allocated to manage capital risk by commensurating the project with its benefits.

Goal D – Environmental Considerations: The fourth goal, Environmental Benefits, is mitigate the environmental impact of the project on natural resources and communities within the study area by developing solutions that environmentally friendly as possible.

The intention the main objective of this report and is to provide a precise, straight-forward analysis of a feasible HRT line that between the Purple Line Extension at Wilshire/ Westwood and the Crenshaw Line at the Airport Metro Connector Station and enable LA Metro to proceed with environmental documentation.

3.Alternatives Considered

Heavy Rail can be envisioned as high-capacity, semiautomated, fast trains which are equipped with amenities to provide comfort and satisfying service to the commuters. While heavy rail transit requires exclusive, and secure the environment to run in, the promise is designing alternative alignment that can be less disruptive to the constructions and the environment. Besides that, the horizontal and the vertical alignments were designed to minimize the travel time between terminals, increase the rider's comfort,

reduce the total cost. The alignments start 30 ft above the ground at the future Wilshire/ Westwood Station and to end 50 ft under the ground at AMC Station. It includes at-grade, tunnel and elevated structures which are associated with the suitable track type.

3.1. Horizontal Alignments

The horizontal Alignments have five segments that make up the entire route.

3.1.1. Westwood Boulevard Alignment

The Westwood Boulevard alignment begins at the future Metro Purple Line terminus at Westwood/Wilshire in Westwood and continues Southeast along Westwood Boulevard through West Los Angeles to Tennessee Ave. There is only one major horizontal curve with 1500 ft. Radius and it starts 1442 ft. after Westwood/Wilshire station. For the rest of this segment, the track runs in tangent with Westwood Boulevard tile reach the connecting station with the Expo line at Westwood/ Rancho Park. The route passes through major intersections that include Wellworth Ave, Rochester Ave, Wilkins Ave, Ohio Ave, Massachusetts Ave, Santa Monica Blvd, Missouri Ave., La Grange Ave, Mississippi Ave, Olympic Blvd, Pico Blvd, and Tennessee Ave. The entire Westwood route is approximately 1.9. Miles in length and, as shown in the diagram, has one elevated and underground stations.

3.1.2. Connecting Westwood Boulevard to Sepulveda Boulevard Alignment.

The segment is linking the end Westwood route to the beginning of Sepulveda route. The two segments are being connected through a reversal curve that is staring 250 ft after the connecting station with Expo Line and terminating near Clover Ave. There are two large curves, which each one has 1500 ft. Radius, form the reversal curve that goes under the ground. The approximate length of this alignment is 0.8 mile.

3.1.3. Sepulveda Boulevard Alignment

The alignment for this segment begins 500 ft. South of National Blvd/Sepulveda Blvd intersection. The route continues Southeast along Sepulveda Blvd through Queensland St, Palms Blvd, Venice Blvd, Washington PI, Washington Blvd, Culver Blvd, Lucerne Ave. Generally, the route runs in tangent with Sepulveda Blvd with fewer curves as possible. Indeed, there are two curves placed between Washington Blvd and Culver Blvd to fit the alignment with the change of the allocation of Sepulveda Blvd. Also, at the end of the Sepulveda route, the alignment turns South to connect to next segment making a 275 ft. curve length. The approximate distance of this segment is 1.97 mile.

3.1.4. South Sepulveda Boulevard Alignment

The alignment continues South along Sepulveda Boulevard. The route first passes through Sawtelle Blvd, Jefferson Blvd, and Saluson Ave to go under I-90 & I-405. Because of the geography of the segment, four sharp curves present after the third station which is located next to Fox Hills Mall. This alignment returns to run in tangent along the boulevard crossing Centinela Ave and Manchester Ave. The entire Santa Monica Boulevard alignment has eight curves with approximate length 1.7 miles in length and as shown has one at-grade station.

3.1.5. Connecting South Sepulveda Blvd. to AMC Station Alignment

The segment is needed to turn the direction of the route to meet with connection Station of Los Angeles International Airport. One colossal curve and long tangent make up this segment when the route starts 200 ft. after Sepulveda Boulevard /Manchester Ave intersection and to go under La Tijera Blvd and at the end terminating at underground connection station with AMC. The length of the final segment is 1.79 miles.

3.2. Vertical Alignments

As well as the horizontal alignment, the same segments are being used to classify the vertical Alignments.

3.2.1. Westwood Boulevard Alignment

The future Metro Purple Line terminus is the starting point for Westwood Boulevard alignment. Westwood/Wilshire Station is going to be built 50 ft. above the ground and connect the two rail Lines together. This segment contains of three major roads which a grade separation is required to reduce the impact on the transportation system. Therefore, the alignment will crossover Santa Monica Boulevard and Olympic Boulevard 30 ft. above the ground then uses a tunnel to go under Pico Boulevard. There are two reasons cause the use of tunnel at the end of the section. First, there is a small bridge that connects the two sides of Westside Pavilion Mall which does not provide enough clearance for the grade separation. Secondly, the route intersects with the Expo Line, and the lateral distance between Pico Boulevard and Expo Line is not sufficient to build a leveled station connecting the two Lines.

3.2.2. Connecting Westwood Boulevard to Sepulveda Boulevard Alignment.

The segment links the end Westwood route to the beginning of Sepulveda route. Because this segment of the route appears in a densely populated area and there is no enough ROW to run the track at-grade. The route is going to run in 50 ft under the ground after passing through the proposed connecting station with the Expo Line.

3.2.3. Sepulveda Boulevard Alignment

The alignment for this segment begins 500 ft. South of National Blvd/Sepulveda Blvd intersection. The route runs mainly at-grade Southeast along Sepulveda Blvd through Queensland St, Palms Blvd, Washington PI, Washington Blvd, Culver Blvd, Lucerne Ave. Indeed, the traffic volume for these intersections should be provided to study the effect of running the track at-grade crossing these roads. While the route intersects with Venice Blvd which has high turning movements, grade separation is being designed for this intersection.

3.2.4. South Sepulveda Boulevard Alignment

The alignment continues South along Sepulveda Boulevard. The route runs at-grade for the entire section and passes through Sawtelle Blvd, Jefferson Blvd, and Saluson Ave to go under I-90 & I-405. After that, the alignment returns to run in tangent along the boulevard crossing Centinela Ave and Manchester Ave. There is a slight change in the elevation at the end of this segment which results in creating steep curves. In order to meet with MRDC maximize rider's comfort, a grade separation with La Tijera Blvd is being proposed.

3.2.5. Connecting South Sepulveda Blvd. to AMC Station Alignment

The segment is needed to turn the direction of the route to meet with connection Station of Los Angeles International Airport. Because the AMC Station is going to build 50 ft. under the ground, the alignments for the final segment were designed entirely to run under the ground. There are two major vertical Curves at the beginning and at the end of the segment that unitize the change in the elevation.

3.2.6. Alignment Calculations

Segment	Start Station	End Station 2	Alignment type	Length (feet)	Radius (feet)	Spiral Curves (feet)	Elevation	G_{ruling} (%)	E_a	Designed Speed (mph)
1	0+00.00	5+30.40	Tangent	530.19			334.00-318.10	3		40
1	5+30.40	8+30.40	Vertical Curve	300.00			318.10-311.00	2		40
1	8+30.40	12+12.82	Tangent	382.42			311.00- 230	1.73		40
1	12+12.8	16+31.63	Horizontal Curve	418.83	1500	200			1	40
1	16+31.63	16+56.87	Tangent				295.00-296.70	1.73		40
1	16+56.87	23+56.87	Vertical Curve	700.00			296.70-279.45	2.53		40
1	23+56.87	24+31.24	Tangent	74.38			279.45-277.07	3.2		40
1	24+31.24	37+31.24	Vertical Curve	1511.82			277.07-256.93	3.3		40
1	37+31.24	46+07.26	Tangent	876.02	-	-	256.93-256.62	0.1	-	40
1	46+07.26	52+07.26	Vertical Curve	576.22	-	-	256.62-244.32	3.9	-	40
1	52+07.26	60+07.68	Tangent	800.42	-	-	244.32-212.31	4	-	40
1	60+07.68	70+07.68	Vertical Curve	1000.00	-	-	212.3-174.61	1.53	-	40
1	70+07.68	81+99.34	Tangent	1191.65	-	-	174.61-132.45	3.5	-	40
1	81+99.34	91+99.34	Vertical Curve	1000	-	-	132.45-111.95	3	-	40
1	91+99.34	100+53.81	Tangent	854.47	-	-	111.95-106.0	0.5	-	40
2	100+53.81	120+40.12	Horizontal Curve	1986.31	1500	150			3	40
2	120+40.12	125+38.58	Tangent	498.46	-	-	96.4-94.0	0.5	-	
2	125+38.58	145+15.83	Horizontal Curve	1977.25	1500	150	-		3	40
2	134+94.78	144+94.78	Vertical Curve	1000.00			89.96-108.65	3		50
3	144+94.99	153+94.99	Vertical Curve	900.00	-	-	108.65-123.17	2.9	-	50
3	153+94.99	157+05.85	Tangent	310.86	-	-	124.74-125.82	0.34	-	50
3	157+05.85	177+05.85	Vertical Curve	2000.00	-	-	125.82-118.41	1.15	-	50
3	177+05.85	178+94.13	Tangent	188.29	-	-	118.41-116.35	1.09	-	50
3	178+94.13	184+94.13	Vertical Curve	600.00			116.35-110.27	2.08		50
3	184+94.13	187+40.22	Tangent	246.09			110.27-107.96	0.93		35
3	187+40.22	191+40.22	Vertical Curve	400.00			107.96-105.03	0.41		35
3	191+40.22	195+21.82	Tangent	397.15			105.03-102.93	0.52		35
3	195+21.82	200+21.82	Vertical Curve	500			99.78-87.07	3		35
3	200+21.82	202+12.06	Tangent	190.24			87.07-79.47	4		35
3	202+12.06	207+12.06	Vertical Curve	500			79.46-67.62	3.27		35
3	207+12.06	212+73.11	Tangent	561.05			59.76-57.0	1.13		50

3	212+73.11	216+90.40	Horizontal Curve	417.29	1500.00	200	-		3.75	50
3	216+90.40	221+79.45	Tangent	489.05	-	-	56.76-53.0	0.5	-	50
3	221+79.45	230+29.26	Horizontal Curve	849.81	1500	250			3.75	50
3	230+29.26	286+33.38	Tangent	5604.12	-	-	46.0-38.7	0.1		50
3	286+33.38	291+40.30	Horizontal Curve	506.92	500	100	-		2	25
4	291+40.30	306+81.47	Tangent	1541.17	-	-	-	0.1	-	55
4	306+81.47	311+90.76	Horizontal Curve	509.29	2000	250	-		3	55
4	311+90.76	327+38.46	Tangent	1547.7	-	-	-	0.1		55
4	327+38.46	331+77.11	Horizontal Curve	438.65	400	130	-		3.25	25
4	331+77.11	333+64.68	Tangent	187.57	-	-	-	0.1	-	25
4	333+64.68	337+90.47	Horizontal Curve	425.79	500.00	150.00	-		2	25
4	337+90.47	339+52.15	Tangent	161.67	-	-	-		-	25
4	339+52.15	342+90.91	Horizontal Curve		800.00	150	-		1	25
4	342+90.91	343+06.41	Tangent	15.49	-	-	44.3-46.29	0.8		25
4	343+06.41	345+36.23	Horizontal Curve	229.82	700.00	75			1	25
4	345+36.23	345+41.75	Tangent	5.52	-	-	40-40.35	0.1		25
4	345+41.75	350+41.75	Vertical Curve	500			40-.35-50.51	4		25
4	350+41.75	352+06.81	Tangent	165.06				1.23		25
4	352+06.81	360+80.29	Horizontal Curve		2500.00	150	-		1	50
4	360+80.29	364+87.8	Tangent	407.51	-	-	-	0.7	-	50
4	364+87.8	367+03.2	Horizontal Curve	215.4	800	100	-		1	50
	367+03.2	367+46.11	Tangent	42.91				4		50
4	367+46.11	372+46.11	Vertical Curve	500.00			124.25-137.59	2.8		50
4	372+46.11	376+36.81	Tangent	390.7			137.59-141	1.23		50
4	376+36.81	380+87.09	Horizontal Curve	450.28	3000.00	2000			2	50
4	380+87.09	385+47.1	Tangent	460	-	-	146-151.77	2.9		50
5	385+47.1	396+47.18	Vertical Curve	1100.00			151.77-140.70	1.62		50
5	396+47.18	399+39.20	Tangent	292.02			140.70-131.64	2		50
5	399+39.20	408+39.20	Vertical Curve	900			131.64-113.59	2		50
5	408+39.20	408+71.45	Tangent	32.25			113.59-113.00	0.22		50
5	408+71.45	433+46.57	Horizontal Curve	2475.12	2500	225			3	60
5	433+46.57	470+00.02	Tangent	3653.45			90-51.00	0.22		50
5	470+00.02	480+00.02	Vertical Curve	1000.00			51.00-45.36	1.12		50
5	470+00.02	489+67.11	Tangent	980.34	-	-	45.36-45.38	0	-	50

* Gruling is the maximum allowed grade in percent

* Ea is actual applied superelevation

* Red Marks show there is an overlap between the horizontal and vertical curves

3.4. Estimated Travel Time

The railroad is a solution to minimize the wasted time that a user spends traveling an origin to a destination in some daily activities. The user's traveling cost cannot be precisely measured, and its benefits that can reflect on another side not only the cost of fuel or fares. In early stages of designing the value of the time spent traveling can indicate the feasibility of the route. In order to measure the estimated travel time for 9.3 miles route with three intermediate stations, several factors should be taken into account. First, the route mainly runs at grade on segment three and four, which can minimize the designed speed to comply with roadway posted speed limit. Secondly, the route uses a different type of constructions, so sustained and constant speed is required to ensure safe transferal. Third, the acceleration and deaccelerating between terminus are neglected. Instead, a fixed speed is assigned to each segment and 2 minutes dwell time per intermediate station is being added. Based on the designed speed and considering other variables, the table below shows the estimated time travel for the suggested route:

Start Station	End Station	Minimum Designed Speed (mph)	roadway speed limit (mph)	Applied Speed (mph)	Length (mile)	Segment travel time (min)	dwell time (min)
0+00.00	39+32.2	40	35	35	0.75	1.3	0
39+32.2	43+82.2	-	Elevated Station	-	0.085	-	2
43+82.2	93+17.4	40	Elevated	40	0.93	1.4	0
93+17.4	97+67.4		Underground Station	-	0.085	-	2
97+67.4	145+15.83	40	Tunnel	40	0.9	1.35	0
145+15.83	184+94.13	50	Tunnel	50	0.75	0.9	0
184+94.13	207+12.06	35	40	35	0.42	0.75	0
207+12.06	286+33.38	50	40	40	1.5	2.25	0
286+33.38	291+40.30	25	40	25	0.1	0.24	0
291+40.30	321+25.3	55	40	40	0.57	0.85	0
321+25.3	325+75.3	-	At-grade Station	-	0.085	-	2
325+75.3	352+06.81	25	40	25	0.5	1.6	2
352+06.81	408+71.45	50	40	40	1.06	1.6	0
408+71.45	433+46.57	60	Tunnel	60	0.47	0.47	0
433+46.57	489+67.11	50	Tunnel	50	1.1	1.32	0
Total						9.3 20	6 20

3.5. Transportation Analysis

Los Angeles' metropolitan regions are known for being the most congested urbanized area in the nation. The Los Angeles-Culver City-Inglewood is considered as one of the densest regions in the County. According to Census Bureau, the average population in 2010 per square mile for Los Angele, Culver City, and Inglewood is 12094.5, 7607.7, 8092.3, respectively. Indeed, the number can be higher today. While the mean travel time to work on these is hovering around 30 minutes which is going to reflect on the daylily trips. In that sense, the alignment comes to provide other alternatives to those who commute to work every day with less impact on the existing transportation network. As described in the alignment's section, the potential track is proposed along the existing roadway, and it takes 26 ft in width of the road. Mainly, the alignment runs at grade on two corridors, Westwood Boulevard and Sepulveda Boulevard. This means the capacity of Westwood Blvd is going to be reduced by 50% due to the railroad right of way. Also, the traffic goes through Sepulveda Boulevard will be affected when two lanes, 35% of road capacity, is dedicated to the track. In addition, there is a potential increase in traffic congestion for the major roadways which the track crosses. Because it would be unfeasible and expensive to provide grade separation for all intersections, only seven intersections have been included. There are four bridge crossings provided at major road

intersections, at Wilshire Blvd, Santa Monica Blvd, Olympic Blvd and Venice Blvd. For the remaining three roads, Tunnels or trenches can be used to cross under the intersections which are Pico Blvd, Manchester Ave, and La Tijera. Other at-grade crossings should be protected by signalized it to ensure the safety of the road users. The table below illustrates the major roadway crossings:

Roadway Crossing	Station	Track Type	Grade
Wilshire Blvd	00+00	Direct Fixation	Aerial
Ohio Ave	19+78	Embedded	At-grade
Santa Monica Blvd	39+32	Direct Fixation	Aerial
Olympic Blvd	65+75	Direct Fixation	Aerial
Pico Blvd	82+49	Direct Fixation	Underground
Palms Blvd	169+10	Embedded	At-grade
Venice Blvd	196+90	Direct Fixation	Aerial
Washington Blvd	221+52	Embedded	At-grade
Culver Blve	234+43	Embedded	At-grade
South Saluson Ave	315+24	Embedded	At-grade
Manchester Ave	422+41	Direct Fixation	Underground
La Tijera	431+20	Direct Fixation	Underground

4. Environmental Considerations

The existing corridor allocated around Los Angeles city, Culver City, Inglewood which include residential, commercial and services uses. The residential areas geographically cover around 70 presents of the total land use in the study area. While the residential areas expand over the study area, the density varies upon the alignments. In addition to the residential land use, there are multi- commercial uses that contain structures predominantly used for the sale of products and services. While the impact of the project can magnificently improve the transportation services, it might have some adverse effects on the area. In this regard, the design of the alignment intends to minimize the displacement of homes and businesses and reduce the impacts to the character of the community. The alignment also attempts to mitigate the impacts on the traffic and circulation system. Also, the impact on sensitive and protected environmental resources have been considered at the time of designing the alignments.

4.1. Land Acquisition

There aren't any private land acquisitions in the chosen corridor. The alignment designed to run along existing roads. The capacity of the streets will be impacted, as described in the traffic analysis chapter because the track Right-of-Way will acquire 26 ft of the corridors' width. Also, Fox Hills Station will be placed at grade, and a private land acquisition might need to reduce the impact on the segment by adding one lane for both directions of South Sepulveda Blvd.

4.2. Cultural Resources

The below list represents the cultural resources that are located within 1000 ft. of alignment that might be impacted. Mainly, several religious and educational institutions will be affected by the project.

- Westwood Presbyterian Church
- St. Paul the Apostle Catholic Community

- Los Angeles California Temple
- Joy of All Who Sorrow Orthodox Church
- WLA Living Word Christian Church
- Culver-Palms United Methodist Church
- Hammer Museum
- Culver City Chamber of Commerce
- Culver City Transit Center
- Westwood Charter School
- Emerson Middle School
- Westwood Hills Congregational school
- National Unversity - West Los Angeles
- Clover Avenue Elementary School
- Charnock Road Elementary School

4.2. Parks and Recreation Resources

There are many recreational resources aligned along Westwood Boulevard and Sepulveda Boulevard. The alignment will affect several malls and plazas which include stores, theatres, and retailers.

- Westwood Village Square
- Moss Plaza -
- Westwood Center
- Westside Pavilion -
- Westfield Culver City

Also, parks and playgrounds in the corridor are Westwood Park, Mar Vista Recreation Center, Tellefson Park, Blanco Park, Hillside Memorial Par

5. Crossovers

Three universal crossovers are provided at entry and exit of the potential stations. The first crossover will be placed before Westwood/Santa Monica Station. The second crossover will be at grade ahead of Fox Hills Station. The last crossover is going to be located before the entrance of the AMC station. All the crossovers are placed on the leveled tangent track.

6. Stations

The alignment begins from Westwood/Wilshire Station and passes through three proposed stations before reach AMC Station.

6.1. Westwood/ Wilshire Station (00+00)

The terminal Westwood/ Wilshire Station is provided 50 ft above the ground for this alignment. It is connected with the Purple line running at grade by staircase and elevators. Island platform is provided in an elevated station for users ease of shifting tracks. It takes no private right of way.

6.2.Westwood/Santa Monica Station (39+32.2-43+82.2)

West Hollywood/Santa Monica Station comes after the grade separation with Santa Monica Blvd, and 4000 feet from Westwood/Wilshire Station. Because of the grade separation with Santa Monica Blvd, the station is placed 30 ft. above the ground. The station platform is considered as island platform where there is no private right of way impact. Also, there is a universal crossover provided for the track change before the station. The terminal serves mixed residential area that live next to the station plus it provides access to multi stores, and Retails. Also, there are several health and educational institutions located nearby the station.

6.3. Westwood/ Rancho Park Station (93+17.4-97+67.4)

Westwood/ Rancho Park is an underground heavy rail station in the Los Angeles County Metro Rail system located at the intersection of Westwood Boulevard and Exposition Boulevard in the Rancho Park. The station with side platforms connects the alignment with Expo Line which has at-grade station. This station is located in Rancho Park, a single-family neighborhood south of Westwood and southwest of Century City. Also, the station location is close to the Westside Pavilion shopping mall.

6.4. Fox Hills Station (321+25.3-325+75.3)

Fox Hills Station is a heavy rail subway station in the Los Angeles County Metro Rail system. The station is going to be at grade station and using a center platform. It is located 300 ft. after the intersection of I-90 and Sepulveda Boulevard in Culver City. The station is placed in the center of commercial use area which includes shopping mall, retail stores, and business offices. The main land mark in this area is Fox Hills mall which situated on a 50-acre site. Also, the station is only 400 feet south of Culver City Transit Center which provides access to many dissentions.

6.5. AMC Station (489+67.11)

The terminal station is given 50 ft under the ground ending at side platforms. It will provide a connection to a future Automated People Mover (APM). Also, the station will provide access to the Metro Green and Crenshaw/LAX Lines. Universal crossover is placed ahead of the station helps for vehicular track interchange.

7. Cost Analysis

The goal of this section is to evaluate whether the costs of the alternative are commensurate with its benefits. Several measures used to calculate the estimated cost of the project which based on estimated capital cost per mile and the capital cost. However, the Metro system operations and maintenance costs are not going to be included.

7.1. Alignment Length

The study is one of the densest areas in the city of Los Angeles. Most of the transit service in the Study Area operates on a congested roadway network which leads to more travel time. For example, a person has to drive approximately 11 miles from Westwood to reach LAX which can take up to 25 minutes. While the proposed alignment between the start and the end stations only expand over 9.3 miles.

7.2. Capital Cost

The capital cost estimate is based on the structure type and its corresponding cost. It utilizes the most current unit cost data available locally which is priced in US dollars. Generally, the alignment uses all three types of constructions, at grade, elevated, and underground to satisfy the requirements. For instance, to minimize the impact of the project on the local corridors, grade separations with direct fixation track were provided. In one hand, the alignment uses aerial structures to cross over Santa Monica Blvd, Pico Blvd, and Venice Blvd. On the other hand, bored tunnels come to provide access beneath Olympic Blvd, and La Tijera Blvd. Except for the road crossings, described previously, the alignment runs at grade and uses an embedded track to utilize other intersections that have fewer demands. Overall, the table below shows the estimated cost for each segment based on the proposed alignments:

Segment	Structure Type	Track Type	Length (mile)	Cost Rate (million)	Total Cost (million)
1	Elevated Station	direct fixation		100	100
1	at grade	ballast /embedded	0.156	60	9.36
1	elevated	direct fixation	1.4	140	196
1	Elevated Station	direct fixation		100	100
1	bored tunnel	direct fixation	0.35	260	91
1	underground Station	direct fixation		300	300
2	bored tunnel	direct fixation	0.84	260	218.4
3	at grade	ballast /embedded	2.3	60	138
3	elevated	direct fixation	0.47	140	65.8
4	At grade	ballast /embedded	1.81	60	108..6
4	At grade station	embedded		50	50
5	bored tunnel	direct fixation	1.97	260	512
5	underground Station	direct fixation		300	300
Total			9.3		**2080.56**

8. Comparison of Alternatives and Recommendations.

The evaluation considered two HRT alternatives as part of the comparative analysis. This report analyses the first alternative which begins at the future Metro Purple Line terminus at Westwood/Wilshire in Westwood and continues Southeast along Westwood Boulevard and Sepulveda Boulevard till it meets with connection Station of Los Angeles International Airport. The second alternative, which considers the same requirements for the track, has been proposed by Engineer Rishab Patil in a separated report. It is proposed between the Wilshire/Westwood to the LAX Airport Connector Station, and it passes through Westwood Blvd, Overland Ave, Venice Blvd and San Diego freeway. Both of the alternatives have been designed taking into account the Prerequisite Requirements.

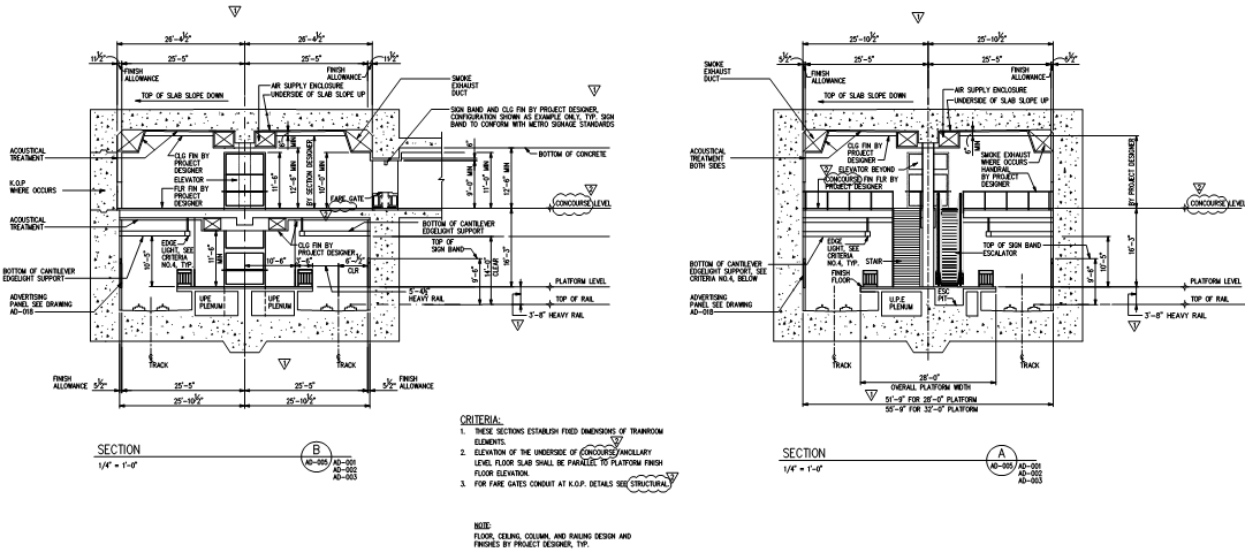
Although the alternatives share the same terminals, the method of the implementation is different. The length of the second alignment is slightly longer than the other by 0.6 miles. Both of the alignment intends to use at grade, Aerial, and Underground structures. For the first alternative, the alignment runs 45%, 20% and 35% of the time at grade, elevated, and underground, respectively. In the other side, the second alternative will mainly, use Aerial and Underground Structures. So that, the cost of the construction significantly will be higher. Despite that, the intervention with local street will be minimized and it's going to reflect on travel time between stations. As shown in the table below, the total travel time for the second alternative is approximately 17 minutes which is relatively low when the first alignment requires 20 minutes which 2 minutes higher than the required travel time. In fact, the total cost in US dollar for the alternatives can sum up all the differences weigh them in dollar cost. The total cost of the project includes the construction cost and the cost of acquired private Right-of-Way. The estimated cost shows that the first alternative will only cost 2/3 of the total cost of the second alternative. The cost of the rail project reaches typically ten figures number so one third can be substantially high. The table below shows there are 1.2 billion dollars more spending on the second alignment.

Three recommendations can result from the comparison between the alternatives. The second alternative is favorable over the first alternative because the second alternative seems to meet all the project prerequisites, but it's going to require more resources to build the track. Nevertheless, the first alternative will be recommended if 2 minutes increase in the total travel is adequate. Because alignment runs along existing corridors which does not require acquired any private ROW, it provides easy access to many areas but with limited speed. Also, another alternative analysis study is recommended to improve the first alignment to meet the required travel time and reduce the cost which can be achieved by reducing the intervention with existing transportation system and minimizing the underground constructions.

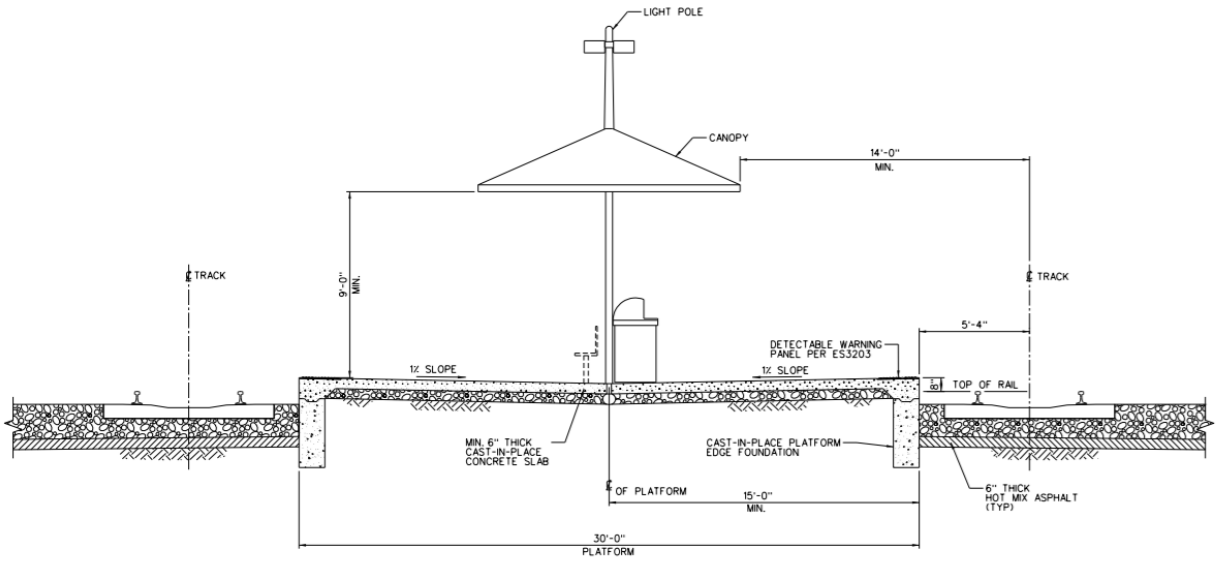
Alternatives Considered	Length (mile)	At grade structures (mile)	Aerial Structures (mile)	Underground Structures (mile)	Travel Time (minute)	Land Acquisition (ft2)	Total Cost (million)
1	9.3	4.2	1.87	3.16	20	0	2080.56
2	9.936	0.757	6.528	2.651	16.77	339117	3269.654

9. Appendix

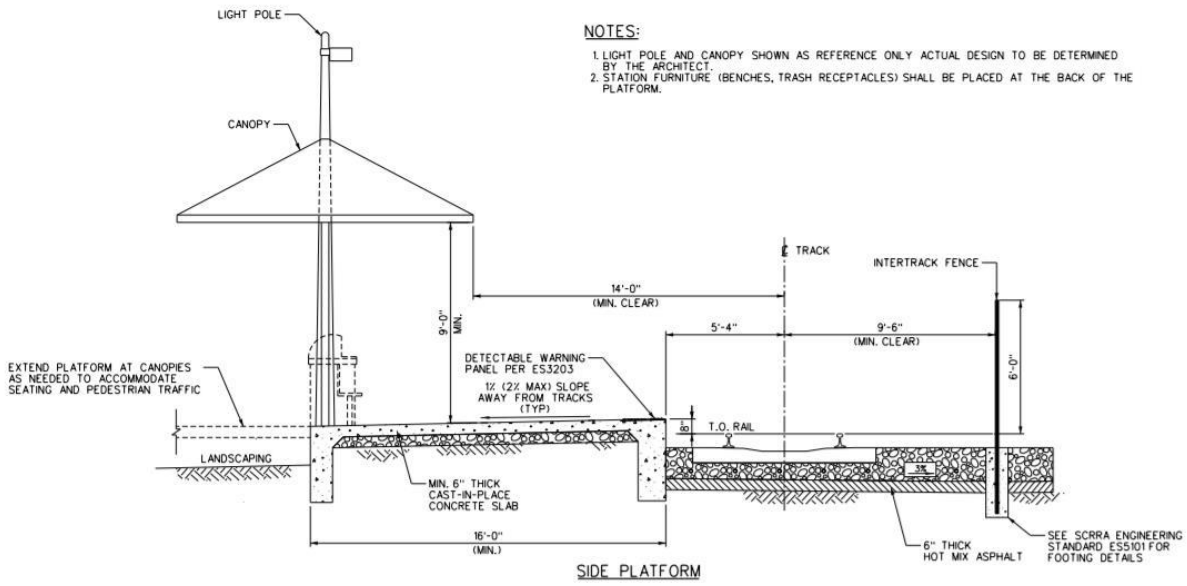
Underground Station: Wilshire/Westwood and Airport Metro Connector Station



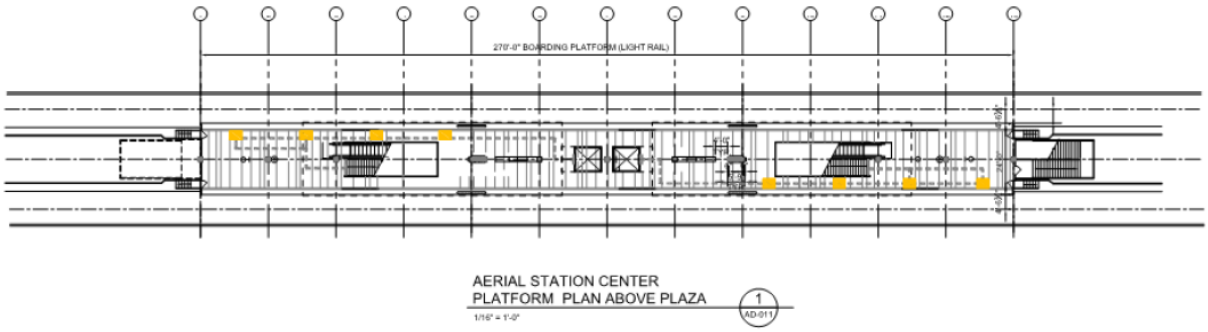
Elevated Station- Centre Platform: Westwood/Rancho Park and Venice Blvd Station

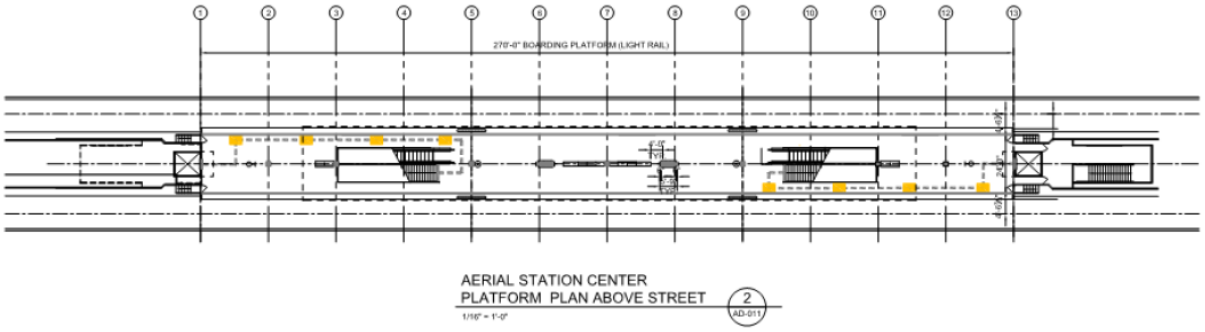


At Grade Station – Side Platform: 1831 Westwood Blvd

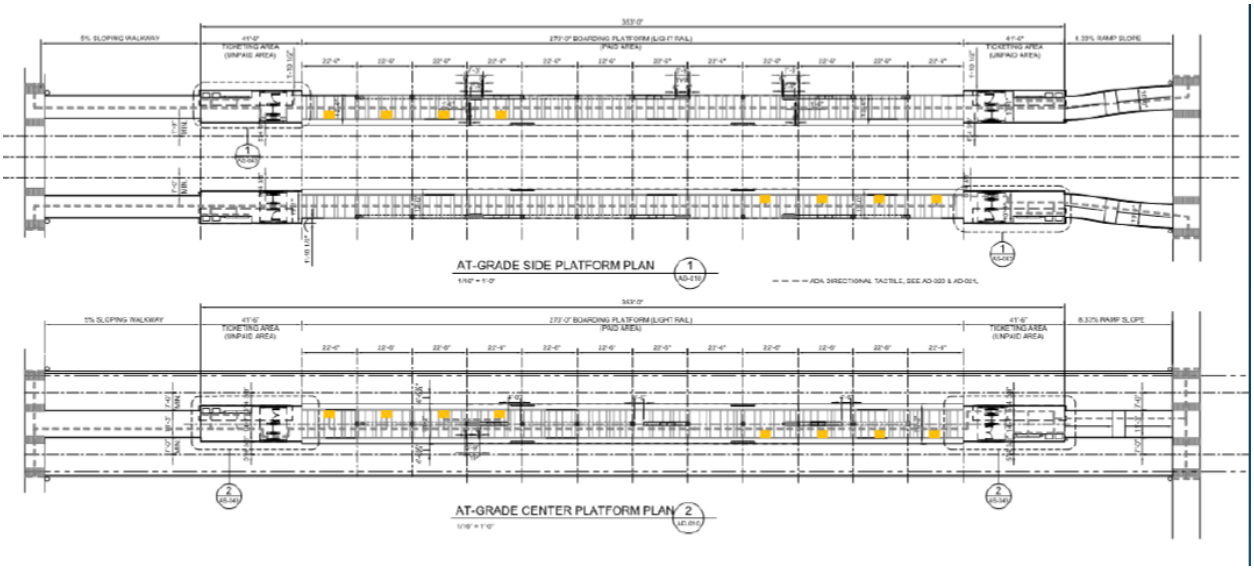


Aerial Station

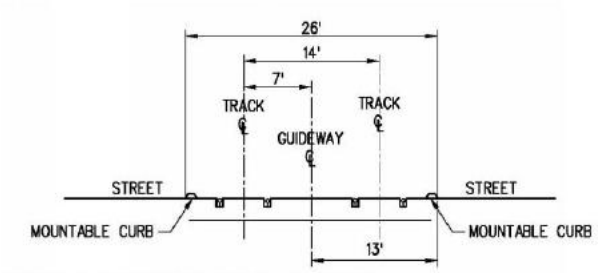




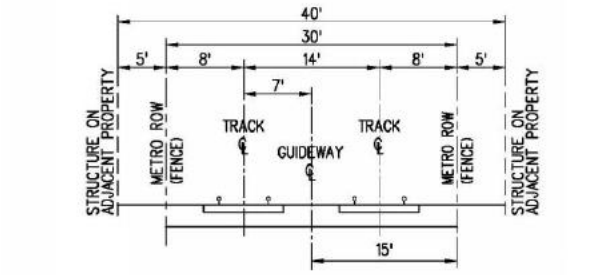
AT GRADE STATION



ROW BETWEEN STATIONS



SECTION A - ROW BETWEEN STATIONS STREET ROW



SECTION B - ROW BETWEEN STATIONS EXCLUSIVE OR SEMI-EXCLUSIVE ROW

Horizontal Alignments

Vertical Alignment