Miramar Tunnels Alternatives Analysis Report

San Diego Regional Rail Corridor
Alternative Alignment and Improvements
Conceptual Engineering Study

December 2023

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ABSTRACT

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ABSTRACT:	This Alternatives Analysis Report documents the analysis of conceptual alternatives for relocating the existing alignment of the Los Angeles-San Diego-San Luis Obispo Corridor to bypass Miramar Hill and replace the Sorrento Valley Station with a new station closer to the University Town Center (UTC). Two conceptual alignments were developed to 10 percent conceptual engineering and evaluated against a set of performance criteria. Both alignments are recommended for further evaluation during the preliminary engineering and environmental phase.

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Acronyms

BNSF	BNSF Railway
CAHSR	California High-Speed Rail
Caltrans	California Department of Transportation
CCHS	Crest Canyon Higher Speed
CEQA	California Environmental Quality Act
CP	Control Point
CPUC	California Public Utilities Commission
EIR	Environmental Impact Report
EIS	Environmental Impact Statement
EMP	Emergency Management Panel
FEMA	Federal Emergency Management Agency
FLS	Fire Life Safety
FRA	Federal Railroad Administration
FTA	Federal Transit Administration
GIS	Geographic Information Systems
GPS	Global Positioning System
I-	Interstate
LOSSAN	Los Angeles-San Diego-San Luis Obispo
MND	Mitigated Negative Declaration
MP	milepost
MTS	San Diego Metropolitan Transit System
NCTD	North County Transit District
NEPA	National Environmental Policy Act
NFPA	National Fire Protection Association
OTE	Over-Track Exhaust
PDT	Project Development Team
PTC	Positive Train Control
RCP	Reinforced Concrete Pipe
ROW	Right-of-Way
SANDAG	San Diego Association of Governments
SanGIS	San Diego Geographic Information Source

SCRRA	Southern California Regional Rail Authority
SDG&E	San Diego Gas and Electric
SD-LOSSAN	San Diego Regional Rail Corridor Alternative Alignment and Improvements Conceptual Engineering Study
SDSVDT	San Dieguito to Sorrento Valley Double Track
SEM	Sequential Excavation Method
SM2	Sorrento to Miramar Phase 2
SOE	Support of Excavation
TBD	To Be Determined
TBM	Tunnel Boring Machine
TMC	Train Management Computer
U.S. DOT	United States Department of Transportation
USC	United States Code
UTC	University Town Center
UTS	Under-Track Supply
ZEMU	Zero-emission Multiple Unit

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Executive Overview

The Los Angeles-San Diego-San Luis Obispo (LOSSAN) Rail Corridor passes through the City of San Diego via a circuitous alignment around Miramar Hill with sharp curves and steep grades that slow the speed of the trains and 2.35 miles of single track, which further reduces capacity. This report documents the analysis of conceptual alternatives for the relocation of passenger service that bypasses Miramar Hill via a double-track tunnel and replaces the Sorrento Valley Station with a new station closer to major destinations, such as the county's second largest employment hub, University Town Center (UTC).

The LOSSAN Corridor is a vital component of the San Diego region's transportation network. North County Transit District (NCTD) COASTER commuter service, Amtrak Pacific Surfliner intercity service, and BNSF Railway (BNSF) freight service rely on the corridor to move nearly 8 million passengers and $1 billion in goods each year (California State Transportation Agency 2021). The length, sharp curvature, and steep grades of the existing alignment result in long rail travel times through the study area. In addition, the existing LOSSAN alignment does not connect riders directly to one of the region's major employment hubs and high-density residential areas and lacks a direct connection to the newly constructed Blue Line Trolley in the UTC area. Therefore, San Diego Association of Governments (SANDAG) commissioned the San Diego Regional Rail Corridor Alternative Alignment and Improvements Conceptual Engineering Study (SD-LOSSAN) that is expected to be completed in fall 2023, which will determine a long-term safety and operations solution for the San Diego segment of the LOSSAN Rail Corridor.

One conceptual alternative considered, which serves UTC via Genesee Avenue, was assessed in a feasibility study by the California Department of Transportation (Caltrans). A second conceptual alternative was developed that travels west of I-5, providing a larger reduction in length of the alignment. These alternatives were refined to support higher operating speeds of up to 110 miles per hour based on new information obtained from the operational feasibility study and the Federal Railroad Administration (FRA) Class 6 basis of design criteria to allow the corridor to better align with regional goals. A third conceptual alternative adjacent to Interstate (I-) 5 was considered but not carried forward to 10 percent design due to impacts to the I-5 southbound on-ramp (at Roselle Street) and adjacent floodway.

To evaluate the conceptual alternatives, workshops were conducted with the Project Development Team (PDT), which consists of representatives from SANDAG, NCTD, Caltrans, Southern California Regional Rail Authority (SCRRA), FRA, LOSSAN Rail Corridor Agency, BNSF, and San Diego Metropolitan Transit System (MTS). At the first workshop in October 2020, the PDT reviewed and selected evaluation criteria to be used in evaluating the two alignments for this planning study. The group selected a total of 11 criteria to use in ranking the conceptual alternatives based on defined planning, construction, postconstruction/operational, and community impact considerations.

At the second workshop in March 2021, the advantages and disadvantages of each alignment were presented to the PDT. The PDT then agreed that both alignments should be studied further. No preferred alignment has been identified at this time. The two refined alignment alternatives are summarized in Table ES-1.

Table ES-1. Summary of Conceptual Alignment Alternatives

	UTC	Nobel
Length of alignment at-grade (miles)	2	0.8
Length of alignment on aerial structure (miles)	0.7	0.5
Length of alignment in tunnel (miles)	2.5	3.8
Total alignment length (miles)	5.2	5.1
Station Depth (feet)	87	107
Potential travel time savings using ZEMU (minutes, all stop/limited stop)	9.2 / 7.8	9.9 / 8.5
Construction Cost (2023 dollars)*	$2.88 billion	$2.60 billion

*Excludes right-of-way and soft costs

At a third workshop in May 2023, the opportunities and challenges for a shared passenger/freight tunnel with an underground station versus a passenger-only tunnel where all freight operations would remain on Miramar Hill were presented to the PDT with a recommendation that the latter be studied in the alternatives analysis. The PDT agreed that, for the purposes of this alternatives analysis planning study, the conceptual alignments could be studied with passenger-only operations in the tunnels. A subsequent meeting was held in August 2023 with BNSF and NCTD where they both agreed to the approach, but NCTD made note that a shared tunnel should not be ruled out at this early phase and should be studied further in the future.

When the conceptual alternatives are advanced beyond the current 10 percent conceptual engineering, potential cost savings, project delivery methods, construction phasing, and station location, configuration, and vertical circulation should be analyzed further. Additionally, although the twin-bore configuration was used in the development of the 10 percent conceptual engineering, both single- and twin-bore configurations are considered viable options and should be evaluated in further detail.

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1 Project Description

This project is part of a larger program of improvements to be carried out on the LOSSAN Corridor in Southern California in order to enhance the safety and reliability of existing services as well as accommodate projected increases in passenger and freight services between San Luis Obispo, Los Angeles, and San Diego. This Alternatives Analysis Report documents the analysis of conceptual alternatives for relocating passenger train service from the existing alignment of the LOSSAN Rail Corridor through the City of San Diego, where the rail line crests Miramar Hill on grades exceeding 2 percent, to a future double-tracked tunnel alignment through Miramar Hill between Los Peñasquitos Lagoon and Rose Canyon. The conceptual alternatives analyzed would provide faster travel times by increasing passenger train operating speeds, reducing the length of the alignment and adding a new station closer to major destinations and trolley connection.

Three conceptual alternatives were considered. The first, serving UTC via Genesee Avenue, was previously studied in the *Miramar Tunnel Feasibility Study for the LOSSAN Corridor* prepared by Caltrans (Caltrans 2020). A second, shorter conceptual alignment west of I-5 was also developed. A third conceptual alignment, adjacent to I-5 was considered but not carried forward to 10 percent design due to impacts to the I-5 southbound on-ramp (at Roselle Street), adjacent floodway, and sensitive receptors. The two conceptual alignments were refined to achieve higher operating speeds, then analyzed to determine their effectiveness in meeting the project's evaluation criteria. They were then evaluated based on defined planning, construction, post-construction/operational, and community effect considerations.

The conceptual alignment alternatives recommended through the alternatives analysis process are anticipated to be advanced for further evaluation, public outreach, and screening in an environmental review process to determine a preferred alignment.

For purposes of this study, it was assumed that only passenger service would operate in the tunnel and freight would remain operating on Miramar Hill with passenger and freight merging back together at both the north and south end of the tunnel in Sorrento Valley and Rose Canyon, respectively. However, a shared passenger and freight tunnel has not been determined to be infeasible at this phase and could be studied further in the future.

1.1 Project Location

The project study area is located in San Diego County in the City of San Diego. The new segment of track for passenger service is located between Mile Post (MP) 247.5 and MP 257.2 of the San Diego Subdivision, which is part of the LOSSAN Corridor and the project would also require modifications to the signal system between MP 245 and MP 259.3. The right-of-way (ROW) in the project study area is owned by MTS and NCTD is responsible for operating and maintaining the corridor. Figure 1-1 shows the limits of the San Diego Subdivision, with the project study area identified, and Figure 1-2 shows the two alternatives that were evaluated. These conceptual alignments will be discussed further in Section 3.3.

Figure 1-1. Project Location

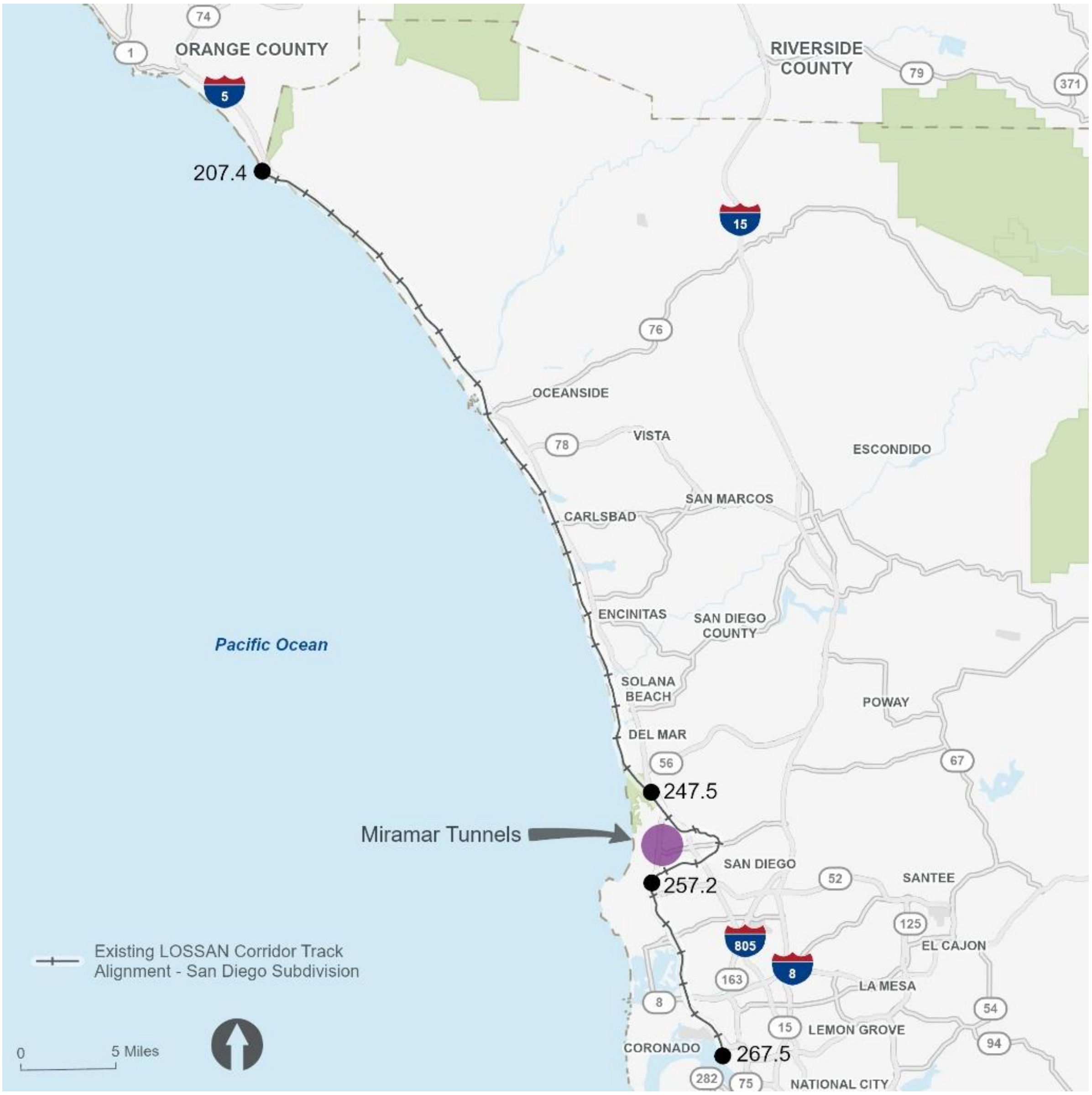

Figure 1-2. Conceptual Study Alignments

1.2 Project Reporting Structure

This planning study is guided by two distinct reporting groups. First is the PDT, which consists of transportation agencies and railroad partners who meet on a bimonthly basis to track project progress and provide feedback, such as the criteria used to evaluate and score the different conceptual alignment alternatives through Miramar Hill. The PDT was responsible for selecting the analysis criteria, reviewing relevant information about the proposed conceptual alternatives, and ultimately determining which alternatives to carry forward for conceptual design.

The PDT consists of representatives from the following stakeholders:

- SANDAG planning staff

- SANDAG engineering staff
- SANDAG outreach staff
- NCTD planning staff
- NCTD engineering staff
- MTS
- LOSSAN Rail Corridor Agency
- SCRRA
- Caltrans Division of Rail and Mass Transit
- FRA
- BNSF

The second group in the project reporting structure is the executive management group, which consists of the SANDAG Transportation Committee, SANDAG Board of Directors, and SANDAG executive staff.

1.3 Existing Facilities

1.3.1 History and Ownership

The San Diego Subdivision forms the southern part of the 351-mile LOSSAN Corridor, linking San Diego, Los Angeles, and San Luis Obispo. The LOSSAN Corridor is the second busiest intercity passenger rail corridor in the United States and supports commuter (COASTER), intercity (Pacific Surfliner), and BNSF freight rail services. The San Diego Subdivision, which is the easternmost segment of the LOSSAN Corridor is a 60-mile section from the Orange County line to the Santa Fe Depot in Downtown San Diego. Currently, two-thirds of the subdivision is double tracked.

The LOSSAN Rail Corridor in San Diego County traces its roots to the California Southern Railroad, a company affiliated with the Atchison, Topeka & Santa Fe Railway, which built a rail line northward from National City through San Diego, Del Mar, and Oceanside, and then eastward to San Bernardino and through the San Gabriel Mountains to Barstow, where a connection was made with a Santa Fe subsidiary called the Atlantic and Pacific Railroad. California Southern constructed its rail line between 1881 and 1885, following the Pacific coastline for most of its route between San Diego and Oceanside. In the years that followed, Santa Fe Railway built several connecting lines to the California Southern line and ultimately acquired the railroad. In 1888, Santa Fe completed the final pieces to establish a through route for trains between San Diego and Los Angeles, which has become today's LOSSAN Rail Corridor.

In 1992, NCTD and MTS purchased the San Diego Subdivision alignment and ROW in San Diego County from Santa Fe Railway. NCTD took ownership of the portion of the line between the Orange County/San Diego County line at MP 207.4 and MP 245.6 near the northern limits of the City of San Diego, and MTS acquired ownership of the line within the City of San Diego from MP 245.6 to the south side of the Broadway grade crossing (east of the Santa Fe Depot) at MP 267.7. The purchase was carried out to enable an expansion of intercity passenger rail service and the introduction of commuter rail service on the line, which began in 1995. Santa Fe Railway, and now its successor BNSF, retains contractual rights to provide rail freight service on the line. Under the terms of the purchase agreement, NCTD is responsible for operating and maintaining the San Diego Subdivision within San Diego County, including the segment owned by MTS, and has agreements with private contractors for dispatching services, maintenance services, and the operation of COASTER commuter rail service.

1.3.2 Main Tracks

The San Diego Subdivision in San Diego County consists of alternating segments of single track and two main tracks, totaling 15.8 miles of single track and 44.3 miles of two main track. Segments with double track allow trains to operate in either direction on either main track.

The majority of the San Diego Subdivision within the study area consists of two tracks, with the exception of two single-track segments totaling 2.35 miles in length (see Figure 1-3). The project begins, based on current conditions, at MP 247.5 in a single-track segment that extends for 0.33 mile to the north of Control Point (CP) Torrey, MP 247.83. At CP Torrey, a 3.12-mile segment of double track begins that contains the Sorrento Valley station. The second main track ends at CP Scripps, MP 250.95, followed by a 2.02-mile single-track section to CP Miramar, MP 252.97, where the second main track resumes to the end of the Project limits at MP 257.2. For the purposes of this study, it is assumed that the San Dieguito to Sorrento Valley Double Track (SDSVDT) project (formerly known as Del Mar Tunnels) would be constructed prior to this project. Although an alignment for SDSVDT has not been selected, for purposes of this study, the existing conditions incorporated into the design alternatives uses the proposed Crest Canyon Higher Speed (CCHS) 10 percent conceptual alignment as the northern tie-in. However, the selection of a Miramar tunnel alignment alternative is independent of which SDSVDT alignment is ultimately selected as the proposed project. Additionally, construction of SDSVDT is not a prerequisite for construction of a Miramar tunnel.

SANDAG is continuing to advance plans to construct the Sorrento to Miramar Phase 2 Double Track Project, which would remove the existing single-track bottleneck between MP 251 and MP 253 by constructing 2 miles of second main track between CP Scripps and CP Miramar. In addition to double tracking, the project also includes:

1. Straightening curves in the track to increase passenger train speeds from 25 to 40 miles per hour and decrease maintenance costs from wear on the rails.
2. Construction of soil nail walls and ¾:1 slopes with benching to prevent slope erosion and mitigate seismic instability.
3. Construction of an improved trackside maintenance road.
4. Construction of trackside ditches on both sides of the tracks to improve trackbed drainage and prevent slope erosion.
5. Replacement of old and undersized culverts with new reinforced concrete pipe (RCP) culverts with energy dissipators.
6. Installation of crash protection walls underneath the Miramar Road bridge.

The Sorrento to Miramar Phase 2 Double Track Project is environmentally cleared and entering 100-percent design. In this study, the project is assumed to be fully constructed by the time the Miramar Tunnels Project is constructed.

Figure 1-3. Existing Alignment in Project Area

1.3.3 Maximum Operating Speeds and Movement Authority

The segment of the LOSSAN Corridor within the Project limits contains one of the line's most significant operating constraints, the climbing of Miramar Hill, which contains both steep grades and sharp curves, significantly limiting train speeds. Trains operating in both directions encounter brief sections of track with grades exceeding 2 percent and southbound trains encounter a sustained climb of 2.2 percent (compensated), the steepest grades on the corridor in San Diego County. CP Miramar, at MP 252.97, is located at the summit of the climb.

The maximum operating speeds on the San Diego Subdivision in San Diego County are currently 90 miles per hour for intercity passenger and commuter trains (Amtrak and COASTER, respectively) and 55 miles per hour for freight trains. However, trains must operate at lower speeds in various locations throughout the corridor where dictated by physical conditions or operational requirements. The section of the San Diego Subdivision in the study area, circling Miramar Hill, contains segments with speed restrictions and is the slowest and steepest section of the LOSSAN Corridor south of Los Angeles. Table 1-1 provides an inventory of maximum authorized speeds on the San Diego Subdivision through the study area per the NCTD Timetable Special Instructions No. 5, effective July 13, 2020. Trains approach the Sorrento Valley area from the north traveling at the maximum operating speed of the rail line must reduce their speed due to a civil speed restriction just south of CP Torrey. Upon passing Sorrento Valley Station, trains enter the slowest portion of the corridor, Miramar Hill. Miramar Hill has the slowest curves and steepest grades on the corridor requiring trains to slow further. As the trains descend from the Miramar Hill peak near Miramar Road, passenger trains are able to resume normal speeds of up to 79 miles per hour through Rose Canyon before reducing speeds again through the Elvira Curves.

Table 1-1. Maximum Authorized Speeds through the Study Area

East End Milepost	West End Milepost	Reason for Speed Restriction	Maximum Authorized Speed		Diverging Authorized Speed	
			Passenger	Freight	Passenger	Freight
247.77	249.63	Civil speed restriction that includes the 2 main track sections between CP Torrey and CP Sorrento including through the Sorrento Valley Station*	60	55		
247.83	*CP Torrey*	*East end 2 Main Track**			*60*	*40*
249.25	*CP Sorrento*	*Single crossover westward from MT-1 to MT-2*			*60*	*40*
249.60	*N/A*	*Pines Spur*			*20*	*15*
249.63	250.24	2-degree curve north of Bridge 249.9	50	20		
250.24	251.00	4-degree curves through this section	40	20		
250.95	*CP Scripps*	*Turnout*			*25*	*20*
251.00	252.97	Curves exceeding 10 degrees on Miramar Hill	25	20		
252.96	*CP Miramar*	*Turnout to west leg of Miramar Wye*			*10*	*10*
252.97	*CP Miramar*	*Turnout*			*30*	*25*
252.97	253.48	Curves exceeding 4 degrees	50	45		
253.48	255.44	Curves exceeding 2 degrees 30 minutes beneath I-805 overpass	65	55		
255.4	256.63	Legacy automatic train stop (ATS) limited speed to 79, track geometry has not been analyzed for faster speeds	79	55		
256.15	*CP Rose*	*Universal crossovers*			*60*	*40*
256.63	257.91	Curve exceeding 2 degrees	70	55		

Italicized text signifies the location of a turnout.
CP-control point; MP=milepost; MT=main track
*These restrictions would be removed when the SDSVDT Project is constructed.

SANDAG has identified relocating the railroad tracks away from the coastline in Del Mar as a high priority project due to erosion of the bluffs; therefore, it is anticipated that SDSVDT would be constructed prior to this project. The SDSVDT Project would raise maximum speeds to 110 miles per hour for passenger and

60 miles per hour for freight trains through its conceptual alignment, including the Miramar Tunnel tie in location between MP 247.5 and MP 248.

Movement authority on the San Diego Subdivision is governed by a Centralized Traffic Control system with wayside signals managed by train dispatchers at NCTD's Rail Operations Center. NCTD has overlaid the existing signal system with Positive Train Control (PTC), as required under federal law for rail lines with regularly scheduled intercity passenger rail or commuter rail service. The type of PTC system deployed on the San Diego Subdivision is known as Interoperable Electronic Train Management System. This system uses global positioning satellite (GPS) data, a fiber optic communication network, data from the wayside signaling system, and an onboard control system on each locomotive that will enforce speed restrictions and train control requirements.

1.3.4 Grade Crossings

There are three at-grade crossings within the study area, one of which is a vehicular crossing at Sorrento Valley Boulevard and two of which are pedestrian-only crossings at the Sorrento Valley Station in the City of San Diego. In 2019, a total daily volume of over 24,000 vehicles was recorded at the Sorrento Valley Boulevard crossing (City of San Diego 2021). Table 1-2 provides a detailed description of the at-grade crossings within the study area. Information provided in the table was obtained through Google Earth, the California Public Utilities Commission (CPUC) Crossing Inventory, and NCTD.

Table 1-2. Existing At-Grade Crossing(s) in the Study Area

Crossing Name	Location or City	MP	U.S. DOT or CPUC #	# of Tracks	Warning Devices	Ped. Gates	Quiet Zone	Ped. Only	Other Features
Sorrento Valley N	San Diego	248.90	923772K	2	2 No. 8	None	No	Yes	In station, Concrete Panels
Sorrento Valley S	San Diego	249.00	966289K	2	2 No. 8	None	No	Yes	In station, Concrete Panels
Sorrento Valley Boulevard	San Diego	249.10	026838H	2 + (1 TBD)	1 No. 9A, 2 No. 9, 1 No. 8	None	No	No	Medians, Concrete and Rubber Panels

Warning device No. 8 – Flashers Only
Warning device No. 9 – Flashers with Gates
Warning device No. 9A – Flashers with Gates and Cantilever
CPUC=California Public Utilities Commission; MP=milepost; TBD=to be determined; U.S. DOT=United States Department of Transportation

1.3.5 Stations

There is one passenger rail station within the study area, the Sorrento Valley Station in San Diego. The Sorrento Valley Station is served by COASTER commuter trains and consists of two main tracks, each served by a side platform with walkways leading to pedestrian grade crossings east and west of the station platforms. There is no station building. The station parking lot is located east of the station platform between Main Track 2 and Sorrento Valley Boulevard. Sorrento Valley/Sorrento Mesa is a major employment center. Various employers provide shuttle service between the station and their place of work to provide the first and last mile connections. The station is also located adjacent to the Sorrento Valley Boulevard at-grade crossing, where vehicles accessing the southbound I-5 currently experience significant delays due to its close proximity to the station and large traffic volumes. There are pedestrian grade crossings east and west of the station platforms, which allow passengers to cross between platforms. The Sorrento Valley Station is a multimodal facility, with a bus lane and bus loading area adjacent to the station platform serving Main Track 2. A walkway from the station platform serving Main Track 1 extends to Roselle Street, providing access to additional bus routes.

1.3.6 Additional Operational Considerations

As previously noted, Miramar Hill has the steepest grade and the sharpest curves on the corridor in San Diego County, resulting in the slowest segment of the LOSSAN rail line south of Los Angeles. Sharp curves limit Pacific Surfliner and COASTER train speeds within the project limits to 25 miles per hour and freight trains to 20 miles per hour. The 2-mile section of single track between CP Scripps and CP Miramar causes system delays of 6 to 9 minutes as trains wait for one another to pass.

NCTD has designated the segment of the existing corridor between the Sorrento Valley station and the CP Sorrento interlocking as a “non-comm zone” to enable safe train movements under PTC through areas where GPS communications can be unreliable. Eastbound trains departing the Sorrento Valley Station must proceed at a speed less than 16 miles per hour until passing the CP Sorrento interlocking while the engineer ensures that the train is able to send and receive GPS communications to and from the PTC system.

The wye track at CP Miramar permits trains operating in either direction on the LOSSAN corridor to enter a rail spur via a progressive movement off the main line. The rail spur provides access to freight rail shippers located in an industrial area adjacent to Miramar Road and is served by local freight trains from San Diego.

1.4 Current Rail Services

Three rail services operate on the San Diego Subdivision of the LOSSAN Rail Corridor in San Diego County: COASTER commuter trains, Pacific Surfliner intercity passenger trains, and BNSF freight trains. By 2035, the number of trains operating along the Corridor is expected to rise dramatically based on the current service plans of each operator. As a result, critical improvements are needed in areas that will benefit all users.

1.4.1 North County Transit District

NCTD operates COASTER commuter rail service daily between Oceanside and Downtown San Diego. Effective under its April 2023 schedule, COASTER service consists of 30 weekday trains (15 round trips) Monday through Thursday, 32 Friday trains (16 round trips), and 20 trains (10 round trips) on Saturday and Sunday. COASTER commuter trains serve eight stations, the Santa Fe Depot in downtown San Diego, Old Town San Diego, Sorrento Valley, Solana Beach, Encinitas, Carlsbad Poinsettia, Carlsbad Village, and Oceanside.

COASTER commuter trains comprise bilevel commuter coaches with a diesel locomotive at one end and a cab car at the other end for operation in push-pull mode, allowing for operation in either direction without the need for turning the train consist. Prior to 2020, COASTER trains had an average weekday ridership of approximately 4,900 people. SANDAG's 2021 Regional Plan projects the 2035 operating frequency of service at a peak of 20 minutes, with 60-minute off-peak for a majority of the service day (SANDAG 2021).

1.4.2 Pacific Surfliner

Pacific Surfliner trains provide regional intercity passenger rail service on the LOSSAN Corridor between San Diego, Los Angeles, and San Luis Obispo. The State of California provides the funding for the Pacific Surfliner service and coordinates with the LOSSAN Rail Corridor Agency, which is responsible for the planning and management of the service. Amtrak is the contracted operator of the Pacific Surfliner service, and trains use a mix of state-owned and Amtrak-owned equipment. Pacific Surfliner trains comprise bilevel intercity passenger cars, with a diesel locomotive at one end and a cab car at the other end for operation in push-pull mode.

As of its July 2023 schedule, Pacific Surfliner service consists of 20 trains (10 round trips) operating daily between San Diego and Los Angeles. Some trains to and from San Diego continue in operation north of Los Angeles to Goleta (3 trains daily in each direction) and San Luis Obispo (2 daily trains in each direction).

Before 2020, Pacific Surfliner had an average daily ridership of approximately 2,300 people in San Diego County. Major cities served are San Diego, Solana Beach, Oceanside, Santa Ana, Fullerton, Anaheim, Los Angeles, Santa Barbara, and San Luis Obispo. The Pacific Surfliner route is the second busiest intercity passenger rail corridor in the United States by ridership, eclipsed only by the Northeast Corridor linking Boston, New York, and Washington. In Fiscal Year 2019, more than 2.8 million people rode Pacific Surfliner trains.

LOSSAN plans to increase Pacific Surfliner service in San Diego County to 32 trains per day by 2025 and 36 trains per day by 2035.

1.4.3 BNSF Railway

BNSF operates freight rail service throughout the San Diego County portion of the LOSSAN Rail Corridor seven days per week. Typically, four to six freight trains per day are operated, consisting primarily of manifest trains carrying general merchandise and unit trains carrying finished vehicles. The LOSSAN Rail Corridor is the only domestic freight rail line to serve international goods movement at the Port of San Diego as well as across the border with Mexico, and the U.S. Department of Defense designated the corridor as part of the Strategic Rail Corridor Network of U.S. freight rail lines serving several military facilities in the San Diego Region.

BNSF transports an average of approximately 12,200 tons of freight daily through San Diego. Under the shared use agreement in place that governs operations on the San Diego Subdivision, freight train operations are not permitted during peak passenger travel periods between 5:30 a.m. and 8:30 a.m. and between 4:00 p.m. and 7:00 p.m. Most BNSF freight operations on the San Diego Subdivision occur during off-peak hours in the late evening and nighttime, although limited movements can take place during the midday off-peak hours. However, the current constrained railroad capacity affects BNSF's ability to conduct its goods movement services, particularly during midday and early evening off-peak hours when commuter and intercity passenger train operations are scheduled.

Demand for rail freight service in San Diego County is projected to double within the next decade and, as a result, BNSF Railway freight traffic is projected to increase to 11 trains per day by 2035 (SANDAG 2018).

1.5 Previous Studies

This section summarizes previous planning and environmental studies that have been undertaken to analyze the potential for realigning the San Diego Subdivision in the study area. Three studies are summarized. The Los Angeles-San Diego Final Program Environmental Impact Report/Environmental Impact Statement and Record of Decision published in 2007 records the decisions of the U.S. Department of Transportation (U.S. DOT) made for proposed improvements to the LOSSAN Rail Corridor between Los Angeles and San Diego, including two potential tunnel options in the study area, under the federal environmental review process at the initial programmatic phase of environmental review. The *Miramar Tunnel Feasibility Study for the LOSSAN Corridor* documents the prior analysis of engineering feasibility of a double-track tunnel bypassing Miramar Hill.

In addition, the *Sorrento to Miramar - Phase 2 Curve Realignment and Second Track Alternative Alignments Analysis* assessed options to improve the current rail corridor by closing the single-track gap between CP Scripps and CP Miramar and increasing speeds. While most alternatives follow the existing alignment around Miramar Hill, a tunnel adjacent to I-805 was also considered.

The *Project Report for I-5/Sorrento Valley Road Interchange Improvements* assessed options to reconfigure the roadway network in the vicinity of the existing Sorrento Valley Boulevard grade crossing, which would be grade separated or bypassed with the proposed Miramar Tunnel Project.

1.5.1 Los Angeles to San Diego Proposed Rail Corridor Improvements Program Environmental Impact Report/Environmental Impact Statement

In 2007, Caltrans and FRA released the Final Program Environmental Impact Report (EIR)/Environmental Impact Statement (EIS) for LOSSAN Rail Corridor Improvements, which was followed by a Record of Decision released by the U.S. DOT in 2009 (Caltrans 2007). The LOSSAN Program EIR/EIS provided the programmatic analysis and National Environmental Policy Act (NEPA) documentation under a tiered environmental review process that made initial decisions on a proposed suite of LOSSAN Rail Corridor infrastructure improvements between Los Angeles Union Station and San Diego to help meet existing transportation demands in the Southern California region resulting from a projected increase in population. The overall goal of the improvements proposed by the project is to improve travel mobility and reliability in Southern California by decreasing trip times and improving the LOSSAN Rail Corridor system in a cost-effective and environmentally sensitive manner.

The Draft Program EIR/EIS compared two alternatives: a No Project/No Action Alternative and a Rail Improvements Alternative that proposed a comprehensive range of alignment and station options in the corridor. After analysis and screening of the two alternatives, Caltrans and FRA completed a Final EIR/EIS that identified the Rail Improvements Alternative (Build Alternative) as the preferred alternative for the future development of the Los Angeles to San Diego portion of the LOSSAN Rail Corridor. U.S. DOT's Record of Decision affirmed the selection of the Rail Improvements Alternative recommended in the Final Program EIR/EIS and stated that a detailed project-level study, additional refinements of alignments and/or station locations, and further public and agency input would be needed to make decisions among the conceptual alignment options proposed in the Program EIR/EIS.

The Program EIR/EIS analyzed the general conceptual design of the proposed program and alternatives rather than providing detailed analysis of a specific project proposal. Caltrans established the following objectives for rail improvements proposed in the Program EIR/EIS:

- Increase the cost-effectiveness of state-supported intercity passenger rail systems by improving running times and reliability to attract additional ridership.
- Increase capacity on existing routes through more efficient, reliable operations.
- Reduce running times to attract additional riders and to provide a more attractive service.
- Improve the safety of state-supported intercity rail service through additional grade crossing improvements and grade separations.

Within the project's study area, the Program EIR/EIS carried forward two alternatives for consideration:

- **Miramar Hill Tunnel:** This alternative would relocate the San Diego Subdivision to a double-tracked alignment via a tunnel that would cut through Miramar Hill. This tunnel option would include a new underground station in UTC. This option was categorized as a "High-Build" Rail Alternative, meaning that it would involve more extensive infrastructure investment and construction complexity when compared with the other alternative carried forward.
- **Interstate I-5 Tunnel:** This alternative would relocate the San Diego Subdivision to a double-tracked alignment via a tunnel underneath I-5. No station would be included in this section with the I-5 tunnel option. This option was categorized as a "Low-Build" Rail Alternative, meaning that it would involve less infrastructure investment and construction complexity when compared with the other alternative carried forward.

1.5.2 Miramar Tunnel Feasibility Study for the LOSSAN Corridor

Caltrans released a study in 2020 that examined the feasibility of constructing a rail tunnel through Miramar Hill as part of a settlement agreement for a highway project in the area. Caltrans prepared the *Miramar Tunnel Feasibility Study for the LOSSAN Corridor,* which assessed the feasibility of a tunnel alignment bypassing Miramar Hill and providing a new station in UTC (Caltrans 2020). The assessment included analysis of engineering feasibility, rail operations, rail travel demand, and funding sources. The study concluded that the tunnel project would meet the four criteria for feasibility listed in the Settlement Agreement:

- Increase discretionary rail ridership;
- Provide competitive travel times;
- Be cost competitive with automobiles; and
- Have no fatal engineering flaws.

The study assessed three conceptual double-track tunnel alignment alternatives between MP 249 and MP 257 that connected with the UTC Transit Center along Genesee Avenue, with speeds of either 70 miles per hour or 90 miles per hour. The 70 miles per hour option was determined to allow the alignment to follow Genesee Avenue more closely and reduce the amount of ROW and environmental impacts. The travel time savings of the 70 miles per hour tunnel option for commuter trains was estimated to be 7.5 minutes in the northbound direction and 6.3 minutes southbound. Initially, an alternative that followed I-5 also was considered, with potentially lower cost and faster travel time, but this concept was rejected since it was outside of the scope of this feasibility study for failing to provide a station at UTC.

Based on unit costs from similar tunnel projects, the study included a rough order of magnitude cost estimate of $1.9 to $2.1 billion.

1.5.3 Sorrento to Miramar Curve Realignment and Second Track Alternatives Analysis

Completed by SANDAG in 2010, the *Sorrento to Miramar - Phase 2 Curve Realignment and Second Track Alternative Alignments Analysis Report* documents the evaluation of potential double-track alignment alternatives between CP Scripps, MP 251, and CP Miramar, MP 253 (SANDAG 2010), including improvements to the existing rail alignment that could be built in the near term. The project would achieve the following objectives:

- Improve rail operations (especially horizontal curve "straightening");
- Improve rail reliability (especially horizontal curve "straightening");
- Improve passenger train speed;
- Increase passenger and freight rail capacity; and
- Increase maintenance flexibility and access.

Alignment alternatives considered included six double-track alternatives that largely follow the existing ROW around Miramar Hill, with deviations to straighten curves. In addition, an alternative bypassing Miramar Hill via a tunnel on the west side of I-805 was considered. Lastly, a single-track alignment with curve straightening was also considered.

Alternatives were evaluated based on the comparison of operational impacts, construction cost, construction access and construction phasing, ROW acquisition, and environmental impact considerations. Two of the double-track alignments around Miramar Hill were recommended to be carried forward in a Draft EIR. The bypass tunnel was found to reduce impacts to the sensitive Soledad Canyon, enable higher speeds, and achieve further travel time savings from the shorter alignment; however, the estimated cost of $1.13 billion was an order of magnitude greater than the other alternatives. An alternative adjacent to I-805 was not included in the present study, because it would not provide a station connection to the Blue Line Trolley in the central area of UTC and would not achieve the reductions in alignment length and resulting travel time savings of the other alternatives.

If funded, the Sorrento to Miramar Phase 2 (SM2) Project would increase capacity by addressing the single-track bottleneck in the area and would provide modest speed increases (up to 40 miles per hour) on the existing alignment. The *Sorrento-Miramar Double Track – Phase 2: Stability Analysis of Existing Slopes Report* (AECOM 2020) developed under the SM2 Project found that the existing track poses a risk to safety and reliability of rail operations due to erosion and instability of the track bed and slopes between CP Scripps to CP Miramar, which would be addressed by the SM2 Project. The SM2 Project would provide substantial benefits that could be implemented both in the near term for all train service prior to construction of the Miramar Tunnel in 2050, and in the long term with freight remaining on Miramar Hill. In contrast, the present study, SD-LOSSAN, seeks to improve regional mobility by providing a station location closer to a major employment and high-residential area in addition to achieving large time savings from higher-speed operation (up to 110 miles per hour) on a significantly shorter alignment, thereby providing travel times that are competitive with automobiles.

1.5.4 Project Report for I-5/Sorrento Valley Road Interchange Improvements

The City of San Diego released this project report in 2015 to recommend alternatives for a reconstruction of the I-5/Sorrento Valley Road Interchange that would alleviate traffic congestion and facilitate transit operations in the vicinity of Sorrento Valley Road, Sorrento Valley Boulevard, Vista Sorrento Parkway, and Roselle Street (AECOM 2015). The limits of the project area contain the LOSSAN corridor rail line beginning at the I-805 overpass and extending northward to the north end of the Sorrento Valley Station. The purpose of the project report was to recommend alternatives for a rebuilt highway interchange that would minimize roadway traffic congestion and air pollution emissions; reduce conflicts between rail and vehicular traffic; and provide compatibility with planned and funded multimodal transportation improvement projects in the area. Several secondary project purposes were identified, including preserving or improving rail operations and ensuring that the project would not preclude future double-tracking of the LOSSAN Rail Corridor in the study area limits.

The study began with 12 alternatives developed in previous planning efforts. Alternatives were evaluated based on estimated congestion relief, roadway traffic impacts, community impacts, cost, construction feasibility, ability to facilitate and improve transit access, and other factors. During the alternatives evaluation process, the City, Caltrans, SANDAG, and MTS agreed that a complete grade separation of the rail crossing at Sorrento Valley Boulevard should be a required element of the project and the foundation for any alternative selected. After reviewing the alternatives, the project team selected one alternative with two options to carry forward for future study. This alternative proposed to raise the rail line on an elevation with a bridge that would cross above Sorrento Valley Boulevard, eliminating the at-grade rail crossing, and relocate Sorrento Valley Boulevard to the south to allow for construction of the railway overpass while the existing road is still in service.

To construct the grade separation, the rail line would have to be elevated at the site of the existing Sorrento Valley Station. As a result, the recommended alternative proposes relocating the Sorrento Valley Station to one of two alternate locations. One site identified for a new station is located 1 mile north of the existing Sorrento Valley Boulevard rail crossing, south of the intersection of Carmel Mountain Road and Sorrento Valley Road (Alternative 1A). The other proposed station site is 1 mile south of the existing station along a small industrial park south of Sorrento Valley Road and west of the I-805 southbound on- and off-ramps at Sorrento Valley Road/Mira Mesa Boulevard (Alternative 1B). The report recommended that SANDAG and NCTD conduct further studies on the proposed alternate station sites to reach a consensus on a preferred station location.

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2 Purpose and Need

SANDAG's 2021 Regional Plan establishes three goals for the region:

- The efficient movement of people and goods;
- Access to affordable, reliable, and safe mobility options; and
- Healthier air and reduced greenhouse gas emissions.

To meet these goals, SANDAG introduced a transformative vision for transportation in San Diego County that completely reimagines how people and goods could move throughout the region in the 21st century. This vision is fundamentally shaped by five key strategies for mobility, collectively known as the 5 Big Moves: complete corridors, transit leap, mobility hubs, flexible fleets, and the next operating system. The commuter rail services utilizing the LOSSAN Rail Corridor fall under the Transit Leap Big Move. Commuter rail is envisioned to operate at speeds up to 110 miles per hour under the Transit Leap vision and as evaluated in the July 7, 2021, Operational Feasibility Study prepared for the LOSSAN Rail Corridor in the San Diego region. The purpose of this project is to assist the region in meeting these goals and objectives by providing a long-term solution to the slow passenger train speeds on the LOSSAN Rail Corridor Miramar Hill Segment and the overall economic and environmental health of the San Diego region. The 351-mile LOSSAN Rail Corridor serves as a crucial link for passenger and freight movements in San Diego County. It is the economic lifeline for the San Diego region and serves as the only viable freight rail link for national and international commerce, carrying about $1 billion worth of goods annually. The LOSSAN Rail Corridor is also the second busiest intercity passenger rail line in the U.S., moving nearly 8 million passengers per year. Additionally, as part of Strategic Rail Corridor Network, the corridor also plays a vital role in our nation's defense by providing rail access to key military bases throughout San Diego County. Allowing passenger train service to bypass the Miramar Hill via tunnel supports the regional plan goals by enhancing safety, reducing travel times, and reducing vehicle miles traveled, which translates into reduced greenhouse gas emissions.

Both freight and passenger rail traffic are expected to grow significantly in the coming years. SANDAG, NCTD, the LOSSAN Rail Corridor Agency, Amtrak, and BNSF have identified the need to increase the efficiency of the LOSSAN Rail Corridor, not only to better accommodate existing train volumes but also to provide capacity to accommodate future demand for rail services. This project directly supports that goal.

Currently, Miramar Hill has the steepest grade and the sharpest curves in the region, resulting in the slowest segment of the LOSSAN rail line south of Los Angeles. Construction of the Sorrento to Miramar Double Track Phase 2 Project will increase passenger train speeds from 25 to 40 miles per hour, increase capacity, and mitigate the risk of slope erosion and seismic instability. Combined with the length of the circuitous route around Miramar Hill, these slow speeds result in long travel times for passenger trains. Reducing travel time is necessary to improve competitiveness with automobile travel and achieve mode shifts that support SANDAG's greenhouse gas reduction and air quality goals.

Furthermore, the project would serve a new station location in one of the region's main commercial centers providing more convenient access to jobs in the UTC area and a connection to the Blue Line Trolley, which extends up to the UTC area from Old Town San Diego where it connects to other trolley lines serving Downtown San Diego, Mission Valley, East County, South County, and the International Border.

Thus, SANDAG identifies the following specific objectives that apply to the Miramar Tunnel Project:

- Encourage rail ridership on the LOSSAN Rail Corridor to reduce vehicle miles traveled and associated greenhouse gas emissions by providing a double-track alignment with a significantly reduced length and eliminating sharp curves to improve rail service, provide more competitive travel times, enable greater frequency of trains, and allow operation at up to 110 miles per hour.
- Provide a station with convenient access to jobs in the UTC area and connections to the Blue Line Trolley.
- Support long-term resiliency by raising the tracks above the 100-year floodplain in Sorrento Valley.
- Promote safety by eliminating the existing at-grade crossing at Sorrento Valley Boulevard through grade separation or moving away from the area entirely.

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3 Alternatives Analysis

This section presents the design standards and assumptions, the criteria used to evaluate the conceptual alternatives, and high-level evaluation of two conceptual tunnel alternatives.

3.1 Design Standards and Assumptions

3.1.1 Train Operations in the Tunnel

The existing LOSSAN Rail Corridor is shared between passenger and freight operations. Both shared and passenger only operations for the tunnel were considered to determine design requirements. Constructing the tunnel to allow freight operations could provide benefits to goods movement by reducing travel time. It would, however, also present significant design challenges. A shared tunnel would not fully replace freight operations on the existing alignment, because access would need to be maintained to Marine Corps Air Station Miramar and other customers via the Miramar Wye. A shared tunnel could reduce the amount of freight traffic on Miramar Hill to only the trains needing to access the wye. This would have the potential to require less infrastructure maintenance and provide opportunities for a reduction in infrastructure needs on the hill.

While there are examples of freight trains passing through tunnels, no known tunnel in the world has freight trains passing through an active passenger station, and this would create potential for risk to passenger safety. Additionally, the noise and vibration of a freight train passing at speeds up to 60 miles per hour would create an intolerable environment for passengers in an underground station. Therefore, a shared tunnel through an active passenger station would require passengers in the station to be isolated as freight trains pass by. Due to the mix of passenger equipment with different door spacing, platform screen doors that separate passengers waiting on platforms from the tracks are not an option. Additionally, platform screen doors would not sufficiently address potential emergency scenarios with freight trains.

Therefore, a concourse tunnel between the two rail tunnels would be needed to provide a separate underground space for passengers to wait while several thousand-foot-long freight trains pass through the station. Passengers would remain in the concourse tunnel between the two rail tunnels while the freight train passes through the underground station. The need for a concourse tunnel would result in a significantly larger station footprint, significantly greater cost, and reduced flexibility in locating entrance shafts for vertical circulation. Twenty-four-hour security would also be required to ensure passengers vacate the platform area when freight passes through, and the separation of the platforms from the passenger concourse would degrade the passenger experience.

A passenger-only tunnel would allow for a smaller footprint and greater design flexibility. Multiple station and tunnel configurations would be possible using either single or twin bore. Additional track alignment and profile flexibility would allow higher speeds in the tunnel with sharper radii, shorter vertical curve lengths, and steeper grades. The shorter vertical curve lengths and steeper grades would allow for a shallower station by approximately 40 feet compared to the shared tunnel. There would be greater flexibility in locating vertical circulation and reduced complexity in fire/life safety and ventilation requirements. A separate passenger concourse in a center tunnel would not be needed, and tunnel diameters, track centers, and cover above tunnel boring machine (TBM) launch and retrieval locations could be reduced, resulting in smaller footprints for the station and tunnel portals resulting in a significant reduction in construction costs.

There are multiple station configurations that could be used with a passenger-only station. Using a single-bore tunnel, the station could be configured with adjacent tracks with platforms on each side, a single center platform with tracks on each side, or two levels with a track and side platform stacked within the tunnel. Using twin-bore tunnels, the station could be configured with side platforms in two Sequential Excavation Method (SEM) caverns, a center platform in a single SEM cavern, or either platform configuration in a cut-and-cover station; although full cut-and-cover construction is not considered viable at either station location.

The opportunities and challenges were presented to the PDT for a shared tunnel with an underground station versus a passenger-only tunnel with all freight operations remaining on the hill. The team recommended evaluating alternatives with a passenger-only tunnel, and the PDT concurred. A subsequent meeting was held with BNSF and NCTD to further discuss a passenger-only concept, and BNSF took no exception noting that combining freight and passenger trains in a station is not desirable. NCTD noted that a shared tunnel should not be screened out at this early phase and should be studied in the future phases. For the purposes of this planning study, the subsequent sections of this study assume a passenger-only twin-bore configuration for the running tunnels and dual SEM caverns with side platforms are assumed for the station; however, no decision has been made on the selection of the proposed project or the project alternatives that would be carried forward in the environmental review phase. A detailed station configuration analysis should be considered in a future phase to determine the optimal station configuration for the project.

3.1.2 Additional Design Standards and Assumptions

The conceptual designs for each alternative were developed using the following standards:

- Basis of Design Report for Track, Grade Crossings and Signals in FRA Class 6 (HDR 2023).
- Basis of Design Report for Tunneling (HDR 2023).
- Basis of Design Report for Noise and Vibration (HDR 2023).
- LOSSAN Design Criteria Manual Volume III, Draft 4 (July 2017).
- LOSSAN Engineering Standard Drawings (April 2023).

Table 3-1 summarizes the design criteria and key assumptions most relevant to the development and evaluation of the alternatives.

Table 3-1. Key Design Criteria and Assumptions

Design Criteria/ Assumption	Description
Design speed	Passenger: Maximum 110 miles per hour. Freight: Maximum 60 miles per hour.
Track spacing	Minimum 15--foot track centers on tangent outside of tunnels. Minimum 50--foot track centers inside bored running tunnels. Minimum 85-foot track centers within underground station limits.
Horizontal alignment	Horizontal curves shall be designed to accommodate the maximum design speeds where possible.
Vertical profile	Grades shall not exceed 2 percent compensated for mixed passenger/freight train operations. Grades shall not exceed 3 percent compensated for passenger train operations. Sags within tunnels and associated approach structures shall be avoided where possible.
Tunnel clearance	23-foot internal tunnel diameter to accommodate the passenger train dynamic envelopes, anticipated tunnel equipment[a] and emergency walkway.
Grade crossings	All roadway crossings within project limits shall be grade separated.
Tunnel boring	Bored tunnel shall be located such that at least a tunnel diameter of ground cover is provided above.[b] At brief ground cover low points such as drainage channels or trails, the ground cover may be reduced to 75 percent of a tunnel diameter of ground cover.
Fire/life safety	Emergency ventilation shall be provided by ventilation facilities at either end of the tunnel and at the station. Cross passages shall be provided at no more than 800-foot intervals. Evacuation walkways shall be provided per National Fire Protection Association 130. Buildings shall be located at each portal to house emergency ventilation fans and other fire/life safety equipment. Maintenance storage, staging, and office facilities shall also be located within these buildings. Systems supported by rooms within the buildings shall be: • Emergency ventilation system, including fans, dampers, sound attenuators, ducts, and shafts. • Normal power and emergency power, including substations, transformers, and switchgear. • Emergency management panels (fire command center). • Hydrant and fire department connections at grade. • Standpipe systems and hose valves. • Gas suppression in select areas/rooms. • Egress stairs. • Emergency lighting and its uninterrupted power supply. • Communications systems rooms. • Heating, ventilation, and air conditioning rooms. • Train control room.
Track subgrade elevation within sea level rise estimated area of influence	Above FEMA 100-year base flood elevation + 7.1-foot sea level rise within Los Peñasquitos Lagoon.[c]

[a] Dynamic envelopes were requested but not available for the current bi-level fleet; therefore, dynamic envelopes for the Rotem cars currently used by Metrolink and the PRIIA 305-001 bi-level outline were used, which are similar in size.

[b] This assumption should be revisited once further geotechnical investigations are carried out in conjunction with more detailed engineering analysis relating to tunneling induced ground movements and potential ground improvement strategies.

[c] Based on 2018 CCC Sea Level Rise Policy Guidance. Refer to 0, Preliminary Drainage Report, for additional information regarding sea level rise assumptions.

CCC=California Coastal Commission; FEMA=Federal Emergency Management Agency; LOSSAN=Los Angeles-San Diego-San Luis Obispo; NCTD=North County Transit District

3.2 Development of Evaluation Criteria

A workshop was conducted with the PDT to develop criteria used to evaluate the conceptual alternatives. At the workshop, potential criteria was presented to the PDT. Representatives from SANDAG, NCTD, MTS, LOSSAN, SCRRA, Caltrans, FRA and BNSF attended the workshop. As a group, the PDT reviewed and revised the criteria and selected a total of 11 criteria to use in evaluating the conceptual alternatives. Due to the conceptual nature of the comparative analysis, some data could only be quantified at a high level while others were more qualitative and subjective in nature and are based on the analysis and judgment of the PDT and subject matter experts (i.e., rail planners and engineers, structural engineers, environmental planners, rail operations and maintenance analysts, and public relations specialists).

Table 3-2 provides a summary of the planning-level evaluation criteria and how the criteria were applied to the conceptual alternatives.

Table 3-2. Evaluation Criteria

Evaluation Criteria	Description	Evaluation Method
Travel time	Minimizes overall travel times through considerations of proposed alignment geometry, grades, tie-ins, and stations.	Based on travel times generated by high-level rail operations modeling in Variato within the project limits.
Potential environmental consequences	Minimizes impacts and maximizes benefits on environmentally sensitive areas, mitigation requirements, permitting schedule, and reduction in greenhouse gases.	Qualitative analysis based on stakeholders' prior experience of other rail projects in San Diego County and evaluating environmental consequences comparatively to other alternatives including considerations for wetlands, cultural, biological, and water resources impacts.
Potential ROW impacts (Each of the proposed conceptual alternative alignments extends outside of the existing railroad ROW; thus, property rights outside of the existing railroad ROW could be required, including temporary construction/access easements, permanent subsurface tunnel easements, and permanent property interests at the portal locations. The ROW needs for the Project depend on the selected alignment and portal locations and will be further refined and examined in the environmental and design phases of the Project.)	Minimizes temporary and permanent impacts on public and private properties, acquisition costs, and schedule.	Quantitative and qualitative analysis based on a preliminary analysis of potential impacts on private properties along the alternative alignments, particularly with respect to private residences. Potential impacts on private properties along the proposed alignment alternatives and at the portals will be further examined during the environmental review phase.
Constructability, construction impacts, and duration	Minimizes construction complexity, including geotechnical aspects, tunnel depths, tunneling technologies, and schedule. Limits construction impacts on the public, including on local roads, utilities, traffic, and material hauling.	Qualitative analysis based on PDT and technical stakeholder's prior experience on similar projects and a comparison of the various potential impacts listed in the description.

Evaluation Criteria	Description	Evaluation Method
Other community impacts	Minimizes impacts on the community.	Qualitative analysis based on PDT knowledge of how each conceptual alternative may affect the community, including potential noise and vibration, and visual impacts.
Connectivity and travel demand	Provides connectivity and access to future mobility hubs like University Town Center and includes the potential to connect with other transit services like higher-speed rail.	Qualitative analysis based on comparing potential connections to future mobility hubs and transit modes identified in the 2021 Regional Plan (e.g., connecting to the Branch Line).
Safety improvements	Provides safety improvements, such as elimination of grade crossings.	Qualitative analysis based on a comparison of the safety improvements made to each alternative, like the elimination of the Sorrento Valley Boulevard at-grade crossing and the perceived risk of flooding.
Construction costs	Minimizes construction costs.	Construction estimate based on high-level costs primarily generated from historical cost information, Caltrans, and FTA.
Railroad operation impacts (during construction)	Minimizes impacts on existing railroad operations during construction.	Qualitative analysis based on technical stakeholders' review of potential phasing sequences and comparison of railroad operations impacts on other alternatives.
Operational complexity (post-construction)	Minimizes complexity of requirements for operations and maintenance of a tunnel, including ventilation system and maintenance access.	Qualitative analysis based on technical stakeholders' prior experience of other rail tunnel projects and comparing to other alternatives.
Operation and maintenance costs	Minimizes costs related to the operation and maintenance within the project limits.	Qualitative analysis based on technical stakeholders' prior experience of other rail projects comparing to other alternatives taking into consideration the need for bridges within saltwater lagoons, elevated structures, and sump pumps. Operation and Maintenance costs within tunnels are assumed to be generally the same.

FTA=Federal Transit Administration; PDT=Project Development Team; ROW=right of way

3.3 Design Alternatives

The Miramar Tunnel Feasibility Study developed for Caltrans (Caltrans 2020) considered a range of conceptual alignments developed for both 70 miles per hour and 90 miles per hour passenger design speeds. Since the scope of the study was to provide a station at UTC, the study area was limited to alignments along Genesee Avenue. An alternative that followed I-5 was presented as an option but was ultimately rejected as it was outside the scope of the feasibility study for failing to provide a station at UTC. This alternatives analysis is not bound by the same constraints and, therefore, all alternatives were considered. This alternatives analysis also considers the new information obtained from the operational feasibility study described in Section 3.3.1 and the FRA Class 6 basis of design criteria required of each proposed alternative. A description of each conceptual alternative alignment is provided below.

3.3.1 University Town Center

2020 Feasibility Study Evaluation

A tunnel alternative that provided a station connection in UTC was initially introduced in the 2007 LOSSAN EIR/EIS described in Section 1.5.1. Subsequently, the 2020 *Miramar Tunnel Feasibility Study for the LOSSAN Corridor* developed by Caltrans looked at a range of alignments along Genesee Avenue developed for 70 miles per hour and 90 miles per hour passenger design speeds. The study area began in Sorrento Valley north of the I-5 overpass, tunneled under Genesee Avenue providing an underground station near the UTC Trolley Station, and daylighted within Rose Canyon.

Proposed Refinements

As part of this study, the following changes to the conceptual alignment were evaluated:

- Flatten curves to increase passenger design speed to a maximum of 110 miles per hour;
- Raise the trackway on aerial structure over a relocated Sorrento Valley Boulevard; and
- Minimize potential impacts to residential properties near the south portal by lowering the track profile.

Revised Alignment Description

The UTC conceptual alignment, see Figure 3-1, would extend a total of 5.2 miles from the northern end of Sorrento Valley near Carmel Mountain Road to Rose Canyon near Regents Road. Starting at the north end near CP Torrey, the double-track alignment could either tie into the existing alignment or the SDSVDT alternative alignment concepts being developed under a separate project. Starting at the tie-in at the north, the track profile is raised to meet the 100-year flood criterion and 7.1 feet of sea level rise until about MP 248, where it is anticipated sea level rise would no longer have an influence on the water surface elevation. After that point, the track profile is only required to meet the 100-year flood criterion. After Bridge 248.7, which would be raised in place to meet the 100-year flood criterion, the tracks begin to rise on retained fill under the I-5 overpass. The alignment then transitions to an aerial structure to provide a grade separation at a relocated Sorrento Valley Boulevard. The alignment then transitions back to a retained fill segment where the freight track would diverge from the mainline and transition down back into the existing alignment before Bridge 249.9. The UTC alignment then transitions back to an aerial structure and continues its ascent at a 2.45 percent grade and leaves the railroad ROW into a cut-and-cover box that transitions to the tunnel portal near the south end of Roselle Street. The cut-and-cover box transitions into a bored tunnel segment that would be approximately 2.3 miles long and follow adjacent to Genesee Avenue at depths of up to 150 feet below existing ground to top of tunnel. A new underground station would be located near the intersection of Genesee Avenue and La Jolla Village Drive in UTC. Following the station, the bored tunnel transitions back through a cut-and-cover box section, then a U-structure would transition up to grade where the alignment reenters the existing ROW in Rose Canyon and merges with the freight alignment.

Figure 3-1. UTC Alignment

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Key Alternative Features

- Would impact existing Sorrento Valley Station. Proposed temporary station should be considered and location further evaluated in a future phase.
- Would require relocation of Sorrento Valley Boulevard to the north and grade separation of the existing at-grade crossing.
- The track centers would transition from 15 feet through Sorrento Valley to 50 in the tunnel, to 85 feet in the station, then back to 15 feet through Rose Canyon.
- The No. 24 universal crossover at CP Rose would be removed and relocated to the south and new No. 24 universal crossovers would be installed within Sorrento Valley, north of Sorrento Valley Boulevard.
- The UTC conceptual alignment results in a reduction of 3.6 miles of total length from the existing alignment through Miramar Hill.

Proposed Operations

Maximum speeds of 110 miles per hour for passenger trains could be maintained throughout the UTC conceptual alignment except for the curve south of UTC station, where maximum passenger train speed is limited to 100 miles per hour in order to avoid the Blue Line Trolley aerial structure cast-in-drilled-hole piles below Genesee Avenue. The maximum horizontal degree of curvature used is approximately 1 degree, 24 minutes, with 5 inches of superelevation. The minimum slope used would be 0.5 percent in the tunnel to allow for positive drainage. The maximum slope leading into the north portal would be 2.45 percent to keep the station depth as shallow as possible. Freight would continue operating on Miramar Hill. A short section of single track before and after the tunnel would be required to diverge from the tunnel alignment before splitting back to two tracks.

For purposes of this study, it is assumed both COASTER and Pacific Surfliner trains would serve the new station at UTC. To accommodate construction, the existing Sorrento Valley Station would need to be removed from service. This alternative does not preclude a station in the Sorrento Valley area and further studies should be conducted to locate a preferred temporary station to maintain service to the area.

3.3.2 Nobel

The 2007 LOSSAN EIR/EIS included a double-tracked alignment via a tunnel underneath I-5. This alternative was rejected as part of the 2020 *Miramar Tunnel Feasibility Study* as it did not provide a connection in UTC.. The Nobel alternative was developed as a similar concept to the I-5 alignment as it provides further reductions in distance and travel times through this segment of the corridor while also providing a connection to UTC via a transfer point to the Trolley at Nobel Drive Station. Additional details are provided below.

Alignment Description

The Nobel alternative alignment, see Figure 3-2, would extend a total of 5.1 miles from the southern end of Los Peñasquitos Lagoon to Rose Canyon near Gilman Drive. Starting at the north end near CP Torrey, the double-track alignment can either tie into the existing alignment or the SDSVDT alternative alignment concepts being developed under a separate project. Starting at the tie-in at the north, freight operations would continue within the existing ROW along the existing alignment, while the UTC alignment leaves the ROW on a bridge structure over Los Peñasquitos Creek. The track profile is raised to meet the 100-year flood criterion and 7.1 feet of sea level rise until about MP 248, where it is anticipated sea level rise would no longer have an influence on the water surface elevation. After that point, the track profile is only required to meet the 100-year flood criterion. The alignment then transitions to an at-grade section before it enters into a cut-and-cover box that transitions to the tunnel portal near Flintkote Avenue and Tower Road. The bored tunnel segment would be approximately 3.4 miles long and continue on the west side I-5 before crossing to the east of I-5 after the Nobel Drive station. The tunnel depths are up to 230 feet below existing ground to top of tunnel. An underground station would be located near Nobel Drive to provide a connection to the Nobel Drive Trolley station. The bored tunnel transitions back through a long cut-and-cover box section under La Jolla Colony Drive, then a U-structure would transition up to grade where the alignment reenters the existing ROW in Rose Canyon near Gilman Drive.

Key Alignment Features

- The track centers transition from 15 feet at the north end of Sorrento Valley to 50 feet in the tunnel, to 85 feet through the station, then back to 15 feet in Rose Canyon.
- Single No. 20 crossovers would be installed north and south of the tunnel portals.
- The Nobel alignment results in a reduction of 4.5 miles of total length from the existing alignment through Miramar Hill.

Proposed Operations

Maximum speeds of 110 miles per hour for passenger trains could be maintained throughout the Nobel conceptual alignment except through the curve under I-5 and La Jolla Colony Drive, where maximum passenger train speed is limited to 75 miles per hour in order to avoid impacts to private property at the south portal. The maximum horizontal degree of curvature used is approximately 1 degree, 35 minutes, with 2¾ inches of superelevation. The minimum slope used would be 0.3 percent in the tunnel to allow for positive drainage. The maximum slope would be 1.84 percent.

For purposes of this study, it is assumed both COASTER and Pacific Surfliner trains would serve the new station at Nobel Drive. It is assumed that COASTER service to Sorrento Valley would be discontinued following implementation of this project due to the proposed alignment. However, while the new alignment would no longer pass through the existing station site, this alternative does not preclude construction of a new station farther north to continue serving the Sorrento Valley area. The existing station would continue to be served through the construction period, until the cutover to the new alignment.

Figure 3-2. Nobel Alignment

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3.3.3 Alternative Considered but Not Studied Further

Another alternative that was considered was a tunnel adjacent to I-5 first introduced in the 2007 LOSSAN EIR/EIS. The 2020 Miramar Tunnel Feasibility Study did not evaluate this as an alternative as it did not meet the objective of providing a connection to UTC. This I-5 alignment would have followed the existing ROW on a similar alignment to the existing tracks until just north of the I-5 local bypass. The alignment would then curve to the west across Roselle Street and go under the I-5 southbound on-ramp where the railway would parallel the freeway on the west side and ultimately tie back into the existing ROW in Rose Canyon near Gilman Drive. This alternative was not included in the ranking process due to impacts to the I-5 southbound on-ramp, impacts to the regulatory floodway, and it would be adjacent to the DIII-D National Fusion Facility, a sensitive receptor.

3.4 Evaluation of Alternatives

This section presents the evaluation of the two conceptual alternatives—UTC and Nobel—using the criteria described in Section 3.2.

3.4.1 Travel Time

Both the UTC and Nobel alternatives provide travel time savings by shortening the alignment and increasing maximum operating speeds. Travel times were estimated for all-stop and limited stop services using either current diesel locomotives or potential future zero-emission multiple units (ZEMUs), which provide faster acceleration. Depending on stopping pattern and vehicle technology, savings range from 5.6 to 9.2 minutes for the UTC conceptual alternative (Table 3-3) and 6.4 to 9.9 minutes for the Nobel conceptual alternative (Table 3-4). Because of its shorter length and flatter curve entering Rose Canyon, the Nobel conceptual alternative achieves additional time savings, but the difference is less than a minute. Travel time savings for limited stop service are less than all-stop service because trains are assumed to stop at the new UTC or Nobel Drive station, whereas the Pacific Surfliner does not currently stop at Sorrento Valley.

Table 3-3. University Town Center Alignment Travel Time Savings

Service Scenarios	Configuration	Travel Time Solana Beach to Old Town (Minutes)	Travel Time Savings Against Baseline Alignment (Minutes)
All Stop (COASTER)	Baseline Alignment [a] Charger + 6 Coaches	24.4	—
	Proposed Alignment [a] Charger + 6 Coaches	17.3	7.1
	Proposed Alignment [a] ZEMU	15.2	9.2
Limited Stop (Amtrak Surfliner)	Baseline Alignment [a] Charger + 7 Coaches	23	—
	Proposed Alignment [a] Charger + 7 Coaches	17.4[b]	5.6
	Proposed Alignment [a] ZEMU	15.2	7.8

Service Scenarios	Configuration	Travel Time Solana Beach to Old Town (Minutes)	Travel Time Savings Against Baseline Alignment (Minutes)

[a] Baseline and Proposed alignment assumes the SDSVDT Project is complete. They do not include the curve straightening projects included in the *LOSSAN Corridor Higher Speed Technical Evaluation Report* (HDR 2023).

[b] Travel times for limited stop service with diesel locomotive hauled coaches are longer between the specified project limits as the trains stop at the new UTC station and take longer to accelerate due to the Pacific Surfliner trainsets using a heavier model of coaches and a larger number of them; however, with ZEMU technology, train length does not impair acceleration because all cars have their own propulsion.

ZEMU=zero emission multiple unit

Table 3-4. Nobel Alignment Travel Time Savings

Service Scenarios	Configuration	Travel Time Solana Beach to Old Town (Minutes)	Travel Time Savings Against Baseline Alignment (Minutes)
All Stop (COASTER)	Baseline Alignment Charger + 6 Coaches	24.4	—
	Proposed Alignment Charger + 6 Coaches	16.5	7.9
	Proposed Alignment ZEMU	14.5	9.9
Limited Stop (Amtrak Surfliner)	Baseline Alignment Charger + 7 Coaches	23	—
	Proposed Alignment Charger + 7 Coaches	16.6 [b]	6.4
	Proposed Alignment ZEMU	14.5	8.5

[a] Baseline and Proposed alignment assumes the SDSVDT Project is complete. They do not include the curve straightening projects included in the LOSSAN Corridor Higher Speed Technical Evaluation Report (HDR 2023).

[b] Travel times for limited stop service with diesel locomotive hauled coaches are longer between the specified project limits as the trains stop at the new Nobel Drive station and take longer to accelerate due to the Pacific Surfliner trainsets using a heavier model of coaches and a larger number of them; however, with ZEMU technology, train length does not impair acceleration because all cars have their own propulsion.

ZEMU=zero emission multiple unit

3.4.2 Potential Environmental Consequences

Both the UTC and Nobel conceptual alternatives were overlayed onto mapping available on the SanGIS website related to several environmental subjects. The conceptual alternatives were compared against the California Natural Diversity Database for federal and state listed species, coastal zone, environmentally sensitive areas, national wetland inventory, City of San Diego Multi Habitat Planning Area, and Federal Emergency Management Agency (FEMA) flood mapping to determine potential environmental impacts. Overall, the UTC conceptual alignment appeared to have a potentially larger environmental impact. Additionally, based on information collected from a previous LOSSAN double-tracking project, the northern portion of the UTC conceptual alignment has the potential for impacts to the National Register of Historic Places Listed Native Village of Ystagua.

3.4.3 Potential ROW Impacts

Both UTC and Nobel conceptual alternatives could require subsurface easements for the tunnel segments of the conceptual alignments. Both Nobel and UTC would potentially pass under a mix of city and state-owned property as well as private property. More subsurface easements under residential property could potentially be required for the UTC alternative than Nobel alternative. The Nobel alignment would cross under the I-5 freeway at an oblique angle immediately after entering the tunnel from the south portal. Obtaining an encroachment permit from Caltrans may not be possible. Property interests for both conceptual alignments outside of the existing ROW could be required, particularly at the north and south portal and station locations.

3.4.4 Constructability, Construction Impacts and Duration

Construction Impacts

The UTC conceptual alternative would require either the temporary relocation of Sorrento Valley Station to the north near CP Torrey or a complete closure during construction, which would be disruptive to COASTER passengers. Since the Nobel conceptual alternative diverges from the existing alignment at the northern tie-in, there would be minimal impacts to Sorrento Valley and the station could remain in operation during construction.

Bridge Structures

The UTC conceptual alternative would require construction of long and very tall retaining walls and aerial structures adjacent to operating track. Due to the inconsistent location of the I-5 flyover column locations, while also being constrained by Sorrento Valley Road to the east and Los Peñasquitos Creek to the west, there is very limited footprint for construction of the proposed structures while also maintaining double-tracked operations. It is possible train operations would need to operate on a single track through this area while the walls and bridge are constructed. A thorough constructability review should be conducted of this area in the next phase. The Nobel conceptual alternative would also have a long bridge structure that crosses over Los Peñasquitos Creek at the north end of the alignment.

Local Roads

The UTC conceptual alternative would require the relocation of Sorrento Valley Boulevard to the south to provide enough clearance below the proposed tracks, which would be grade separated above the roadway while also providing enough clearance above the tracks to the soffit of the I-5 freeway overpass just to the north. As such, traffic in the area would be impacted temporarily in the transition between the existing Sorrento Valley Boulevard location and the new location. The Nobel conceptual alternative would require crossing an existing private access road, which is a continuation of Flintkote Avenue and leads to a grouping of existing buildings located within the State Torrey Pines Preserve. Maintaining access to the private road would need to be studied further in future phases. Lastly, the Nobel conceptual alternative would pass under La Jolla Colony Drive. Temporary shoring and decking would need to be constructed to maintain access during construction and therefore temporarily impacting traffic while the shoring is put in place.

Tunneling

Both Nobel and UTC conceptual alignment alternatives would utilize the same TBM technology (pressurized face TBM). The alignments also cross through similar geological formations, comprising sandstones, siltstones and claystones overlain by superficial alluvial deposits.

The UTC conceptual alignment alternative would involve an added level of complexity due to the proximity of the Blue Line Trolley aerial structure along Genesee Avenue. Furthermore, the transition from tunnel to aerial structure at the north portal (345+00) would require extensive temporary work comprising platforms and ramps to allow the TBM to be transported to grade.

Following the launch of the TBM for the Nobel conceptual alignment alternative, the TBM would have to navigate an area of relative low cover (approximately 40 feet above top of rail) at station 295+00. At this location, ground improvement may be required to allow passage of the TBM.

Station

For both conceptual alignment alternatives, SEM cavern construction would be required adjacent to the Blue Line Trolley aerial structure. At a later design stage, further analysis of the cavern and its impacts on adjacent infrastructure would be required, considering ground movement acceptance criteria for specific structures.

The UTC station would be shallower than the Nobel Drive station, which would have smaller effects in terms of construction costs, constructability, and ease of passenger access.

For the Nobel Drive station, SEM construction would have to take place directly beneath the Blue Line Trolley parking facility. Contractor laydown areas would need to be coordinated to allow continued access for the parking structure.

Geotechnical

The surficial formational units located near the Nobel conceptual alternative's proposed northern tunnel portal and the alluvial materials underlying the proposed southern tunnel portals may be very sandy, and are moderately weathered. These soils may contain locally friable zones (i.e. easily crumbled) and can be highly erodible if left unprotected.

Where the alternative tunnel alignments cross through the Ardath Shale, the potential for adverse effects from expansive bedrock should be accounted for during the design phase, since the Ardath Shale is derived from ancient marine, estuarine, and lagoonal deposits, which can be highly expansive. The Nobel conceptual alignment crosses the Ardath Shale substantially more in comparison to UTC. The claystone facies of the Ardath Shale may also pose landslide and slope stability issues. Where present, weak clay beds should be investigated to allow evaluation of global slope stability.

The site of both alignments is located within the Peninsular Ranges Geomorphic Province, which is traversed by several major Holocene-active faults. The primary seismic risk to the project area is the Rose Canyon Fault Zone located approximately 2.5 miles west of the project. The effect of seismic shaking may be mitigated by adhering to the applicable design codes and state-of-the-art seismic design practices.

Shallow groundwater is anticipated within the alluvial deposits present within Rose Canyon and Soledad Canyon. Perched groundwater is expected along the geologic contact between the Quaternary-aged Old Paralic Deposits and the Tertiary-aged Ardath Shale near the tunnel portals and within the transitional facies change between formation units. For SEM construction, groundwater could be managed with temporary dewatering. In the bored tunnels, the use of a pressurized face TBM would ensure watertightness during construction.

Refer to Section 8 for more information regarding geotechnical considerations in the tunnels.

Schedule

Both conceptual alternatives are expected to have a similar duration at this early stage of design. As design progresses into preliminary engineering, detailed construction schedules should be developed at which time the differences in duration between the two alternatives may become more obvious.

3.4.5 Other Community Impacts

Potential visual and noise and vibration impacts, and any associated mitigation measures will be further examined in the environmental review phase of the project. Feasible noise and vibration mitigation measures would be implemented to reduce potential long-term impacts to within established thresholds.

3.4.6 Connectivity and Travel Demand

Both conceptual alternatives would provide a new station in the University City area, which is a major regional job center, and provide direct connections to the stations on the Blue Line Trolley. However, as described further below, the UTC alternative provides greater connectivity to the local bus system and direct access to more destinations in the immediate station vicinity.

Key Destinations

The UTC conceptual alternative provides a station at the Westfield UTC mall, a major generator of trips for shopping, entertainment, and employment. In addition, the station area has a substantial concentration of office employment and high-density residential development that is accessible by the street network in all directions. In contrast, the Nobel alternative would provide a station at Nobel Drive, which is currently bounded by two smaller malls. The Nobel Drive station area contains some office and high-density residential uses and may be further developed in the future. While the overall development intensity is high, there are fewer opportunities than UTC. Additionally, the station area is bisected by I-5, which limits connectivity to destinations east of the station.

MTS Trolley and Mobility Hubs

Both conceptual alternatives provide transfer connections to the Blue Line Trolley. The UTC conceptual alignment would provide connections to either the Executive Drive Trolley Station or UTC Trolley Station; however, the location currently shown in the plans is in much closer proximity to the Executive Drive Trolley Station, which does not provide a direct connection to the UTC mall like the UTC Trolley Station does. The Nobel conceptual alignment would provide a connection to the Nobel Drive Trolley Station. Each of these stations is intended to become a mobility hub providing transit amenities, pedestrian amenities, micromobility services, and wayfinding amenities.

MTS and NCTD Bus

Seven existing bus routes stop at the intersection of La Jolla Village Drive and Genesee Avenue, the southern entrance to the proposed UTC station: NCTD Route 101 and MTS routes 31, 41, 60, 204, 237, 921, and 979. In addition, the UTC Transit Center, a major bus hub, is located just south of the proposed station, providing additional connections to MTS routes 201 and 202. Nine routes in the station vicinity are included in the Next Generation Rapid Network: 30, 41, 201, 202, 204, 237A, 237B, 473, and 870.

Four bus routes serve existing bus stops near the Nobel Drive station site on the Nobel alternative: NCTD Route 101 and MTS Routes 30, 201, and 202. The SANDAG Regional Plan's Next Generation Rapid Network includes the three NCTD routes in the station vicinity.

California High-Speed Rail

Neither California High-Speed Rail (CAHSR) alternative includes a stop in UTC; however, both Miramar alternatives would have station stops in close proximity to the proposed CAHSR alternative that generally follows I-805 and I-5. Should CAHSR decide to add a station in UTC, either Miramar tunnel alternative could potentially provide a connection.

3.4.7 Safety Improvements

Both conceptual alternatives would eliminate the pedestrian at-grade crossings at the Sorrento Valley Station. The UTC conceptual alternative would eliminate the Sorrento Valley Boulevard at-grade crossing and would require a grade separation over a relocated Sorrento Valley Boulevard. For the Nobel conceptual alternative, passenger trains would no longer utilize the at-grade crossing at Sorrento Valley Boulevard as they would divert off the existing mainline at the north end of Sorrento Valley Boulevard. While the Sorrento Valley Boulevard at-grade crossing would not be eliminated with the Nobel alternative, the amount of train traffic at the crossing would be significantly reduced as only freight trains during off-peak hours would need to utilize the crossing.

3.4.8 Construction Costs

At this conceptual phase, it is anticipated that the Nobel conceptual alternative would have an approximately 11 percent lower construction cost than the UTC conceptual alternative.

Refer to Section 16.1 and Appendix G for more information regarding construction costs.

3.4.9 Railroad Operations (During Construction)

In evaluating potential impacts to railroad operations, both conceptual alternatives would require multiple phases to complete construction to limit operational impacts to both passenger and freight service throughout the corridor, while considering the importance of maintaining operational flexibility with temporary measures implemented to support construction. Potential phasing concepts developed for each alternative illustrate a 3-phase scenario and highlight some of the key challenges. The north connection for the UTC conceptual alternative is very challenging in its interface with I-5, Sorrento Valley Boulevard, and the anticipated need to maintain double-track operations. This has the potential to require many sub-phases to construct the northern tie-in. Conversely, the Nobel conceptual alternative northern tie-in, although challenging, is less complex. Both scenarios may need slow order operations due to restricted geometry and potential use of a temporary control point and limited single track to work around constraints and provided adequate working footprints for construction.

The south connection for both conceptual alternatives proposes a double-track shoofly to support the current operations with potential for slow order operations due to restricted geometry and occasional use of single-track operations. In either scenario, the functionality and flexibility that CP Rose provides would be maintained; however, for the UTC conceptual alternative, it would be relocated to support the tunneling operations.

It is anticipated that Absolute Work Windows would be utilized to construct improvements adjacent to and on current operational track for both conceptual alternatives as major components are constructed and cutover between phases occur.

Refer to Section 11.4 for more information regarding operational impacts and potential phasing during construction.

3.4.10 Operational Complexity (Post-Construction)

Both of the tunnels for the UTC and Nobel conceptual alternatives would have similar operational requirements pertaining to operation of the ventilation system, station, and maintenance access. Both conceptual alternatives also have one low point near the south end of the tunnel to avoid private property impacts, which would require a sump pump.

With regard to post-construction train operations, the Nobel conceptual alternative would provide space for one No. 20 crossover north and south of the tunnel, which allows for freight trains on main track 2 to cross over to main track 1 to get onto Miramar Hill. It would also allow operational flexibility for passenger trains to converge onto track should there be an emergency or maintenance needs in one of the tunnels. The UTC conceptual alternative provides room for No. 24 universal crossovers north and south of the tunnel providing more operational flexibility that would allow trains operating on main track 2 within the tunnel the ability to switch over to main track 1.

3.4.11 Operation and Maintenance Costs

At this early phase of the project, it is anticipated both conceptual alternatives would generally have the same operations and maintenance costs in the tunnels. Refer to Section 16.2 for more information regarding the anticipated costs of the tunnel operations and maintenance. The UTC conceptual alternative is a slightly longer alignment that includes a very long and tall aerial structure that takes the alignment up to the northern tunnel portal. The Nobel conceptual alternative has a shorter bridge; however, it crosses the Los Peñasquitos Lagoon and may expose the bridge to salt water, which has potential to increase the maintenance requirements of the bridge.

3.5 Summary

As part of advancing the two alignment alternatives to 10 percent conceptual engineering, several design components of the UTC and Nobel alternatives were evaluated and compared in more detail in order to carry them forward into the preliminary engineering and environmental phase. These components included considerations for utilities, grade separation, railroad systems, tunneling, potential noise and vibration, drainage, construction, operations and maintenance, and construction costs. This additional analysis is covered in Sections 0 through 0. These alternatives are subject to further changes and refinements in the next phase of the project.

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4 Utility Impacts

The tunnel portal locations for each conceptual alternative alignment were investigated to identify potential conflicts with existing utilities. All utility owners identified as having facilities within the portal improvement areas per the Digalert.org website were initially contacted. Each owner responded as to whether its utility was located within the respective portal vicinity. Eight of the 12 utility owners contacted confirmed that their utilities existed in the vicinity of the proposed portals and/or associated improvements as described below. Responses were received from AT&T Distribution, CENIC, the City of San Diego, Cox Communications, MCI-Verizon, MPower Communications, San Diego Gas and Electric (SDG&E), and Charter/Spectrum. The utilities associated with the City of San Diego encompass water, sewer, and storm drain improvements. The City's geographic information systems (GIS) website as well as construction drawings from the Mid-Coast Corridor Transit Project were also included as sources in record gathering. The reference documents received from the utility owners consisted of as-built drawings and asset map exhibits. The asset maps provided were generally from the "dry utility" companies such as electric, gas, and telecommunication companies.

The as-builts, asset maps, and reference plans provided by the utility owners were reviewed to identify potential utility conflicts within the areas of the proposed portals including the portal approach structure, fill grading, and other permanent facilities. Potential temporary trackwork associated with the southern portals of both conceptual alternatives were also included in the utility conflict assessment as were the proposed UTC and Nobel Drive Stations located between the respective portals. A utility conflict matrix (0) was developed for each portal area and at the station. The likelihood of each utility conflicting with the conceptual alternatives was evaluated based on the facility's constructed depth, height, and horizontal location. In instances where as-built depths were not available, such as in the case for the dry utilities (electric, telecom, gas, etc.), 'TBD' (to be determined) was indicated in the depth column of the utility matrix. Utility locations with 'TBD' depths would need to be potholed to determine actual utility depth. The disposition for each conflict was determined based on various considerations, including its existing location and the future depth at which the utility would be under the proposed project improvements. In general, the cost responsibility for the dispositions shown on the matrix are typically carried out in one of two manners: the 'dry utility' owners perform its own respective installations or modifications and is noted on the matrix by "UTILITY" while the wet utility improvements noted on the matrix are addressed by the project implementor and are noted in the matrix by "PROJECT."

4.1 University Town Center Alternative

Two portal locations and one station location along the UTC conceptual alternative alignment were investigated to identify potential conflicts with existing utilities. The overall footprints of the permanent improvements and potential temporary impacts needed for construction were investigated at each of the portal and station areas. The proposed station along the UTC alternative would be outside of the public ROW and is therefore not expected to create any significant conflicts with the existing major utilities.

The portal improvements for the UTC conceptual alternative are all within the City of San Diego. As such, the City of San Diego GIS website and Digalert.org were utilized in identifying and contacting potential utility owners that may have facilities located within each portal area referenced.

4.1.1 University Town Center North Portal

The utility research performed in the vicinity of the UTC north portal found one potential utility conflict. An existing SDG&E overhead power line overlaps with the southern excavation limits of the portal including a pole within the portal structure that would need to be relocated.

4.1.2 University Town Center South Portal

The utility research performed in the vicinity of the UTC south portal identified several potential conflicts with existing utilities including 'dry' utilities such as electrical and telecommunication lines, as well as City of San Diego-owned 'wet' utilities including sewer and storm drain.

An existing 12-inch vitrified clay pipe sewer line transects the Rose Creek Canyon Open Space in areas that would likely conflict with the temporary trackwork, permanent facilities, and potential staging areas. Much of the existing storm drain system originated from Regents Road and the residential developments located north of the Rose Canyon Creek Open Space. More recent improvements constructed per the Elvira to Morena Double Track Project altered or replaced portions of the old drainage system. In general, there are four small drainage systems affected by this portal's improvements with pipe sizes ranging from 18 to 48 inches, which are composed of either corrugated metal pipe or RCP material. These storm drains are typically perpendicular to the existing and proposed track improvements and spread across the length of the proposed improvements. As such, they would create a conflict with the proposed permanent portal facilities, temporary trackwork, and staging areas. In all cases, the installation of the temporary trackwork would require that the respective storm drain system be extended.

Dry utilities consisting of electric and telecommunication lines are in the vicinity of the portal's associated improvements. These utilities generally run parallel to and north of the existing railroad track. Two overhead power lines could potentially create a conflict with the proposed improvements depending on their respective pole locations, line heights, and the extent of protective measures used to protect-in-place. For example, it may be possible to protect-in-place the northern power line that borders the staging area and permanent portal facilities, but not the southern power line, which runs through the proposed staging area and permanent portal facilities. It should be noted that the southern power line also carries an overhead telecom line. As such, it is important to coordinate with all appurtenance owners. Per information received from TPx Communications, they "have aerial cable attached to the poles on the north side of the tracks within your noted project area" and "are underground on Genesee coming from the north, then turn west and rise on the first pole west of Genesee and continue aerially from there going west." The remaining dry utilities that pose a potential conflict with the proposed improvements were identified to be underground telecommunication lines. These lines owned by NCTD and MCI-Verizon meander separately on the north side of the existing tracks. A shared duct bank was constructed with the Elvira to Morena Double Track Project but kept the existing utilities protected in place. It can be expected that the underground telecommunication lines would need to be relocated since their locations directly coincide with many of the proposed improvements and staging areas.

4.1.3 University Town Center Station

This station is situated outside the existing City of San Diego ROW where there are minimal utility conflicts. SDG&E Facility Maps and plans from recent work related to the Mid-Coast Corridor Transit

Project were referenced to determine that the potential conflicts at this location would consist of two underground electrical handholes, a switchbox, and an abandoned handhole. These conflicts are in the same vicinity at the northern side of the station footprint adjacent to Genesee Avenue south of Executive Drive.

4.2 Nobel Alternative

Two portal locations and one station location along the Nobel conceptual alternative alignment were investigated to identify potential conflicts with existing utilities. The northern and southern portal areas were investigated similar to the UTC conceptual alternative described above. That is, the overall footprints of the temporary and permanent improvements were investigated at each portal for potential conflict. Record research on the station location investigated footprint areas of two access shafts.

The portal improvements for the Nobel conceptual alternative are all within the City of San Diego. As such, the City of San Diego GIS website and Digalert.org were utilized in identifying and contacting potential agencies and utility companies that may have facilities located within each portal area referenced.

4.2.1 Nobel North Portal

Although the initial Digalert.org search identified several utilities in the vicinity of this portal, actual conflicts with utility facilities were not found with information received from the respective utility companies. Similarly, as-builts from the City of San Diego found sewer and storm drain facilities in the vicinity but did not show any conflict with the proposed portal and associated improvements. However, it should be noted that this is located on private property and it could be inferred that utilities supporting this structure exist in potential conflict with proposed improvements.

4.2.2 Nobel South Portal

Review of record plans and maps received from the various agencies and utility companies identified potential conflicts related to the wet and dry utilities in the vicinity.

The wet utilities in this area consist of:

- An 18-inch polyvinyl chloride pipe sewer line from La Jolla Colony Drive crosses the existing tracks in the vicinity of the staging area and temporary track on the east end of the proposed improvements. The cover of this line varies between 7 and 17 feet. Therefore, this line could be kept and protected in place if only minimal grade cut is proposed.
- Four existing storm drain lines that cross La Jolla Colony Drive were found to be in conflict with this portal's improvements on the south side of La Jolla Colony Drive. These storm drains, which vary in sizes between 24-inch and 84-inch RCP, present conflicts with the construction staging area, shoofly track, and portal trench. Two of the crossings would need to be relocated as their locations coincide with the portal structure. Two crossings would likely require extension due to construction of the temporary trackwork.

The dry utilities potentially impacted by this portal and its associated improvements consist of electrical power and telecommunications including:

- Two overhead power lines potentially conflict with most of the proposed improvement areas such as temporary trackwork, permanent portal facilities, and construction staging areas. The degree of conflict would depend on the pole line location and line height. It should be noted that TPx Communications has aerial cable attached to the southern set of power poles on the north side of the tracks.

- Underground telecommunication lines from AT&T and Cox would present a conflict with the proposed portal structure location at its crossing with La Jolla Colony Drive. Therefore, these lines would need to be relocated.
- The remaining underground telecommunication lines generally run parallel to the existing rail tracks on its north side. These lines, which belong to NCTD and MCI-Verizon, are located in the areas proposed for the construction staging and portal structure. Their exact depths are to be determined. However, it is likely that the proposed improvements would require that they be relocated.

4.2.3 Nobel Drive Station

The utility research performed at the Nobel Drive Station location identified potential conflicts with underground telecommunication (AT&T, Charter-Spectrum) and gas (SDG&E). It is possible that other utilities may present a conflict at this location due to pending delivery of as-builts from several utility owners. However, in consideration of the location outside the public ROW, any pending utilities are not expected to present a significant conflict. Further evaluation would be needed when the conceptual alternatives advance into preliminary engineering.

4.3 Summary

As noted in the utility conflict matrices developed for the portals and stations, depths and specific locations for some utilities could not be conclusively determined from the documentation received from the respective utility owners. In the next phase, it is recommended that a subsurface exploration be performed on those utilities shown to be in conflict to determine precisely their location and extent of potential conflict. All utilities can then be mapped utilizing as-built construction drawings and the confirmed locations of utilities found through exploration. Additionally, the utility investigation should be expanded to include all potentially impacted utilities beyond the portal and station locations.

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5 Railroad Systems

5.1 Signal System Analysis

As detailed in the previous sections of this document, both conceptual alternatives maintain the existing track alignment for freight movements from Sorrento Valley to Rose Canyon via Miramar Hill, while constructing a new passenger-only track alignment through the proposed twin-bore tunnel. Maintaining both track alignments will require the installation of control points at each railroad junction point. Refer to Appendix A**,** which illustrates the proposed railroad system configuration and new control points for both alternatives. *Note: The schematics in Appendix A assume the completion of the Sorrento to Miramar Curve Realignment and Double Track Project as currently shown in the 90 percent design dated January 2021.*

Signal spacing, preview, and safe braking requirements on the freight alignment will be as determined by the Sorrento to Miramar Curve Realignment and Double Track Project. Modification to signal aspects may be required on the freight alignment to accommodate the new control points where passenger and freight alignments junctions. More detailed analysis will be required on the freight alignment to determine if additional modifications would benefit railroad operations in this area. For example, signal spacing at the junction points of the freight and passenger alignments is less than optimal. It may be possible to combine two control points that are close together into a single, larger control point. It may also be beneficial to respace or modify signals within the freight alignment and outside the project limits.

For the purpose of this study and more specifically, tunnel analysis, control points have been designated where special track work dictates. Existing signal locations on the freight alignment and outside of the project limits would remain as currently installed or as proposed on projects anticipated to precede the tunnel project. Development of advanced conceptual engineering phases would need to determine the preferred configurations at the freight and passenger alignment junction points, within the freight alignment and outside the project limits. It should also be noted, that due to the steep grades and curves on the freight alignment between Sorrento and Rose Canyon, that 60 miles per hour freight speeds would not be achievable.

5.2 Tunnel Alignment Analysis

To support the analysis of the proposed Nobel and University Town Center conceptual alternative alignments between Sorrento and Rose Canyon, a preliminary assessment of the associated impacts to the wayside signal and crossing warning systems was performed. The main challenge for the integration of rail systems for these conceptual alignments is to minimize wayside signal infrastructure within the tunnels to the extent practical. The Nobel and UTC conceptual design stations at UTC and Nobel Drive, respectively, with westbound and eastbound signals controlling movements following a station stop. These signal locations would have control rooms located at the ends of the platform. Maintenance access can be accomplished 24/7 via the station elevators and escalators. However, the installation of signal infrastructure within the tunnels that are not located near stations could result in access challenges for routine monthly maintenance, longer response times for signal troubles, and the need to use on-track equipment to bring in heavy materials, etc. With this in mind, it was determined that the strategic placement of minimal wayside signal infrastructure in the tunnels would be necessary to support efficient train operations and to reduce headways. The following text highlights the key features of the modified wayside signal system, impacts to existing grade crossings, and any other pertinent information as it relates to the preliminary assessment.

5.2.1 University Town Center Alternative

The UTC conceptual alternative would result in an approximately 11,900-foot-long tunnel from station 346+00 to 465+00 as shown in the Track Plan and Profile drawings in Appendix A. Assuming train speeds of 110 miles per hour for passenger trains and factoring in the proposed grades as shown in the Track Plan and Profile drawings, ideal signal spacing between two consecutive blocks should ideally be no less than 17,000 feet combined. This allows safe braking for a passenger train travelling at 110 miles per hour to pass a flashing yellow signal to safely reduce to a stop at a red signal using typical signal indications. Signal placement at the junction points for the freight and passenger alignments would not accommodate this ideal signal spacing; therefore, safe braking calculations would need to determine signal indications in these areas to allow safe train braking while also supporting preferred passenger and freight train speeds.

Table 5-1 lists the approximate locations of the proposed wayside signals for the UTC alternative.

Table 5-1. University Town Center Proposed Wayside Signals

Station	Signal Name	Direction
250+52	CP Torrey EB	EB Ground Signals
264+06	CP Torrey WB	WB Ground Signals
306+00	CP Sorrento EB MT1	EB Ground Signal MT1
312+60	CP Sorrento WB MT1	WB Cantilever Signals MT1
312+60	249 Intermediate Signals MT2	Bi-Directional Ground Signals MT2
400+00	250 Intermediate Signals WB	WB Ground Signals
425+00	251 Intermediate Signals EB	EB Ground Signals
484+07	CP Rose EB	EB Bridge Signals
503+07	CP Rose WB	WB Cantilever Signals

CP = control point, EB = eastbound, WB = westbound, MT = main track

Table 5-2 and Table 5-3 list the approximate signal blocks associated with this signal spacing.

Table 5-2. University Town Center Eastbound Signal Blocks

From Signal	To Signal	Length (feet)
CP Torrey MT1	CP Sorrento MT1	5,548
CP Torrey MT2	249 Signals MT2	6,208
CP Sorrento MT1	251 Signals MT1	11,900
249 Signals MT2	251 Signals MT2	11,240
251 Signals	CP Rose	5,907
CP Rose	257 Signals	4,521

CP = control point, MT = main track

Table 5-3. University Town Center Westbound Signal Blocks

From Signal	To Signal	Length (feet)
257 Signals	CP Rose	3,191
CP Rose	250 Signals	10,307
250 Signals	CP Sorrento MT1	8,740
250 Signals	249 Signals MT2	8,740
CP Sorrento MT1	CP Torrey MT1	4,854
249 Signals MT2	CP Torrey MT2	4,854

CP = control point, MT = main track

As indicated in the tables above, there are three instances where consecutive blocks result in less than 17,000 feet combined for the proposed placement of wayside signals. In the eastbound direction, between the 251 signals and the 257 signals, the consecutive block length is 10,428 feet. Elevation data are not available for the 257 signals to preliminarily assess the impact of this short aggregate signal block; however, it is assumed for the purposes of this analysis that the 257 signal location would require relocation to approximately MP 258.

In the westbound direction, there is a short block between the 257 signals and CP Rose that would present braking issues. As noted in the previous paragraph, this issue further supports the need to relocate the 257 signal location. Also, in the westbound direction, between the 250 signals and CP Torrey, the consecutive block length is 15,594 feet. Further analysis reveals that the approximate average grade between these signals would be no greater than -1.84 percent, which when applied, would not meet the requirements for safe braking with typical signal indications. Advanced conceptual engineering should identify deviations from typical signal indications for this aggregate block to mitigate safe braking concerns.

The future 247 signals would be removed in their entirety. A new CP Torrey will be installed railroad east of the future location in a universal crossover configuration.

The existing CP Sorrento signal house would be removed in its entirety. A new CP Sorrento would be installed in essentially the same location as the existing, but would become a single turnout, which would serve movements onto the freight alignment. On main track 2, the 249 signals would segment the signal block between CP Torrey and the 250 signals.

The 250 westbound signals are proposed to be installed in the tunnel several hundred feet north of the proposed train station. This westbound-only signal installation is necessary to ensure adequate visibility for trains departing the station. This would prevent delayed-in-block speed restrictions for trains leaving the station westbound toward Oceanside. The signal equipment for this location could be housed inside the tunnel in a cross-channel section that connects both main tunnel bores or in dedicated control rooms located at each end of the platform. The latter option of housing signal equipment in control rooms at either end of the platform facilitates maintenance access via elevators and escalators.

The 251 eastbound signals are proposed to be installed in the tunnel several hundred feet south of the proposed train station. This eastbound-only signal installation is necessary to ensure adequate visibility for trains departing the station. This would prevent delayed-in-block speed restrictions for trains leaving the station eastbound toward San Diego. The signal equipment for this location can be housed inside the tunnel in a cross-channel section that connects both main tunnel bores or in dedicated control rooms located at each end of the platform. The latter option of housing signal equipment in control rooms at either end of the platform facilitates maintenance access via elevators and escalators.

The CP Rose eastbound control bridge signals and westbound control cantilever signals are proposed to be installed at Station 484+07 and 503+07, respectively. The placement of these signals is being driven by the proposed universal crossover and turnout to the freight alignment configuration. The eastbound bridge structure is needed to support the installation of three absolute signals for eastbound train movements. The westbound cantilever signal is needed to maximize signal preview for westbound trains approaching from the existing curve south the of the proposed control point. Existing CP Rose would be decommissioned and completely removed as part of the UTC conceptual alternative.

There is an existing Torrey Pines PTC Base Station at MP 249.80 and Miramar Communications Case at MP 252.90, which provide necessary PTC radio, PTC backhaul, and voice radio coverage, which would remain in service. The 257 signals location houses a PTC base station as well. Further investigation needs to be performed to determine if new PTC and voice radio base stations would need to be constructed somewhere along the new alignment or if the existing infrastructure can remain protected-in-place. For PTC, a 220-megahertz radio frequency propagation analysis should review PTC radio coverage in this area to determine the optimal reconfiguration of PTC base radios.

A new fiber duct bank would be required between station 305+00 and Station 496+00. This duct bank would comprise four 2-inch high-density polyethylene pipe conduits for NCTD and Verizon use. The fiber installed for NCTD would include a 24-strand fiber cable for PTC communications and Rail System Network, and a 72-strand fiber cable would be used for Information Technology and FLS communications. Voice radio would use “leaky coax” cable to propagate the 160-megahertz frequency band inside of the tunnel to ensure voice communications on railroad-provided radios. The PTC radio would also use leaky coax cable to propagate the 220-megahertz frequency band inside of the tunnel to ensure Wayside Status Message communications to locomotive onboard Train Management Computers (TMC). The PTC system would determine train location by the use of dead reckoning currently built into the TMC.

5.2.2 Nobel Alternative

The Nobel conceptual alternative would result in an approximately 18,200-foot-long tunnel from station 284+00 to 466+00 as shown in the Track Plan and Profile drawings. Assuming train speeds of 110 miles per hour passenger and factoring in the proposed grades as shown in the Track Plan and Profile drawings in Appendix A, ideal signal spacing between two consecutive blocks should ideally be no less than 17,000 feet combined. This allows safe braking for a passenger train traveling at 110 miles per hour to pass a flashing yellow signal to safely reduce to a stop at a red signal using typical signal indications. Signal placement at the junction points for the freight and passenger alignments would not accommodate this ideal signal spacing; therefore, safe braking calculations would need to determine signal indications in these areas to allow safe train braking while also supporting preferred passenger and freight train speeds.

Table 5-4 lists the approximate locations for the proposed wayside signals for the Nobel alternative.

Table 5-4. Nobel Proposed Wayside Signals

Station	Signal Name	Direction
218+37	CP Torrey EB	EB Ground Signals
325+50	249 Intermediate Signals	Bi-Directional Ground Signals
405+50	251 Intermediate Signals WB	WB Ground Signals
428+50	251 Intermediate Signals EB	EB Ground Signals
472+40	CP Gilman EB	EB Bridge Signals
485+70	CP Gilman WB	WB Cantilever Signals

CP = control point, EB = eastbound, WB = westbound, MT = main track

Table 5-5 and Table 5-6 list the approximate signal blocks associated with this signal spacing.

Table 5-5. Nobel Eastbound Signal Blocks

From Signal	To Signal	Length (feet)
CP Torrey	249 Signals	10,713
249 Signals	251 Signals	10,300
251 Signals	CP Gilman	4,390

CP = control point

Table 5-6. Nobel Westbound Signal Blocks

From Signal	To Signal	Length (feet)
CP Gilman	251 Signals	8,020
251 Signals	249 Signals	8,000
249 Signals	CP Torrey	9,735

CP = control point

As indicated in the tables above, there are two instances where consecutive blocks would result in less than 17,000 feet combined for the proposed placement of wayside signals. In the eastbound direction, between the 249 signals and CP Gilman, the consecutive block length is 14,690 feet. Further analysis reveals that the average grade is ascending between these signals; therefore, meeting safe braking requirements would not be an issue. In the westbound direction, between the CP Gilman and 249 signals, the consecutive block length is 16,020 feet. Further analysis reveals that the approximate average grade between these signals would be no greater than -0.50 percent, which when applied, meets the requirements for safe braking.

The future 247 signals would be removed in their entirety. A new CP Torrey will be installed railroad west of the future location in a universal crossover with a turnout configuration. The turnout would serve movements onto the freight alignment. The westbound bridge structure is needed to support the installation of three absolute signals for westbound train movements.

The 249 signals are proposed to be installed in the tunnel at station 325+00. There is tangent track in both directions for several thousands of feet, so signal visibility would be adequate. Installation of this location within the tunnel would present some challenges. The signal equipment for this location would be housed inside the tunnel in a cross-channel section that connects both main tunnel bores and would be accessible by on-track equipment only.

The 251 westbound signals are proposed to be installed in the tunnel several hundred feet north of the proposed train station. This westbound only signal installation would be necessary to ensure adequate visibility for trains departing the station. This would prevent delayed-in-block speed restrictions for trains leaving the station westbound toward Oceanside. The signal equipment for this location could be housed inside the tunnel in a cross-channel section that connects both main tunnel bores or in dedicated control rooms located at each end of the platform. The latter option of housing signal equipment in control rooms at either end of the platform facilitates maintenance access via elevators and escalators.

The 251 eastbound signals are proposed to be installed in the tunnel several hundred feet south of the proposed train station. This eastbound only signal installation would be necessary to ensure adequate visibility for trains departing the station. This would prevent delayed-in-block speed restrictions for trains leaving the station eastbound toward San Diego. The signal equipment for this location could be housed inside the tunnel in a cross-channel section that connects both main tunnel bores or in dedicated control rooms located at each end of the platform. The latter option of housing signal equipment in control rooms at either end of the platform facilitates maintenance access via elevators and escalators.

CP Gilman would be installed railroad west of the existing 257 signal location in a single crossover with a turnout configuration. The turnout would serve movements onto the freight alignment. The eastbound bridge structure is needed to support the installation of three absolute signals for eastbound train movements. The existing 257 signal cantilever structure would be modified to accommodate the new westbound control signals for CP Gilman.

Further analysis and coordination would be needed to determine if existing CP Rose would be removed or reconfigured under this alternative.

There is an existing Torrey Pines PTC Base Station at MP 249.80 and Miramar Communications Case at MP 252.90, which provide necessary PTC radio, PTC backhaul, and voice radio coverage, which would likely be permanently removed as part of this alternative. Further investigation would need to be performed to determine if new PTC and voice radio base stations would need to be constructed somewhere along the new alignment. If necessary, 220-megahertz radio frequency propagation analysis should review the existing CP Torrey/proposed 247 signals location for the permanent relocation of the Torrey Pines PTC Base Station.

A new fiber duct bank would be required between Station 235+00 and Station 485+00. This duct bank would comprise four 2-inch high-density polyethylene pipe conduits for NCTD and Verizon use. The fiber installed for NCTD would include a 24-strand fiber cable for PTC communications and rail system network, and a 72-strand fiber cable would be used for Information Technology and FLS communications. Voice radio would use leaky coax cable to propagate the 160-megahertz frequency band inside of the tunnel to ensure voice communications on railroad-provided radios. PTC radio would also use leaky coax cable to propagate the 220-megahertz frequency band inside of the tunnel to ensure Wayside Status Message communications to locomotive onboard TMC. The PTC system would determine train location by the use of dead reckoning currently built into the TMC.

5.3 Summary

Both the Nobel and the UTC conceptual alternatives would present unique challenges with the integration of wayside signal infrastructure. Both alternatives would propose the installation of wayside signals and associated infrastructure within the limits of the tunnel. These installations are not typical for rail systems on the San Diego Subdivision and provisions would have to be proposed by outside disciplines to support these installations.

In conclusion, of the two conceptual alternatives, it appears that the Nobel alternative would have some preferable attributes that the UTC alternative does not. Firstly, the grades on the Nobel alternative would facilitate more forgiving safe braking requirements as compared to the UTC alternative. Secondly, nominal signal spacing would be easier to achieve with the Nobel alternative. Finally, the Nobel alternative does not require the relocation of the existing 257 signals location, whereas the UTC alternative does.

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6 Grade Separations

6.1 University Town Center Alternative

In 2015, a project report titled the *I-5/Sorrento Valley Road Interchange Improvements* was developed for the City of San Diego (AECOM 2015). The study evaluated various potential improvements to the local street system and railway adjacent to the I-5/Sorrento Valley Road interchange. The project improvements were intended to alleviate traffic congestion and facilitate transit operations in the vicinity of Sorrento Valley Road, Sorrento Valley Boulevard, Vista Sorrento Parkway, and Roselle Street. The I-5/Sorrento Valley Road interchange and surrounding roadway network currently experiences several traffic operational and queuing issues due to (1) heavy peak-hour traffic volumes, (2) close spacing of intersections, and (3) the existing at-grade rail crossing at Sorrento Valley Boulevard. The preferred alternative included raising the rail over a relocated Sorrento Valley Boulevard to provide sufficient clearance over Sorrento Valley Boulevard and below the connector bridges of I-5 and moving the existing station either north or south. The UTC conceptual alternative has incorporated the grade separation over the relocated Sorrento Valley Boulevard identified in the project report and assumes Sorrento Valley Boulevard is relocated concurrently with this project but funded separately. Due to limited availability of survey information, the 10 percent conceptual engineering assumed the I-5 bridge soffit elevations identified in the previous project report, converted to North American Vertical Datum of 1988. Detailed survey of the overpass and surrounding area will be required in future phases.

6.2 Nobel Alternative

The Nobel conceptual alternative crosses an existing private access road, which is a continuation of Flintkote Avenue. The private access road leads to a grouping of existing buildings located within the State Torrey Pines Preserve. The private access then transitions to a trail for about ½ a mile north. At the location where the Nobel conceptual alternative crosses the private road, the road is partially located within the regulatory floodway and the 100-year floodplain. Maintaining access to the private road would need to be studied further in future phases. The Nobel alternative would diverge from the existing rail alignment north of the Sorrento Valley station and would not cross Sorrento Valley Boulevard, avoiding the need for a grade separation at that location.

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7 Summary of Noise and Vibration Analysis

The Noise and Vibration Technical Memorandum prepared in December 2023 by HDR and Entech (0) provided the following noise and vibration findings for the project development.

The UTC and the Nobel conceptual alternatives could have potential noise and vibration impacts on the surrounding land use at the portal locations. Feasible noise and vibration mitigation measures would be implemented to reduce potential long-term impacts to within established thresholds. The at-grade sections at the entrance of each tunnel section would consist of U-structures and cut and cover treatments, reducing potential noise and vibration levels. Further, acoustic absorption under the trainsets, tangent track with high resilience fasteners, and a smooth track surface would reduce potential noise and vibration levels. At the tunnel portals and station, vents and a ventilation shaft could be a potential source of noise without abatement features. Attenuators, fan enclosures, and other abatement features could be implemented at the portal and station locations to lower the exiting exhaust to meet the City of San Diego daytime and nighttime exterior noise levels. Sensitive habitats could experience similar noise and vibration levels to existing conditions as these environments currently experience train pass-bys along at-grade tracks. Potential vibration levels and groundborne noise would not be anticipated to exceed Federal Transit Administration (FTA) and FRA threshold levels while trains are operating below the ground surface. There are many different land uses above the tunnel alternatives. A detailed vibration assessment would have to be completed during final design to more fully understand vibration generation, propagation, levels at receivers, their sensitivities to vibration, and mitigation measures.

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8 Geotechnical Tunnel Considerations

8.1 Geotechnical Reports

The additional geotechnical efforts included the development of a geotechnical report prepared specifically for this study. This report is included as 0.

- Leighton Associates performed a geologic desk study and geologic reconnaissance for the Miramar Tunnels Project, reported in the *Geologic Reconnaissance Report – Miramar Conceptual Engineering Study.*

8.2 Tunnel Geotechnical Considerations

8.2.1 Geologic Setting

The report herein was developed to better understand existing conditions and provide an understanding of the anticipated geologic setting within the project footprint. As noted in the report, the conceptual tunnel alignment alternatives are situated within the Peninsular Ranges Geomorphic province, which is characterized by uplifted terraces ocean front segmented by drainages coming from the mountainous region to the east. Refer to 0 for further details on the overall setting anticipated with the project limits.

8.2.2 Material Engineering Characteristics

The desktop study identified engineering characteristics of the anticipated geological conditions and identified the unique engineering characteristics to consider including erodibility, expansion potential, corrosivity, excavation difficulty, and slope stability. These characteristics support the development of the approach in engineering appropriate solutions. These are further defined in the Geological Reconnaissance Report in 0.

8.2.3 Seismic Hazards

Seismic Hazards are described in the Geological Reconnaissance Report in 0.

Severe ground shaking is most likely to occur during an earthquake on one of the regional Holocene-active faults in Southern California. The effect of seismic shaking may be mitigated by adhering to the applicable design codes and state-of-the-art seismic design practices. Secondary effects associated with severe ground shaking following a relatively large earthquake that may affect the site include shallow ground rupture, soil liquefaction and dynamic settlement, and tsunamis.

8.2.4 Groundwater

Two types of groundwater would be expected along the conceptual alternative tunnel alignments. The first includes perched water (seepage), commonly found within 10 to 30 feet of the existing ground surface. This groundwater, resulting from irrigation and precipitation, infiltrates through the sandy terraces, then becomes perched on or within the less porous and denser underlying sedimentary formational units. At the proposed tunnel elevations, the geologic contact between the geologic units may have seepage conditions from perched water, and seepage is possible at the locations of the pre-

Holocene faults which cross both tunnel alignments. Based on the high variability of groundwater depths within previous borings, heavy infiltration of groundwater from perched zones and from fractures would be anticipated.

The second type is anticipated as shallow groundwater within the alluvial deposits present within Rose Canyon and Soledad Canyon. The level of groundwater within the alluvium is anticipated to vary seasonally and may be assumed to be at the ground surface during flooding events.

It is not anticipated that the static groundwater table would be encountered during tunnel or underground station excavation activities.

The hydrogeology and groundwater conditions should be further investigated and evaluated during preliminary engineering, as this would have a major impact on selection of the TBM and development of construction strategy for the underground station.

8.3 Ground Behavior and Risks during Tunneling and Station Construction

There are risks associated with both bored tunneling and SEM excavations. Some of these risks are discussed in the following sections.

8.3.1 Ground Classification and Behavior within Bored Tunnels

The bored tunnels would be excavated primarily in Ardath Shale, a sequence of weakly fissile, soft to moderately soft, locally moderately hard, sandy siltstone to sandy claystone with interbeds of silty fine sandstone and thin layers of conglomerate. The Ardath Shale locally contains hard cemented concretions and expansive clays.

The UTC conceptual alternative tunnel would also have localized excavation in Scripps Formation, typically soil-like, weakly cemented sandy siltstone and sandstone. The Nobel conceptual alternative tunnel would locally be excavated in Torrey Sandstone, consisting of dense to very dense, moderately well indurated Arkosic sandstone.

The previous feasibility study concluded that excavation by pressurized TBM would be required for the bored tunnels (Caltrans 2020). Given the groundwater conditions assessed in the Geological Reconnaissance Report (0), use of a mix-shield TBM should be evaluated. These are capable of operating in closed, pressurized mode where groundwater is present and open, non-pressurized mode with full plenum and bentonite injection around the shield where groundwater is absent. The use of mix-shield should be evaluated together with the earth pressure balance and slurry TBMs.

8.3.2 Ground Classification and Behavior at Station and Cross Passages

The UTC and Nobel conceptual alternatives would likely encounter sandstone, siltstone, and claystone, belonging to the Scripps Formation, Ardath Shale, and Torrey Sandstone. In these formations, the process of lithification (hardening and cementation of the rock) has not resulted in the development of a hard rock. These formations are therefore classified as soft rock or stiff soil and can be excavated easily with conventional excavation equipment. They are not expected to behave like jointed rock but are more like a homogeneous stiff soil. The soft soil would result in less stable ground during tunneling and would require early support to prevent tunnel collapse during construction.

It is anticipated that raveling and flowing behavior would typically occur in the Scripps Formation, with localized flowing behavior where perched groundwater is present.

It is anticipated that firm to raveling behavior would typically occur in the Ardath Shale, with localized squeezing behavior where expansive clays are present.

It is anticipated that the moderately well indurated Torrey Sandstone would exhibit firm to raveling behavior.

Sequential Excavation Method

The station on the selected conceptual alignment would be constructed by SEM as described in Section 11.3.9, either with the bored tunnels in place or with platform tunnels constructed and the TBM being walked through. SEM is an observational construction method that responds to the ground conditions in the excavation. Construction of the station would be from shafts that would subsequently be converted to operational use for elevators, emergency egress, and ventilation circulation to the deep station.

Given the generally weak soils, it is anticipated that the sequential excavation would require multiple openings/headings and the use of toolbox items, such as canopy pipe, wellpoints, and vacuum dewatering, to control stability and manage perched water.

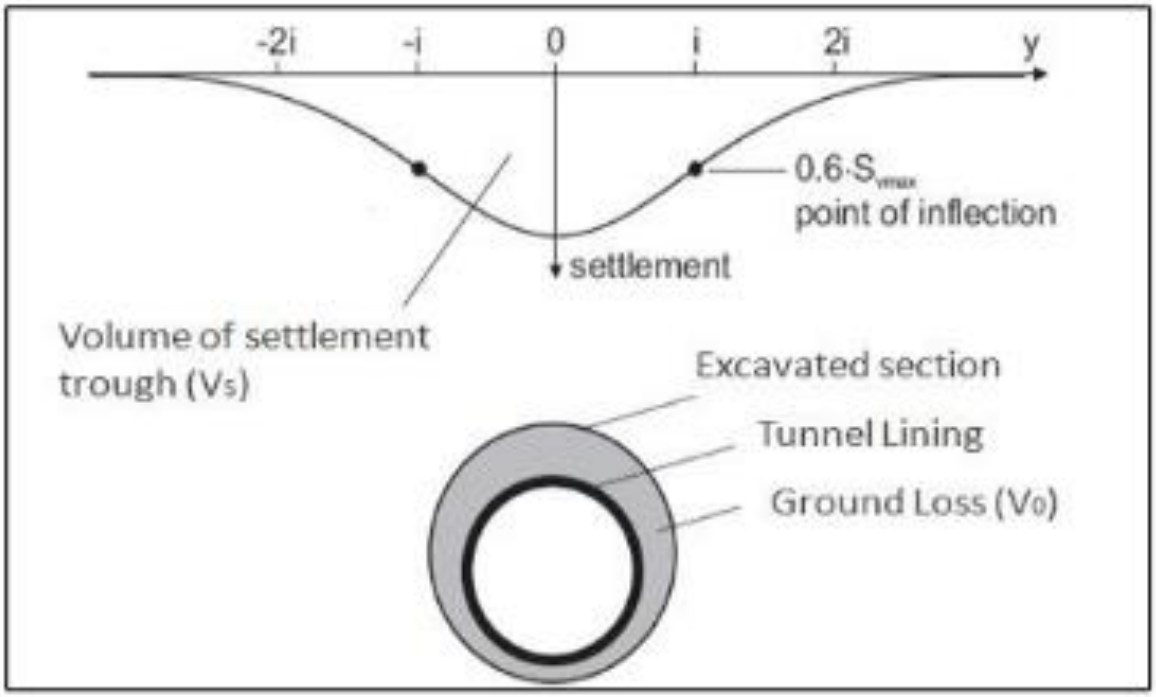
8.3.3 Control of Ground Movement (Settlement)

The proposed tunnel construction would have the potential to generate ground movements as the TBM tunnels and SEM caverns are excavated. These ground movements would be the subject of future studies so that potential excavation-induced deformations are kept within acceptable levels.

Bored Tunnels, SEM Station, and Cross Passage Excavations

The settlement could vary depending on the depth and size of the tunnels and station excavations, the local ground conditions, and the construction techniques used to excavate the tunnels. The amount of settlement is a function of the amount of ground loss that has occurred during the excavation of the tunnel. The ground loss is generally defined as the volume of soil that has been excavated more than the theoretical design volume for the tunnel excavation. The ground loss at the tunnel results in soil movement that can propagate up to the surface. This can result in a settlement trough that develops above the tunnels. The actual settlement with a TBM excavation can also vary depending on the overall quality of the construction work. This relationship is shown in Figure 8-1.

Figure 8-1. Gaussian Curve for Transverse Settlement Trough above a Tunnel



8.3.4 Stickiness and Clogging Potential for the Tunnel Boring Machines

The Scripps Formation and Torrey Sandstone are considered to have low clogging potential. The Ardath Shale is considered to have medium clogging potential, and this should be considered in the design and maintenance of the TBMs. This risk can be mitigated by using an additive to help condition the spoil generated by the TBM.

8.3.5 Abrasive Ground Conditions

The cutterhead of a TBM would include different types of cutting tools (e.g., disc cutters, picks) to help break down the rock and soil. Replacing worn or damaged tools can cause delays for a project, and failure to replace tools can damage the TBM leading to even longer and more costly repairs. Therefore, tool wear is a very important parameter to evaluate when proposing to use a TBM, and this can be highly affected by the abrasiveness of the rock. Soil conditioning agents would reduce the risk of abrasion, but the cutterhead, cutterhead tools, plenum, and spoil removal systems should be designed to mitigate the risk of wear from abrasion.

The Scripps Formation and Torrey Sandstone contain quartz grains, which are the primary source of abrasion. Abrasion testing and petrographic analysis should be performed on samples from these formations as part of the site investigation.

8.3.6 Potential Obstructions

A significant risk for any TBM project is encountering obstructions in the ground ahead of the TBM. This can result in significant delays for a project. Obstructions can be either geological in nature or man-made. Examples of man-made obstructions include building foundations, oil wells, and utilities.

Examples of geological obstructions include cobbles, boulders, and cemented concretions. As part of the next phase of preliminary engineering, a Building Inventory Study should be undertaken. The purpose of the Building Inventory Study would be to document as-built conditions of major structures adjacent to and on top of the tunnel alignment, with the aim of determining any conflicts between existing structures and proposed tunnel alignment. If conflicts were identified, the design could recommend mitigation measures such as underpinning, ground improvement, or tunnel realignment.

As to geotechnical obstructions, the TBMs would have cutting tools to excavate all soil/rock types anticipated. Man-made obstructions would be identified in later stages of design.

Obstructions are also a significant risk for the construction of Support of Excavation (SOE) for portal structures and shafts. Similar to tunneling, obstructions can impede the progress of installing vertical SOE elements and can also result in significant delays for a project. The SOE installation method would need to consider the soil/rock types anticipated.

8.3.7 Gassy Ground

The conceptual alternative tunnel alignment would be excavated within sedimentary type rocks, which are often associated with gassy or potential gassy ground conditions. Gases often encountered in tunnels include methane and hydrogen sulfide. Without mitigation measures, these types of gases can pose health and safety risks.

To mitigate these risks, it is expected that the following measures would be required:

- A ventilation plan for the construction work would need to be prepared, to ensure that sufficient ventilation is provided in the tunnels.
- Monitoring devices would need to be installed on the equipment; these can automatically shut down electrical equipment if gases are detected.
- Monitoring devices would need to be provided to the workers; these can detect the gases if encountered, providing notification to the workers. Self-rescuer breathing equipment would also need to be provided.
- All equipment used underground would need to be Class 1, Division 2 certified (i.e., be explosion-proof) and approved for underground use.
- Safety training would be required for all those working underground.

In addition to these mitigation measures, the project would need approval from California Department of Industrial Relations, Division of Occupational Safety and Health, which would review the available information and provide a classification for the tunnel.

8.4 Ground Behavior and Risks at Portals

Portals would consist of cut-and-cover tunnel section and open cut U-structure section. Portals would be constructed using SOE and mass earthwork operations.

Poorly consolidated and potentially compressible soils of the Quaternary age Young Alluvial Deposits are present at the south portal of both conceptual alternative alignments. These can present a settlement concern where additional loading or dewatering operations are proposed. Additionally, these materials may be susceptible to liquefaction during seismic shaking.

Well consolidated Quaternary age-Old Alluvial Deposits soils would be present at both of the conceptual alternatives' south portals. These can present a settlement concern where additional loading or dewatering operations are proposed. The potential for lateral spreading occurring at the south portal location, during a seismic event, should be evaluated.

The claystone faces of the Ardath Shale may pose landslide and slope stability issues. Ardath Shale would be present at the north portal locations for both conceptual alternatives. Explorations to investigate for the presence of weak clay beds at the portals should be performed to allow evaluation of global slope stability.

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9 Underground Station

Both the UTC and the Nobel conceptual alternatives would include an underground station within the tunnel segment of each alternative alignment. For the UTC alternative, the station is called the UTC Station and for the Nobel alternative, the station is called the Nobel Drive Station. Both station locations provide transfer locations to the Blue Line Trolley at UTC or Nobel Drive. The Trolley service is located on elevated guideways and pedestrian connectivity and vertical circulation would need to be studied further in future phases.

9.1 Station Location – University Town Center

The conceptual alternative location for the UTC Station would be at the intersection of La Jolla Village Drive and Genesee Avenue. As discussed in Section 9.3, the proposed station layout would consist of two entrance structures and shafts with potential for a third center shaft. One entrance structure could be located at the southeast corner of the La Jolla Village Drive and Genesee Avenue intersection. The other entrance structure could be located at the southeast corner of the Executive Drive and Genesee Avenue intersection. The station would be approximately 1,250 feet long. The location of the station is still to be determined and should be evaluated further in future phases.

9.2 Station Location – Nobel

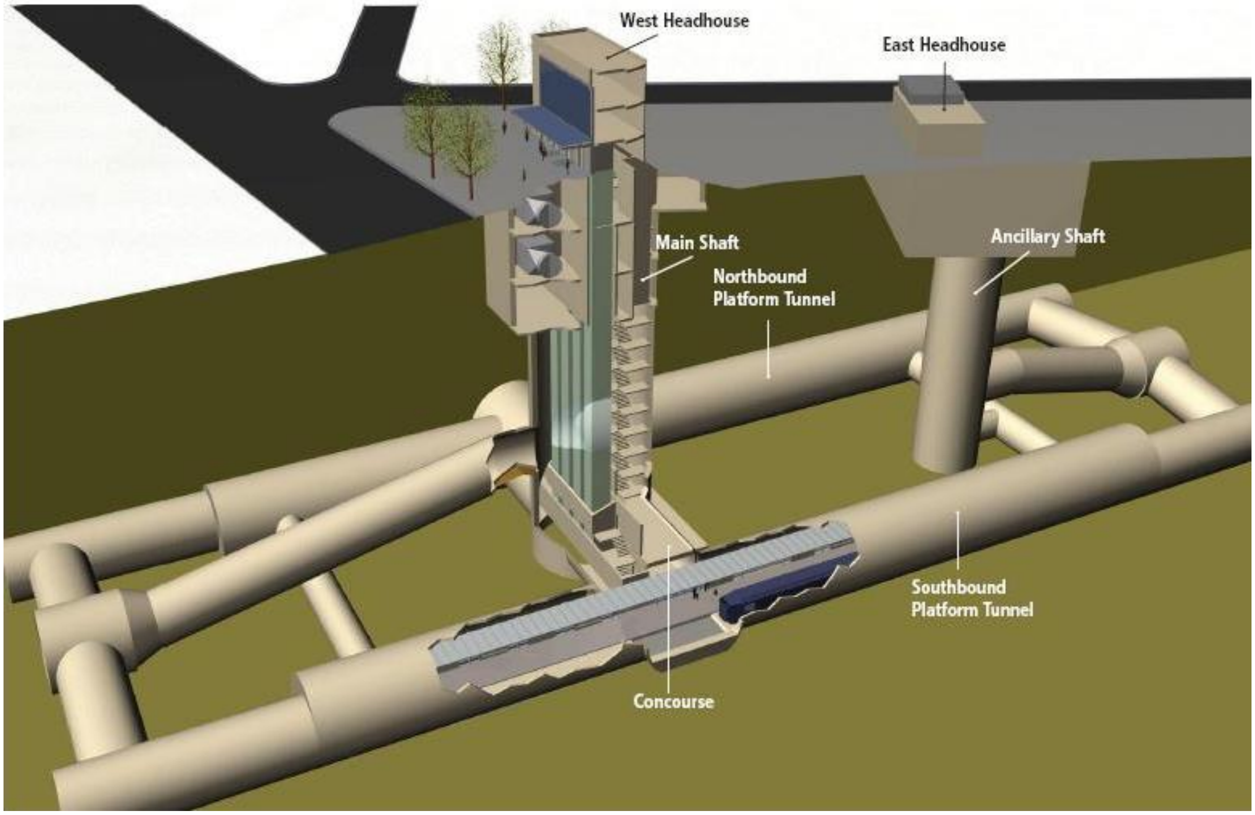
The conceptual alternative location for the Nobel Drive Station would be near the intersection of Nobel Drive and I-5, just west of the Nobel Drive MTS Trolley station. As discussed in Section 9.3, the proposed station layout would consist of two entrance structures and shafts. One entrance could be located just south of Nobel Drive and just west of the existing trolley aerial structure. The other entrance structure could be located approximately 1,000 feet south of the first entrance. Between the two proposed entrance structures is the MTS trolley station and newly built parking structure servicing the trolley station. As proposed, the station would be located under these structures as well as a shopping center parking lot. The location of the station is still to be determined and should be evaluated further in future phases.

9.3 Station Layout

Given the depth to top of rail (approximately 87 feet for the UTC Station and 107 feet for the Nobel Drive Station) as well as the long length of platform required and significant surface disruption of such large excavation footprints, cut-and-cover excavation for the station is not considered to be cost-effective or practical. A deep-mined station has therefore been assumed for this study.

Because the ground conditions are expected to consist of soils and weak rocks, excavating a large mined underground station would not be possible. Therefore, the station would need to be excavated using SEM and would consist of a series of connected tunnels (or adits) to form the overall station layout. An example of an SEM excavated station is the Beacon Hill Station in Seattle, WA. An example three-dimensional layout of the Beacon Hill Station is shown below in Figure 9-1.

Figure 9-1. Example Beacon Hill Station Layout



The UTC and Nobel Drive Stations are expected to be similar but not exactly the same as the Beacon Hill Station.

The UTC and Nobel Drive Stations are expected to have a minimum of two vertical shafts that would act as entrances and exits and as ventilation structures. SEM techniques would be used to construct the platform tunnels, as well as the ventilation adits and cross-passenger adits.

9.3.1 Station Entrance and Ventilation Structures

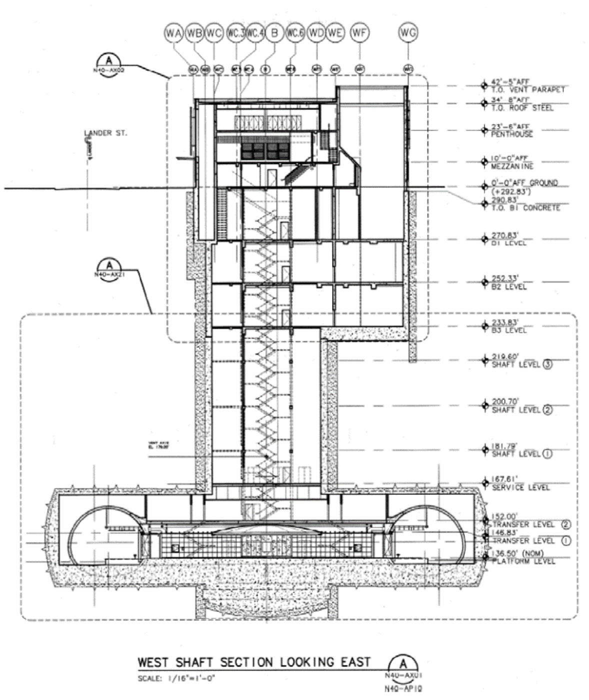
At the surface above the main shaft, there would need to be an entrance and ventilation structure, where passengers can access elevators to take them up or down to the trains. Emergency stairs would also be accessible from this structure. An example of an entrance structure is shown in Figure 9-2. These structures would also enclose mechanical, electrical, plumbing, and other FLS and operational equipment.

Figure 9-2. Beacon Hill Station Entrance

9.3.2 Station Shafts

At least two shafts would be required at the ends of the platform for emergency egress, and station ventilation. The shafts are required to be located at the end of the platforms to allow passengers to move in either direction in case of a fire or other incident and not cut them off from an exit to the surface should one exit become inaccessible. An example layout for the two shafts is shown in Figure 9-3.

Figure 9-3. Example Beacon Hill Station Shaft



The finished internal dimensions of each shaft would be confirmed at a later engineering phase and would include elevators to move passengers from the surface to the concourse level, emergency access stairs, and space for station mechanical, electrical, and ventilation equipment. The shaft dimensions near the surface would be larger to accommodate back-of-house rooms.

The conceptual engineering plans currently show vertical shafts as they are the easiest to construct with the shortest means of egress; however, they also would potentially require property acquisition. A potential solution to avoiding large developments would be to consider constructing mid-level adit tunnels. These adits (which would be located approximately 40 feet below the surface) could branch off from the vertical shaft and then a second vertical shaft would provide a station entrance at a site that is undeveloped. For example, a mid-level adit could be constructed at the position of the south shaft for the station and under Genesee Avenue with the station entrance located in an adjacent car park. Potential issues with the mid-adit scheme could include the requirement for two separate sets of elevators (which would increase passenger travel time) and constructability issues with shallow-cover SEM and/or cut-and-cover construction.

Another alternative would be to consider reducing the platform length to 850 feet similar to what is being proposed for the San Diego Convention Center Station project. A shorter platform would provide more flexibility in where the vertical shafts could be placed and could still accommodate a 10-car train with the existing fleet. It is recommended that further optimization of the station shaft locations and platform length be evaluated in the next phase.

9.3.3 Station Platforms Tunnels

Two station platform tunnels would be needed. In accordance with Section 7.3.1 of the LOSSAN Design Criteria, new station and platforms must accommodate 1,000-foot-long platforms to accommodate Amtrak Pacific Surfliner trains. The platform tunnels would be approximately 37 feet wide and 26 feet tall to accommodate the clearance envelopes of the trains and the platform. Side platforms would be a minimum of 16 feet wide with an elevation of 15 inches above the top of rail. The clearance between platform tunnels is approximately 48 feet, resulting in a center-to-center track spacing of 85 feet. See Figure 9-4 and Figure 9-5. For ventilation purposes, the platform tunnels would extend approximately 125 feet beyond and on either end of the 1,000-foot-long platform.

Figure 9-4. Example of Cross-Passenger Adit (photo, left, typical section, right)

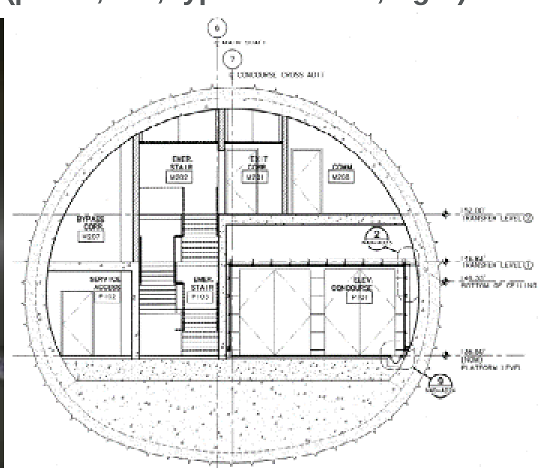


Figure 9-5. Example of Platform Adit (photo left, typical section right)

9.3.4 Cross Adits and Vent Adits

Typically, two sets of cross-passenger adits would connect the two platform tunnels. Due to existing surface infrastructure at the Nobel Drive station, a third cross-passenger adit is envisaged. At the UTC station, a third shaft would be constructed. This would allow for passenger transfer at midway along the platform.

The two sets of adits, one set at each of the two shafts, would allow access between the platforms as well as emergency egress away from the platforms. The adits at either end of the platforms would also contain the under-track supply (UTS) ducts. The spacing and size of these adits would be determined based on FLS requirements. Another two sets of adits, the transverse vent adits, would be located approximately 100 feet beyond the ends of the platform to achieve station and tunnel ventilation, as described in Section 9.3.6.

9.3.5 Station Fire/Life/Safety General Provisions

Tunnel FLS provisions are included in the Tunnel Basis of Design Report in 0.

General

If a life-threatening emergency occurs as a result of a derailment, collision, or fire in the trainway or the station, the basic life safety goals would be:

- Preserving human life, which is of prime consideration and includes all individuals: the public, operating and maintenance workers, and emergency personnel.
- Providing emergency egress for passengers.
- Providing safe access for firefighters, police, emergency medical services, and other emergency response personnel.
- Controlling the spread of hot gases and rapidly removing smoke to maintain visibility and keep the egress routes smoke-free in order to facilitate safe evacuation of the passengers.
- Minimizing property damage to the structures, equipment, and ancillary facilities.

- Purging the smoke after a fire to allow reopening of a station and restoring train operations as quickly as possible.

The FLS concepts are achieved by providing tenable conditions for evacuation of occupants. This is achieved with fire hazard control through:

- Use of fire-hardened non-combustible materials in stations, tunnels, and trains.
- Provision of fire detection, alarm notification, communication systems, and evacuation routes.
- Passive and mechanical ventilation providing smoke control and introduction of uncontaminated air to provide tenable egress paths.
- Fire safety system reliability through system redundancy and increased safety in emergency system wires and cables that might be exposed to fire.
- Provision of automatic fire suppression systems in stations provides an active system that can limit fire growth and thereby assist in reducing risk to life and property.

FLS provisions and equipment to be provided include the following:

- Emergency ventilation system.
- Dedicated firefighter access at stations.
- Fire Department access roads and turning areas.
- Emergency Management Panels (EMPs), also called fire command centers.
- Extension of first responder two-way voice/data communications radio system into all accessible underground and remote locations.
- Egress stairs.
- Emergency rescue zone spaces with two-way communication at each end of the platform.
- Emergency signage and markings.
- Passenger communications systems.
- Direct access to platform from elevated walkways in tunnels.
- Central fire alarm monitoring system.
- Fire Detection and Alarm Systems in public areas and ancillary rooms.
- Manual pull stations.
- Fire suppression systems:
  - Hydrant and fire department connections at grade;
  - Standpipe systems and hose valves;
  - Undercar deluge systems;
  - Gas suppression (Clean Agent System) in select areas/rooms; and
  - Fire extinguishers.
- Emergency lighting.

- Normal power and emergency power.
- Station Public Address systems, closed-circuit television.

In addition, the following FLS equipment would be provided at each station:

- EMP (termed Fire Command Centers in National Fire Protection Association [NFPA] 130). The EMP would be located in the public area in the immediate vicinity of the main entrance, or as determined by the requirements of the local fire service. EMPs would include at least the following provisions: fire alarm control panel, tunnel ventilation system control panel, emergency telephone, and emergency radio.
- The intrusion detection and alarm systems would detect and provide warning of entry into underground ancillary spaces, equipment and storage rooms in stations, and emergency exits. The system would also be operated when the station is closed. The alarm intrusions detection would be fed back to the monitoring station for subsequent action.

9.3.6 Station Emergency Ventilation

An emergency ventilation system is provided for the station public spaces and tunnels to provide smoke control and a tenable environment for individuals to egress to a point of safety for an Available Safe Egress Time, which must be greater than the Required Safe Egress Time calculated based on station geometry.

The station emergency ventilation system would include track dampers 50 to 100 feet beyond the ends of the platforms in both running tunnels. It would also include an over-track exhaust (OTE) duct above the trainway and a UTS duct beneath the platform running the length of both platforms. Each ventilation shaft to the surface would be dual compartment and include an exhaust shaft and a supply shaft. Each headhouse would include exhaust fans (providing both tunnel and station ventilation) and supply fans.

Station emergency ventilation would be designed to handle two scenarios:

- Normal operations ventilation; and
- Emergency ventilation for a passenger car fire.

Station fan plants would be used in conjunction with portal fan plants to provide push-pull ventilation in case of a tunnel fire as outlined in the Tunnel Basis of Design report in 0.

The station ventilation airflow schematic is shown in Drawing No. SU002 in Appendix A.

Normal Operations

Two ventilation considerations must be addressed in normal operations. First, exhausting diesel fumes as the train arrives at the station would be achieved using the OTE duct and fans at the forward end of the train. Second is blast relief, important for reducing pressure transients and platform wind as a train approaches an underground station and is principally addressed by opening the track damper before the station platform. The control system may be automated with trackway sensors that alert the system of an incoming train. It may be necessary to prevent the blast relief air from being forced through the fans; if so, there would be the need to provide fan isolation dampers and a bypass damper in each fan room. The UTS would provide make-up air to reduce fan pressure head due to the station depth. Future design optimization may include running fans at both ends of the platform to assist in blast relief and station cooling.

Emergency Ventilation for a Passenger Car Fire

In the case of a passenger car fire within the station, the OTE duct would be used to exhaust the smoke from the platform tunnel. The UTS system would provide make-up air and would help to keep the hot smoke buoyant. The Point of Safety at the entrance adits would be protected with automatic fire doors and would need to be pressurized to prevent smoke ingress into the adits during platform evacuation.

9.3.7 Station Drainage

The trackway in the station would have a deluge system to suppress an undercar fire as required by the California Building Code. Drainage must be provided to handle the deluge water and would consist of catch basins in the trackway routed to a sump pit within the cross adits. Station drainage water would be pumped to a city storm drain or sewer in accordance with environmental review and local ordinances.

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10 Summary of Drainage Considerations

The *Miramar Tunnels Alternatives Analysis Drainage Report* (0) details design requirements and potential floodplain impacts associated with the two proposed conceptual alignment alternatives as outlined above.

The UTC and Nobel conceptual alternatives begin and end in two separate watersheds, Los Peñasquitos (including Carroll Canyon) and Rose Canyon, as well as their associated floodplains. Potential flood risks influence proposed design features such as portal elevations, fill and bridge locations, and track alignment and profile. Recommended hydraulic design criteria for these features considered SANDAG design criteria, proximity to the sea level rise Area of Influence, current FEMA flood elevations, and recent hydraulic analyses in an attempt to limit impacts from and risk to project elements.

In the areas potentially affected by sea level rise, recommendations are made to elevate track and portal elevations above the 100-year flood event considering the effects of sea level rise through year 2100.

Recent hydraulic analyses were reviewed and used to assess the design elevation based upon this standard. Tunnel portals are recommended to be above the 100-year flood plus sea level rise or the current 500-year flood, whichever is greater. These recommended criteria are considered in addition to other design constraints that are not hydraulics related.

This report also describes the current FEMA Special Flood Hazard Areas (floodplains) at Los Peñasquitos, Carroll Canyon, and Rose Canyon, and the compliance requirements related to the National Flood Insurance Program. The proposed alignments should minimize impacts to the FEMA floodplains for the sake of the community and project. A recommended approach to FEMA compliance for each floodplain and alignment is provided in the drainage report.

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11 Construction Considerations

11.1 Construction Impacts

A range of impacts needs to be assessed for the conceptual alternatives. These include impacts to the following:

- Transportation and Traffic: Local roads, parking, pedestrians, site access, and local and regional transportation systems, including existing road and rail networks.
- Human Environment: Local landscape and environment, including noise and vibration, air quality, and visual impacts both during and after construction.
- Local Residents and Properties: Property rights that could be required that extend outside of the existing railroad ROW.
- Historic and Archaeological Resources: Historical, archaeological, and paleontological resources.
- Geological Hazards: Faulting and seismicity, liquefaction, subsidence, and flooding.
- Biological Resources and Ecosystems: Ecological, aquatic, and terrestrial resources, such as tidal wetlands, floodplains, woodlands, wildlife, and endangered species.
- Water Resources: Water quality or supply, surface and groundwater conditions, drainage, stormwater control, erosion, and sedimentation.
- Mined Cross Passages versus Water Table: Depending on the groundwater table, the excavation of mined cross passage may affect the water table; however, ground improvement prior to cross passage excavation can mitigate any negative impact on the groundwater table.
- Community and Local Neighborhoods.
- Site Contamination and Waste Management: Ground or groundwater contamination and risks associated with the management of waste material.
- Permitting and Approvals: The ability of the project to obtain local permits and regulatory approvals.
- Land Use and Development: Current or future land use (i.e., residential, commercial, mixed-use, industrial, transportation, or public facilities) both during and after construction.
- Recreational Resources and Open Spaces**:** Local parks and recreational facilities.
- Natural Resources: Local resources.
- Wet and Dry Utilities: Depending on the nature of the utilities and the potential ground movement, advanced relocation of utilities may be required.

11.2 Tunnel and Portal Structures Construction

11.2.1 Portals Structures

The conceptual alternatives include tunnel portal structures that stretch from the end of bored tunnels to at-grade or elevated segments and consist of U-structures transitioning to cut-and-cover or directly to the bored tunnel section. A support of excavation system is anticipated to be required to retain the existing ground on the sides of the portal structures. Support of excavation could consist of a driven steel soldier pile and timber lagging system. From the limited borings drilled during the conceptual engineering phase, both excavation and installation of support of excavation can be achieved with conventional construction equipment. Representative geologic materials and groundwater conditions should be discussed when additional subsurface investigations are performed in the future.

11.2.2 Bored Tunnel and Station Caverns

The majority of the UTC conceptual alternative tunnel alignment would be excavated within the sedimentary rock associated with both the Scripps Formation and Ardath Shale. The Nobel conceptual alternative will be predominantly excavated in Ardath Shale. Tunnel excavations should anticipate encountering soft rock conditions consisting of sandstone, siltstone, and claystone associated with these formations.

Based on the limited preliminary investigation and site assessment, the anticipated rock mass conditions should be considered as suitable for a bored tunnel excavation. Additional investigation would be needed as part of the next phase of design to better define the subsurface conditions from a geotechnical and geologic standpoint. At this conceptual level of study, the use of TBMs is considered the most appropriate for the running tunnels. TBMs would allow the lining to be built in one pass. Constructing the main line tunnels using SEM would likely result in a longer construction schedule and higher construction costs. While the majority of the running tunnel would be excavated using a TBM, the cross passages and station platform tunnels would be mined using SEM techniques. At the cross-passage locations, the precast lining would be broken out and the cross passage would be excavated using road headers or small excavators. Ground improvements would be required to allow this breakout and the associated SEM work to install the cross passages. The ground improvement methods would depend on the ground conditions at the location of each cross passage and can include canopy tubes, spiles, or grouting.

An additional 100 to 150-foot-long oversized SEM cavern may also be constructed at the north portal (345+00) of the UTC conceptual alternative. The purpose of this SEM cavern is to provide a space where the TBM cutterhead can be accessed and dismantled without having to navigate the challenges of the difference in grade between the north portal and original surface.

11.3 Tunnel Construction Staging

Tunnel construction work sites would be required at each selected portal and station location to accommodate both temporary construction work and the permanent condition. Each site should be sized and identified in the preliminary engineering phase.

Space for the following should be considered: construction trailers, water treatment plants, worker parking, mechanics shop, material and equipment laydown areas, muck handling facilities (including drying area), grout plant, electrical substation, shaft support facilities, precast segment storage areas, dry-house, site roadways and street access, perimeter fencing, temporary ventilation system, and sound walls (if required).

It is anticipated that at least 10 acres of laydown area could be required for each TBM launch portal location to enable efficient construction of the tunnels and includes parking spaces for two shifts, two days' worth of muck, and two days' worth of segmental lining storage. The precast segmental lining facility is assumed to be off-site.

It is envisaged that each of the conceptual alternative station shafts could require staging area approximately 1.5 to 3 acres in size. This size is based on similar projects of similar size.

TBM tunneling requires a larger site compared with SEM tunneling. Given that it is anticipated TBMs would be used for each of the conceptual alternatives, the construction lay-down areas are sized for TBM use. The construction site layout considers the need for the following:

- Maintain access to adjacent properties and minimize impacts to local streets and driveways.
- Minimize the number of property parcels required.
- Minimize potential impacts to property owners.
- Provide additional locations for site access both during construction and operation of the tunnels.
- Provide additional site storage in parcels already acquired.
- Increase space at portal locations for future ventilation buildings and access.
- Reduce visual impacts to adjacent properties.
- Increase clearance from the floodplain to the site boundary.

11.3.1 Power Requirements

Coordinating a power source for TBM tunneling can be a long process; therefore, a power assessment should be performed early in the preliminary engineering phase as well as coordination with the local power agency. Anticipated power consumption ranges from 8 to 12 megawatts per TBM.

11.3.2 Spoils Handling and Disposal

For bored tunnel construction, excavated spoils would be collected at the launch portal site. Spoil handling would also be required for portal construction and station construction. While each laydown site would have space for a limited amount of spoils, spoils would need be hauled off site continuously, particularly during construction of the bored tunnels and station. Haulage routes from each site to potential disposal sites would need to be identified in a later engineering phase. These routes should minimize the amount of travel on surface streets. Soil conditioners may be used during bored tunneling, so additional treatment measures may be required before the bored tunnel spoils can be disposed of or reused.

11.3.3 Groundwater Treatment

Groundwater treatment would be required for construction water and the output of any dewatering wells and wellpoints at the portals, station, and station shafts, for compliance with the Regional Water Quality

Control Plan or City sanitary sewer discharge permit. Treatment would normally be limited to removal of Total Dissolved Solids with a Baker Tank, but treatment requirements would be developed through analysis of groundwater samples during the site investigation. Stormwater runoff would also need to be managed and potentially treated.

11.3.4 Tunnel Boring Machine Procurement

With the tunnels having an internal diameter of approximately 23 feet, it is likely that the TBM(s) would need to be fabricated for purpose. Candidate manufacturers could include Robbins (Seattle), Herrenknecht (Germany), and Mitsibushi (Japan). Manufacturing capacity is limited and the schedule for procurement, design, delivery, and commissioning may take upwards of 15 months for each TBM. The manufacturing of the TBMs would typically be done concurrently with construction of the tunnel launch portal and design and manufacture of the segmental lining.

11.3.5 Number of Tunnel Boring Machines

The two twin bore tunnels may be constructed using a single TBM or using two TBMs. With a single TBM, the machine completes one tunnel first from launch portal to reception portal, is then disassembled, transported back to the launch portal, reassembled, then completes the second tunnel. Using two TBMs, one for each tunnel bored concurrently, would likely reduce the project schedule but is more costly because an additional TBM would need to be procured. A full schedule and cost comparison should be performed in a future design phase to determine the optimal number of TBMs.

11.3.6 Drive Direction

As shown in the conceptual drawings in Appendix A, at this conceptual engineering phase, it is assumed that the TBM would be launched from the south portal in Rose Canyon to the north portal for both alignment alternatives. For the UTC alternative, the north portal is located on a hillside and is not conducive to TBM launch activities, and the north portal on the Nobel alternative is located in a commercial/industrial area where there is limited space for a launch site. Therefore, the larger launch portal sites are anticipated to be located in Rose Canyon.

11.3.7 Ground Pre-Treatment at Launch Portal

The TBM would potentially be driven from the south portals located in Rose Canyon. The Quaternary age Young and Old Alluvial deposits at the portal seasonally contain groundwater. A jet-grouted block may be required at the south portal headwall to facilitate launch of the TBM particularly if operating in pressurized mode. The jet-grouted block would enable construction and annular grouting of the initial concrete segmental liner rings. Jet grouted blocks may be required at the reception portals if groundwater is present.

11.3.8 Noise Restrictions

San Diego Municipal Code Chapter 5, Article 5 Noise Abatement and Control, defines limits on permissible noise levels and restrictions on allowable construction working hours. Construction activities and general arrangements at the station and portal sites would be planned to maintain noise levels below the limits. Temporary sound walls could be used to minimize potential noise and visual impacts adjacent to residential, commercial, and retail properties.

11.3.9 Sequential Excavation Method for Station and Cross Passages

As discussed in Section 9.3, the mined station would be constructed using SEM. Construction access to the station would be provided through the two shafts. The shafts would be excavated using mechanical excavation equipment. Depending on the local ground conditions and depths of the shafts, the shafts could be constructed using a pre-installed wall around the perimeter of the shaft, such as a slurry wall. Figure 11-4 shows the excavation of a side drift for a larger tunnel, similar to the approach to be used for the larger platform tunnels (left image), and a completed platform tunnel (right image).

Figure 11-1 shows a typical worksite layout for shaft construction area.

Once excavation of the shaft is complete, construction of horizontal elements can begin. The proposed shafts would be rectangular and approximately 80 feet wide by 130 feet long internal dimensions. This rectangular shape provides for five headings from each shaft as shown on Drawing No. ST001 in Appendix A from which SEM excavation can begin. Figure 11-2 shows the SEM sequence for horizontal elements. SEM involves subdividing the full-face cross section of the various tunnels into multiple headings. Each heading is excavated by using mechanical excavation equipment such as roadheaders, and then temporary support of lattice girders and shotcrete is applied to support the ground. Figure 11-3 shows an example of a typical SEM excavation sequence. The tunnels and adits are typically completed with a cast-in-place concrete structural lining.

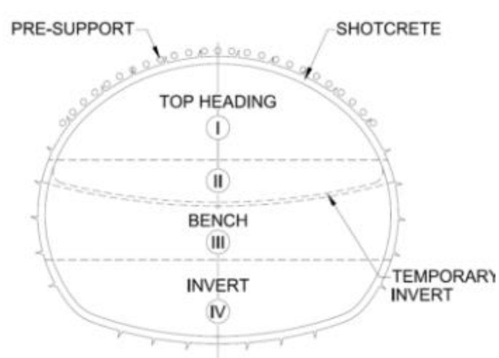
In the station construction sequence, the bored tunnels may be constructed before the station excavation begins or may be constructed after the station excavation is completed. If the station platform tunnels are mined first, then when the TBM arrives at the station excavation, the TBM would be “walked through” the open chamber to resume mining on the other side of the station. If the bored tunnels are completed first, then the mined excavation of the platform tunnels would include the removal of bored tunnel segmental lining and involve less muck handling where the bored tunnels have already been excavated. The schedule impacts of driving the bored tunnels prior to developing the platform tunnels should be evaluated as this would substantially reduce the SEM work.

SEM would also be used to construct cross passages between the running tunnels. These are smaller tunnels than at the station and would typically be top heading and bench excavation.

Figure 11-4 shows the excavation of a side drift for a larger tunnel, similar to the approach to be used for the larger platform tunnels (left image), and a completed platform tunnel (right image).

Figure 11-1. Example of Shaft Construction for the Station

Figure 11-2. Example of Typical SEM Excavation Sequence



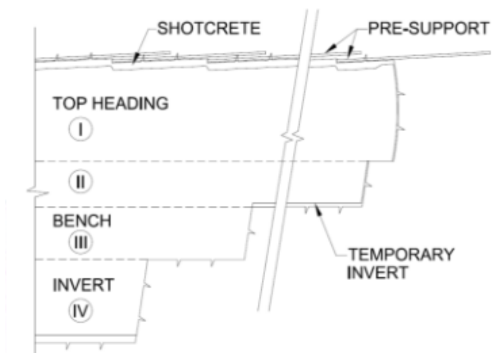
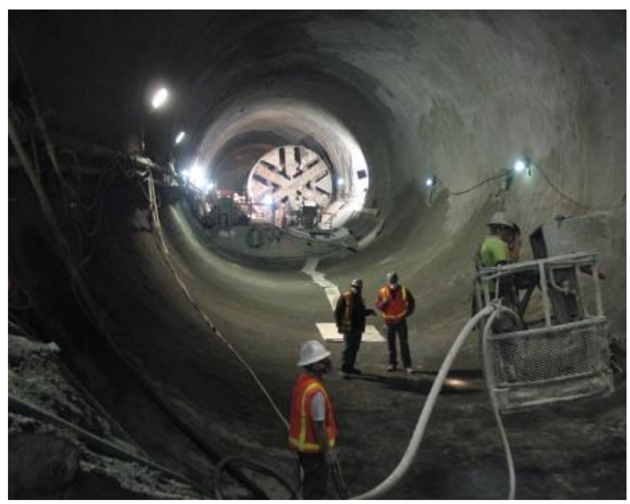


Figure 11-3. Example of Typical SEM Excavation Sequence

Figure 11-4. Example of Typical SEM Excavation Sequence and Final Completed Section for a Platform Tunnel



Following completion of the temporary shotcrete lining, a waterproofing membrane (as discussed in the Tunnel Basis of Design Report in 0) would be installed in the SEM tunnels within the station. Figure 11-5 shows an example of station waterproofing.

The final concrete lining would then be cast-in-place, for each of the station tunnels, as shown in Figure 11-6.

Figure 11-5. Example of Station Waterproofing

Figure 11-6. Example of the Station Final Concrete Lining

11.4 Operational Impacts During Construction

One of the bigger challenges in rebuilding or building additional trackage adjacent to existing operational track is the need to minimize operational impacts. In evaluating potential impacts to operations, it is assumed that the SDSVDT Project would be in operation at start of construction for either alternative. Construction would need to be phased to maintain operation of the tracks. In general, each alternative requires a raise in the existing track profile at the northern end to meet the requirements specified in the Basis of Design, primarily driven by the need to accommodate peak storm period coupled with anticipated sea level rise. Considering the anticipated service frequency at the time of construction, the existing operations would be maintained as double-track operations through the duration of the project, where possible. In addition, it is anticipated that some phases of construction may require short periods of single tracking to accommodate site constraints and to provide flexible cutovers while to maintaining service to Sorrento Valley Station until the new station becomes operational. Availability of single-track limits can be defined through further operational modeling and provide appropriate work windows, while minimizing impacts during construction.

Although specific construction phasing plans have not been developed in this study, the following summaries provide a high-level review of considerations for subsequent phases of the project, to be further developed in coordination with operational stakeholders. The summaries below provide a potential construction sequence for each alternative. It should be noted that these potential scenarios do not dictate the anticipated construction schedule and only depict a possible construction sequence.

11.4.1 University Town Center Alternative

The UTC conceptual alternative would require multiple phases to complete construction. One potential scenario includes the following (refer to Figure 11-7 for a schematic of this scenario):

1. In the first phase, at the south end, a double-tracked shoofly would be constructed to go around the proposed south tunnel portal area as the anticipated footprint required to construct would not accommodate the use of the existing track alignment. This would also require the relocation of the existing CP Rose and the universal crossovers to the south.

   Operations would be maintained on the shoofly and the remainder of existing mainline track within the project limits.

   Both tunnels would be constructed, including the station, portals, associated structures and support facilities, and mainline tracks.

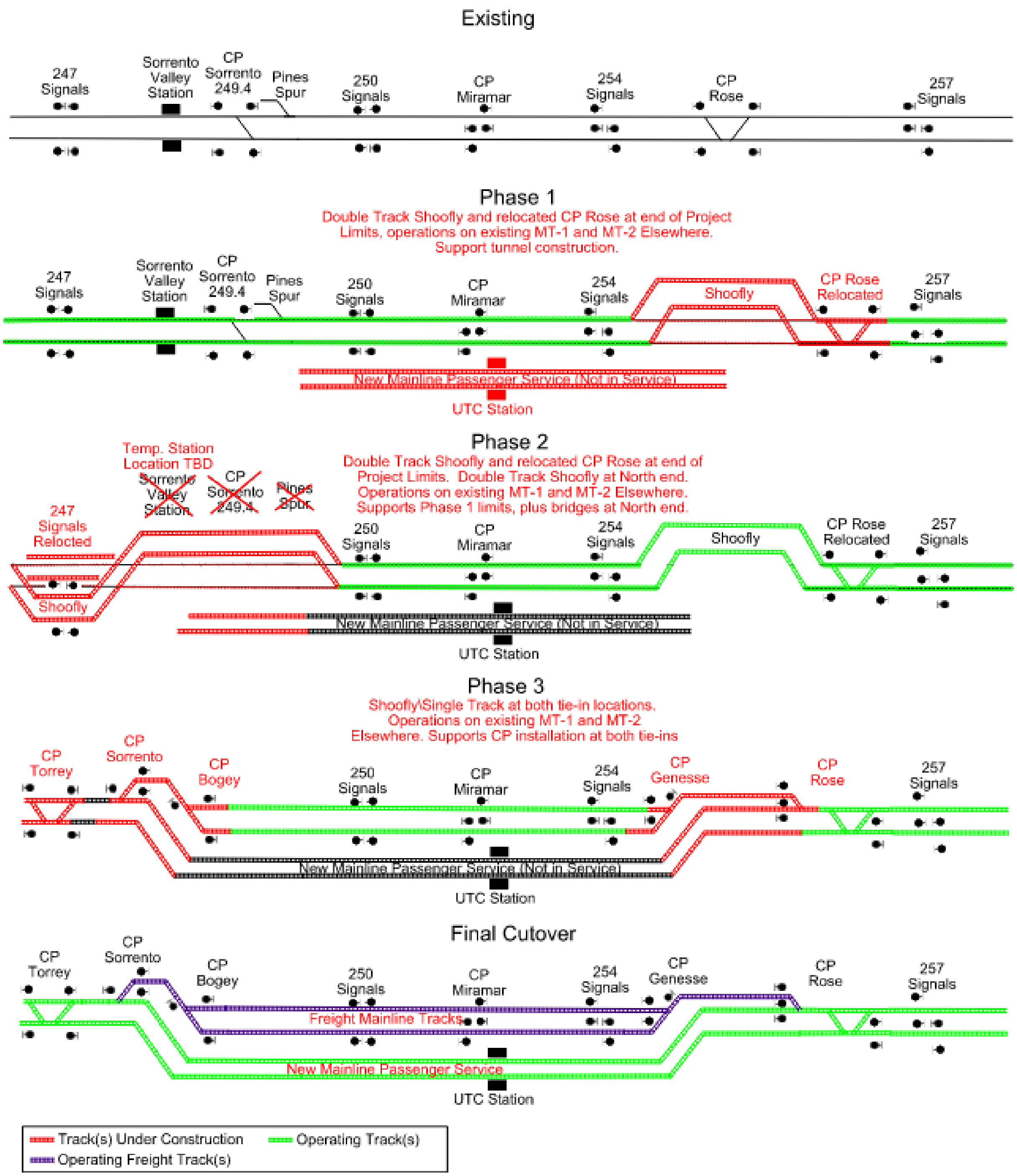
2. The second phase requires a double-tracked shoofly be constructed on the west side of the existing tracks starting at the beginning of the project. The shoofly would go across a temporary bridge adjacent to existing Bridge 248.7 and then cross over to the east side of the existing tracks. A temporary grade crossing would be required at Sorrento Valley Boulevard. The existing Pines spur and CP Sorrento would be removed and the double-tracked shoofly would continue running parallel to the existing tracks and eventually tie in before Bridge 249.9.

   The proposed shoofly at the north end to facilitate project construction impacts the existing Sorrento Valley Station. To maintain service to this community, two sites have been considered for a temporary station. One location is near CP Torrey, based on previous studies developed by the City of San Diego, and a second location is to the south near MP 249.5. Further evaluation is necessary to determine the needs of the temporary facility. For the northern location, a double-track scenario with two side platforms could be accommodated based on the City's study. For the southern location, the site could potentially accommodate a double-track shoofly, but the available footprint limits the service to one side platform adjacent to

Sorrento Valley Road. This would require crossovers and signaling infrastructure to accommodate operations to the single platform.

Operations would be maintained on both shooflies and the remainder of existing mainline track within the project limits.

Figure 11-7 UTC Potential Phasing Schematic



The proposed mainline tracks and freight mainline tracks, berm, retaining walls, bridges through Sorrento Valley would be constructed. The use of temporary shoring would be required between the operational shoofly tracks and new track under construction, similar to the approach used on the Elvira to Morena Double Track Project.

Further evaluation of the interface with the I-5 overcrossing would be necessary to confirm a double-track shoofly can be accommodated. If a single-track section is determined to be the most feasible option to accommodate construction of the new alignment through this congested area, it is anticipated that the level of service at time of construction could accommodate a limited segment of single track of approximately 1 mile, preferably in conjunction with the temporary platform serving Sorrento Valley at the northerly location noted above.

3. The third phase would require working at both tie-in locations to cutover the mainline tracks at the north end and the south end, with the removal of both shooflies, temporary bridge, temporary station, and construct the freight mainline connections.
4. Once complete, the operations would be cut over to both mainline tracks for passenger service, and both freight mainline tracks for continued freight service. This existing Sorrento Valley Station could be removed from service and demolished.

11.4.2 Nobel Alternative

The Nobel conceptual alternative would require multiple phases to complete construction. One potential scenario includes the following (refer to Figure 11-8 for a schematic of this scenario):

1. In the first phase, the start of the alignment at the north end could be deferred until a later stage, while at the south end, a double-tracked shoofly will be constructed to the east of the existing tracks within Rose Canyon to accommodate the south tunnel portal construction. It is assumed that the shoofly would transition back to the existing alignment prior to CP Rose without need to modify that control point.

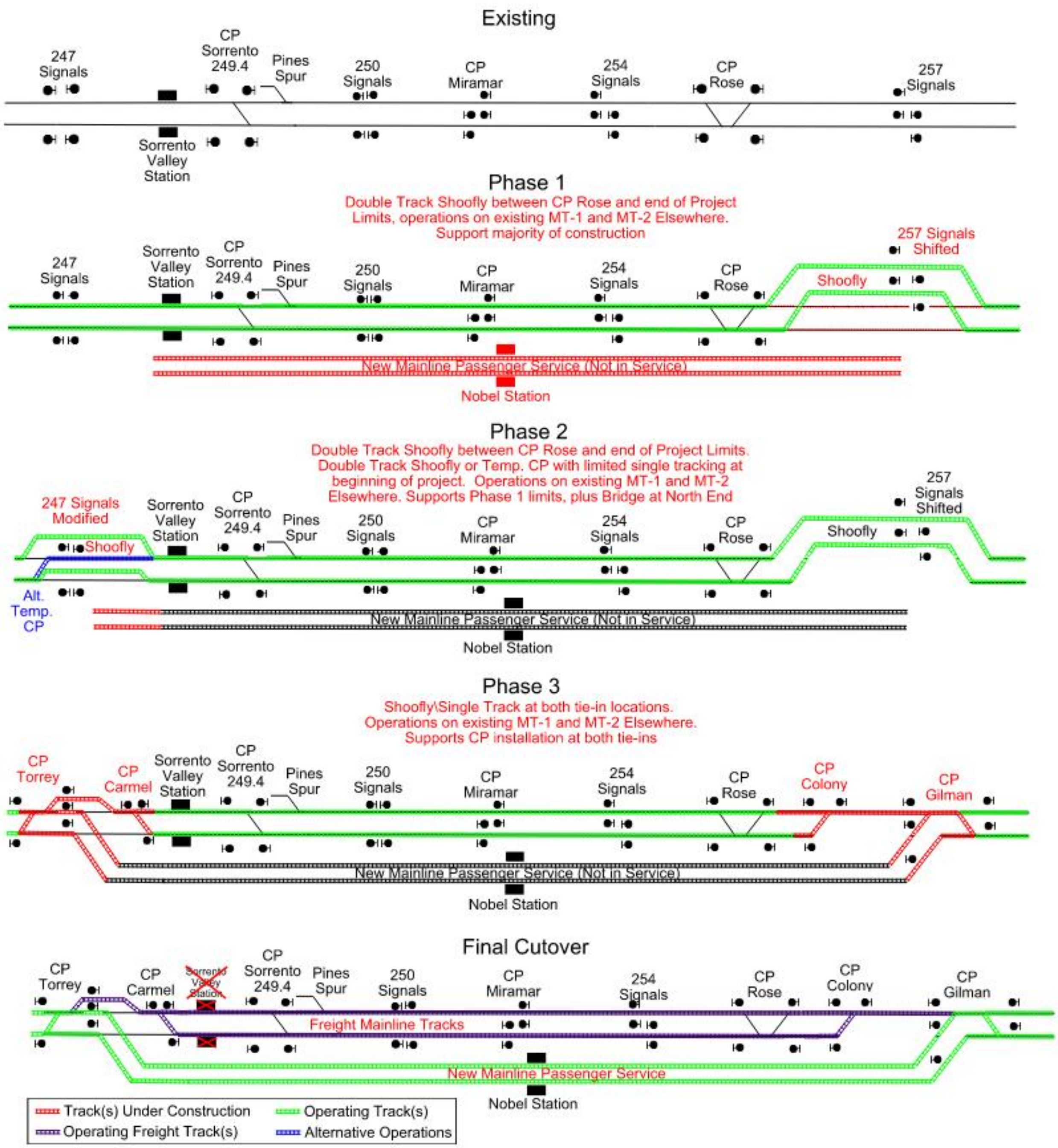
   The south portal will also impact La Jolla Colony Drive. To facilitate construction of the tunnel, south headwall, and cut-and-cover box section, roadway closures, detours, and temporary realignments are anticipated.

   Operations would be maintained on the shoofly(s) and remainder of existing mainline track within the project limits.

   The proposed mainline tracks, both tunnels including the station, portals, associated structures, and support facilities would then be constructed without impacts to train operations.
2. The second phase will require use of single tracking or a double-track shoofly to accommodate the bridge construction at the start of this alignment, including the restoration of La Jolla Colony Drive. This would include establishing temporary control points and special trackwork to accommodate a short segment of single-track operations if the shoofly is not the preferred approach to support operations. The double-track shoofly would be retained at the tie-in at the south end.
3. The third phase would require both tie-in locations to cut over the mainline tracks at the north and the south ends, with the removal of the shoofly(s), and\or temporary control points. The tie-in to allow freight operations will remain on Miramar Hill and include constructing CP Torrey and CP Carmel at the north end, and CP Colony, and CP Gilman at the south end.

4. Once complete, the operation would be cut over to both mainline tracks for passenger service, and both freight mainline tracks for continued freight service. This existing Sorrento Valley Station could be removed from service and demolished.

Figure 11-8 Nobel Potential Phasing Schematic



11.4.3 Summary

In comparing the two conceptual alternatives, the UTC alternative includes additional risk elements in the interface with the I-5 overcrossing, the need to develop and serve a temporary station, and coordinating and/or incorporating the City of San Diego's intent to relocate and grade separate Sorrento Valley Boulevard. This may require additional phases; however, based on the anticipated construction schedule, the Nobel alternative is expected to have a longer duration due to the length of the tunnel.

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12 Tunnel Operations and Maintenance Considerations

Both the operational plan and the tunnel maintenance plan would be developed as the design progresses.

12.1 Operational Considerations

Normal tunnel operations consist of routine tasks that ensure the safe operation of the tunnels. These tasks include:

- Monitoring train operations within the tunnels.
- Monitoring incident detection systems.
- Inspecting critical areas to ensure a safe operating environment.
- Checking that FLS and security systems are operational; these systems include ventilation equipment, air quality monitors, pump and pumping equipment, lighting, and closed-circuit television.
- Maintaining service vehicles.
- Cleaning of tunnels and tunnel auxiliary structures.

12.2 Tunnel Maintenance

An effective maintenance program would limit expenditure, minimize the amount of tunnel downtime, increase safety to the traveling public, and maximize levels of service. Maintenance activities can range from extensive repair and replacement of tunnel components as the tunnel ages through to more routine maintenance activities. Routine maintenance activities can include the following:

- Removing debris in and around the tunnels and auxiliary facilities.
- Washing tunnel structures, flushing drains and cleanouts, cleaning track drainage, and changing lighting and lighting fixtures.
- Servicing ventilation equipment including testing and calibrations.
- Leak repair and remediation.
- Testing signals.
- Inspecting track.

12.2.1 Maintenance Rail Equipment

After consultation with NCTD on May 12, 2021, the following vehicles would likely be required for NCTD for maintenance of the tunnel and tunnel systems. Maintenance needs should be evaluated in more detail in a future phase.

- Three bucket trucks;

- Three hi-rail vehicles; and
- Three utility terrain vehicles.

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13 Environmental Compliance

13.1 National Environmental Policy Act

Two likely federal actions associated with the project could trigger the need to demonstrate compliance with the requirements of NEPA (42 United States Code [USC] 4321, et seq.) and the Act's implementing regulations (40 Code of Federal Regulations 1500 et seq.). These actions are:

- Federal funding provided by FRA or FTA; and
- Permit Issued by the U.S. Army Corps of Engineers under Section 404 of the Clean Water Act.

FRA and FTA recognize classes of actions that normally require an EIS. Actions likely associated with the Miramar Tunnel project appear to fall within 23 USC 771.115 (a)(3) construction or extension of a fixed transit facility (e.g., rapid rail, light rail, commuter rail, bus rapid transit) that will not be located primarily within an existing transportation ROW.

In addition, the UTC conceptual alternative may impact a National Register-Listed Native American Village site (Village of Ystagua). Such impacts could trigger the need for an EIS. The project team will need to evaluate the need for an EIS in future phases.

13.2 California Environmental Quality Act

CEQA (California Public Resources Code Section 2100 et seq.) and the Guidelines for Implementation of the CEQA (California Code of Regulations Section 15000 et seq.) could apply to the Miramar Tunnel Project because its approval likely constitutes a discretionary action. The project likely may not qualify for a statutory or categorical exemption or for a Negative Declaration or Mitigated Negative Declaration; for example, the UTC conceptual alignment may impact the National Register-Listed Native American Village of Ystagua. Impacts to this site could trigger the need for an EIR. SANDAG would be the lead agency for compliance with CEQA, if required. The project team will need to evaluate the need for an EIR in future phases.

13.3 Regulatory Permitting

The project team will evaluate the necessary permits in future phases. The following permits could be required based on the conceptual alignments in this study, which all involve placement of fill in waters of the United States, occur in the Coastal Zone, have the potential to affect threatened and endangered species, and have the potential to affect important cultural resources:

- Clean Water Act Section 401 Water Quality Certification.
- Clean Water Act Section 404 Fill Permit.
- Rivers and Harbors Act Section 10 Permit (processed with the Section 404 permit).
- California Coastal Act Coastal Development Permit and/or Coastal Zone Management Act Federal Consistency Certification.
- Federal Endangered Species Act Section 7 Consultation.

- California Fish and Game Code Section 1600 Streambed Alteration Agreement and Section 2081 Incidental Take Permit; and
- National Historic Preservation Act Section 106 Consultation.

Additional details regarding Environmental Compliance are provided in Appendix B.

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14 Project Schedule

The overall project schedule is subject to future actions by the SANDAG Board of Directors and the availability of future project funding. The project schedule was developed to identify key milestones necessary to successfully deliver the project by 2050 as shown in the 2021 Regional Transportation Plan. A detailed schedule for each activity has not been developed but was based upon providing reasonably anticipated durations considering the current conceptual alternatives. It is anticipated that construction durations would be further evaluated during the preliminary engineering and environmental phase as the alternative selection process is finalized. The preliminary engineering and environmental phase of the project is assumed to follow an EIR/EIS approach to gain project clearance and approval to enter final design. Although not discussed in detail, the project delivery method should be selected as an early action to expedite the project as the schedule is subject to change depending on the delivery method.

Figure 14-1 provides an estimated schedule. Construction is estimated to last up to 8 years.

Figure 14-1. Estimated Project Schedule

Activity Name	Start	End	2038	2039	2040	2041	2042	2043 - 2050
Preliminary Engineering and Environmental	Q1/2038	Q4/2039						
Circulate Draft Environmental Document	Q4/2038	-						
Record of Decision	Q4/2039	-						
Final Design	Q1/2040	Q4/2041						
Right of Way Support Acquisition	Q1/2040	Q4/2042						
Construction	Q1/2042	Q4/2050						

Notes:
[1] Assumes two-year EIS preparation schedule per the One Federal Decision process codified in the Infrastructure, Investment, and Job Act.

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15 Project Funding

Funding for this planning study has been primarily Federal Regional Surface Transportation Program funding by a Caltrans planning grant and local *TransNet* funds.

Project funding sources for future phases of the project have not currently been identified. It is expected that funding would come from several public sources at the federal, state, and local levels.

15.1 Federal

There are funds available through the Federal Highway Administration, FTA, and FRA that are either formula funds to the San Diego Region or competitively awarded through grant applications. Typically, there are matching funds requirements. SANDAG also works with the San Diego federal delegation through the federal earmark or appropriations processes. Lastly, the U.S. DOT Build America Bureau offers low-interest loan programs for large-scale improvement projects such as the Transportation Infrastructure Finance and Innovation Act and Railroad Rehabilitation and Improvement Financing.

15.2 State

There are several formula and competitive grant programs, primarily funded through Senate Bill 1 and the Cap-and-Trade Programs that could be potential funding sources. These include the Local Partnership Program, Solutions for Congested Corridors Program, Transit and Intercity Rail Capital Program, and Trade Corridor Enhancement Program. Matching funds are also needed or at least recommended, depending on the program. The State Transportation Improvement Program includes funds for both regional and interregional improvement projects.

15.3 Local

The *TransNet* transportation sales tax program funds a variety of transportation improvements throughout the San Diego Region. The LOSSAN Rail Corridor in San Diego County has benefited from this program, primarily through funding to increase track capacity over the last 12 years, as well as providing a local matching fund source to be leveraged for additional state and federal funds. SANDAG's 2021 Regional Plan assumes various sources of revenue including additional sales tax funding measure for future transportation improvements such as those identified in the SD-LOSSAN Study.

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16 Construction Costs and Operations and Maintenance Costs

16.1 Construction Costs

The construction costs included in 0 were established based on 10 percent conceptual engineering and cost data obtained from various sources including recent projects, Caltrans, and FTA. The tunnel costs were developed to a Class 5 level. All unit costs from recent projects have been escalated to 2023 dollars. A contingency totaling 35 percent of the construction cost is added to each estimate to account for the conceptual nature of the design included with this report. Additionally, the tunnel costs have an added 20 percent contingency on top of the 35 percent included for the total construction cost. These preliminary level estimates are subject to change as the design progresses in the next phase. Note that these costs do not include soft costs, which will be provided in a separate project study report to be developed by others.

The total estimated construction cost for UTC is approximately $2.88 billion in 2023 dollars.

The total estimated construction cost for Nobel is approximately $2.60 billion in 2023 dollars.

16.2 Tunnel Operations and Maintenance Costs

The tunnel operations and maintenance costs included in 0 were established based on the following parameters:

- Team of three inspectors/maintenance crew operating 260 shifts per year.
- Shifts are eight hours/day.
- Equipment per shifts consists of pick-up truck, vent fans, utility terrain vehicles, and miscellaneous power (refer to Section 0).

Personnel needs were developed through feedback from experienced individuals who have worked for various operator/maintainer agencies with tunnel operations and maintenance programs.

The total annual estimated cost for the tunnel system would be approximately $5 million in 2023 dollars, which includes a 20 percent contingency. These annual costs are the same for both alignment options, which is appropriate at this stage given the preliminary nature of the design and estimate. Operations and maintenance funding needs and sources should be further evaluated in a future phase.

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17 Next Steps and Future Considerations

The conceptual engineering effort completed as part of this report was built upon the recommendations of the PDT. These efforts have concluded with 10 percent conceptual plans for two conceptual alternative alignments that address the current and future needs of the corridor.

It is recommended that both alternatives be carried forward into the preliminary engineering and environmental phase for further evaluation. Throughout the development of the conceptual plans and associated reports, the team identified various items that should be considered or reviewed during future phases of the project. Although this list is not exclusive, it highlights some of the key project features that should be further developed in support of the environmental documents:

- Further evaluate the station concepts including station configuration options, alternative shaft locations to reduce impacts, vertical circulation, connections to trolley, and potentially reducing platform length.
- Further refine and evaluate the single- and twin-bore configurations.
- Evaluate the cost/benefit of keeping all freight operations on Miramar Hill with passenger-only operations in the tunnel versus a joint passenger/freight tunnel with only freight operations servicing Miramar wye on Miramar Hill.
- Conduct building foundation investigation of buildings near the proposed alternatives.
- Evaluate alternative delivery methods and determine preferred contracting approach.
- Develop draft construction phasing plans and schedule.
- Further refine tunnel portal footprints and identify additional opportunities to reduce impacts.
- Evaluate potential use of SEM cavern at the UTC conceptual alternative north portal.
- Coordinate with City of San Diego on appropriate approach to incorporate the Sorrento Valley Boulevard relocation and grade separation into UTC conceptual alternative.
- Coordinate with stakeholders on the proposed temporary solutions to maintain service to Sorrento Valley Station as part of the UTC conceptual alternative.
- Continue conversations with General Atomics to confirm long-term plans for its property at the north portal of the Nobel alternative and its buildings on Tower Road.
- Update the Basis of Design Report to incorporate findings from the alternatives analysis effort and update the LOSSAN design criteria to adopt new criteria for Class 6 track and tunnel design.
- Develop a robust risk analysis.
- Determine whether additional portal alternatives should be considered.
- Work with stakeholders to identify alternative disposal/reuse options for the tunneling and other soils associated with construction of the project.
- Develop utility base mapping, utility potholing, and complete utility conflict matrix for the rest of the alignment outside of the tunnel and portals. Include additional effort to flush out major utility conflicts that could impact environmental process.

- Determine the geologic subsurface conditions along the proposed tunnel alignment at depth.
- Collect additional groundwater data and provide quantitative data using piezometers along the proposed conceptual tunnel alignment.
- Collect additional data to document variability within subsurface geologic formations.
- Conduct additional investigation for the mapped fault crossing the proposed alignment to determine impacts on the proposed tunnel design and construction.
- Perform additional in-situ testing to further develop subsurface design parameters along the proposed tunnel alignment including soil modulus and permeability values.
- Collect additional shear wave velocity data for the purposes of characterizing the subsurface conditions for design and construction.
- Update existing floodplain models to reflect current topography, hydrology, and future sea level rise projections.
- Federalize the project to begin the NEPA process; work with federal lead agency to scope NEPA review and develop schedule.
- Conduct cultural resources records search and pedestrian survey.
- Conduct hazardous materials records search.
- Conduct biological resources survey to verify the San Diego GIS vegetation data.
- Prepare habitat assessment maps for endangered, threatened, or candidate species based upon refined vegetation mapping.
- Conduct survey to refine the limits of Waters of the U.S. and CCC wetland as indicated by the National Wetland Inventory.
- If CEQA is required, prepare maps of geologic formations and identify those with the highest probability to support sensitive paleontological resources.
- Develop a bridge type selection report.

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