# San Dieguito to Sorrento Valley Double Track

## Del Mar Tunnels Alternatives Analysis Report

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

August 2023


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# ABSTRACT

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| ABSTRACT: | This Alternatives Analysis Report documents the analysis of conceptual alignment alternatives for relocating the existing singletrack alignment of the Los Angeles-San Diego-San Luis Obispo Rail Corridor through the City of Del Mar and City of San Diego. Five alignment alternatives were refined based on a previous conceptual engineering study and evaluated against a set of performance criteria. Two of these alternatives were advanced to 10 percent conceptual engineering and were further analyzed for engineering and environmental considerations. Based on feedback from stakeholders and community groups, four additional potential tunnel portal locations were then also evaluated to further minimize impacts on the community and private properties. Additional conceptual alignments were looked at from a high level to demonstrate potential connection between various portal locations. |

# Contents

## Tables

## Figures

# Appendices

# Acronyms

| | |
|---|---|
| ACP | asbestos cement pipe |
| ATS | automatic train stop |
| CalSTA | California State Transportation Agency |
| Caltrans | California Department of Transportation |
| CCC | California Coastal Commission |
| CCHS | Crest Canyon Higher Speed |
| CDM | Camino Del Mar |
| CEQA | California Environmental Quality Act |
| CP | Control Point |
| CPUC | California Public Utilities Commission |
| EIR | Environmental Impact Report |
| EIS | Environmental Impact Statement |
| EMU | Electric multiple unit |
| FEMA | Federal Emergency Management Agency |
| FRA | Federal Railroad Administration |
| FTA | Federal Transit Administration |
| GIS | Geographical information systems |
| I-5 | Interstate 5 |
| IDP | Infrastructure Development Plan |
| LOSSAN | Los Angeles-San Diego-San Luis Obispo |
| MP | milepost |
| MT | main track |
| MTS | San Diego Metropolitan Transit System |
| NCTD | North County Transit District |
| NEPA | National Environmental Policy Act |
| PDT | Project Development Team |
| PTC | positive train control |
| PVC | polyvinyl chloride pipe |
| ROW | right-of-way |
| SANDAG | San Diego Association of Governments |
| SBCTA | San Bernardino County Transportation Authority |
| 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 Project |
| SEM | Sequential Excavation Method |
| TBD | to be determined |
| TBM | tunnel boring machine |
| U.S. | United States |
| U.S. DOT | United States Department of Transportation |
| ZEMU | Zero-emission Multiple Unit |

# Executive Overview

The Los Angeles-San Diego-San Luis Obispo (LOSSAN) Rail Corridor passes through the City of Del Mar atop coastal bluffs, and the alignment consists of a single track in this location. This report documents the analysis of alternatives for the San Dieguito to Sorrento Valley Double Track (SDSVDT) Project, which would relocate the alignment from the Del Mar bluffs to a double track, higher-speed alignment between Milepost (MP) 242.8 on the south side of the San Dieguito Lagoon basin (near the Del Mar Fairgrounds) to MP 247.8 at the north end of Sorrento Valley in the City of San Diego. Note that in previous documentation and appendices, this project was referred to as the Del Mar Tunnels. To accommodate higher speeds by minimizing curves and grades while traversing the area's varied topography, the project alignment would consist primarily of a tunneled section with additional bridge, trench, and at-grade sections. Modifications to the train control signaling system would be required between Control Point (CP) Valley (MP 242.1) and CP Sorrento (MP 249.25).

The LOSSAN Rail 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 freight service rely on the corridor to move nearly 8 million passengers and $1 billion in goods each year. Bluff erosion and the threat of sea level rise due to climate change pose a threat to the continued safety and reliability of rail operations through Del Mar, and the single-track alignment restricts capacity to increase rail service. To address these concerns, the San Diego Association of Governments (SANDAG) commissioned this alternatives analysis as part of the San Diego Regional Rail Corridor Alternative Alignment and Improvements Conceptual Engineering Study (SD-LOSSAN) that is expected to be completed in fall 2023. SD-LOSSAN is a countywide study which will determine long-term safety and operations solutions for the San Diego County segment of the LOSSAN Rail Corridor.

Table ES-1 provides a timeline summarizing the major milestones for the alternatives development.

**Table ES-1. Alternative Development Milestones**

| Timeframe | Milestone Description |
|---|---|
| December 2017 | **Conceptual Alignment Study (conducted prior to this alternatives analysis study):** Completion of five conceptual alternatives including: CDM, CCHS, Crest Canyon, I-5, and I-5 East |
| October 2020 | **Initiation of Alternative Analysis Study:** This initial step to the alternatives analysis developed basis of design and evaluation criteria to be considered by SANDAG, NCTD, MTS, LOSSAN, SCRRA, Caltrans, FRA, and BNSF through a series of workshops and ranking conceptual alternatives based on defined planning, construction, post-construction/operational, and community impact considerations |
| Ongoing since late 2020 | **Stakeholder Outreach and Community Meetings:** Outreach and meetings were conducted to introduce the project and purpose. Refer to Section 4, Public Involvement for details |
| May 2021 | **Refined Alternatives:** The 2017 conceptual alternatives were refined to meet established basis of design criteria. These conceptual alternatives were ranked based on evaluation criteria by the PDT. CDM and CCHS advanced to a 10 percent level of design |
| August 2022 | **Revisions to the Design Criteria:** Revisions to basis of design criteria were considered to address feedback received during stakeholder outreach after review of the refined conceptual alternatives, with a focus on reducing potential impacts on the community and private properties |

**Table ES-1. Alternative Development Milestones**

| Timeframe | Milestone Description |
|---|---|
| August 2023 | **Alternative Analysis Report:** Updated two conceptual alternatives to incorporate revised design criteria and analyze the feasibility of four other potential portal locations based on stakeholder feedback |

Notes:
CCHS=Crest Canyon Higher Speed; CDM=Camino Del Mar; FRA=Federal Railroad Administration; I-5=Interstate 5; LOSSAN=Los Angeles-San Diego-San Luis Obispo; MTS=San Diego Metropolitan Transit System; NCTD=North County Transit District; PDT=Project Development Team; SANDAG=San Diego Association of Governments; SCCRA=Southern California Regional Rail Authority

For the purpose of this analysis, five conceptual alignment alternatives considered were based on a SANDAG conceptual alignment study completed in 2017, as listed in Table ES-2. These conceptual alternatives were refined as part of this study 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. The refinement of conceptual alignments resulted in two variations of the Crest Canyon alternative, one passing above and one below Carmel Valley Road. Conversely, the two variations of the Interstate 5 (I-5) alignment from the 2017 study were refined to a single conceptual alignment to be evaluated as part of this study.

**Table ES-2. Alignment Alternatives**

| 2017 Conceptual Study | SD-LOSSAN (Current Study) |
|---|---|
| CDM | CDM |
| CCHS | CCHS |
| Crest Canyon | Crest Canyon Above Carmel Valley Road |
| | Crest Canyon Below Carmel Valley Road |
| I-5 | I-5 |
| I-5 East | |

Notes:
Caltrans=California Department of Transportation; CCHS=Crest Canyon Higher Speed; CDM=Camino Del Mar; I-5=Interstate 5; SD-LOSSAN=San Diego Regional Rail Corridor Alternative Alignment and Improvements Conceptual Engineering Study

To evaluate the conceptual alternatives, workshops were conducted with the Project Development Team (PDT), which consists of representatives from SANDAG, NCTD, the California Department of Transportation (Caltrans), Southern California Regional Rail Authority (SCRRA), FRA, the LOSSAN Rail Corridor Agency, BNSF, and the San Diego Metropolitan Transit System (MTS). In October 2020, the PDT reviewed and selected evaluation criteria to be used in ranking of the proposed alternatives for this planning study. The group selected a total of 11 criteria to use in ranking the conceptual alternatives based on defined planning, construction, post-construction/operational, and community impact considerations. Each public agency then ranked the importance of each criterion, and the results were averaged to determine the overall weighting of each criterion.

In May 2021, the PDT reviewed advantages and disadvantages of each conceptual alternative and then worked as a group to assign scores of 1 through 5 to each alternative for all evaluation criteria. Using these scores and the criteria weighting, an overall score was computed. The Crest Canyon Higher Speed (CCHS) alternative scored highest, as it provided the most benefit relative to the

evaluation criteria. The Crest Canyon Above Carmel Valley Road alternative scored second highest; however, rather than selecting two Crest Canyon alternatives with identical north portals and similar south portals, the next highest scoring alternative, Camino Del Mar (CDM), was recommended as the second alternative to be carried forward into the preliminary engineering and environmental phase.

The CDM (publicly known as West) and CCHS (publicly known as East) conceptual alignment alternatives were then advanced to 10 percent level conceptual engineering, and further analysis was conducted, including consideration of potential implications for right-of-way (ROW), utilities, grade separations, railroad systems, construction, and environmental impacts.

As a result of the feedback from stakeholder outreach and community presentations, which focused on reducing potential impacts on the community and private properties, the assumptions made as part of the basis of design were reevaluated with proposed engineered solutions to address the modified design criteria for the two recommended alternatives. As a result of this reevaluation, two specific design constraints were modified:

1. The tunnel diameter controlled by the shared use agreement between BNSF, NCTD, and MTS and the current LOSSAN Design Criteria
2. The approach to track subgrade elevations in relation to peak storm events and sea level rise

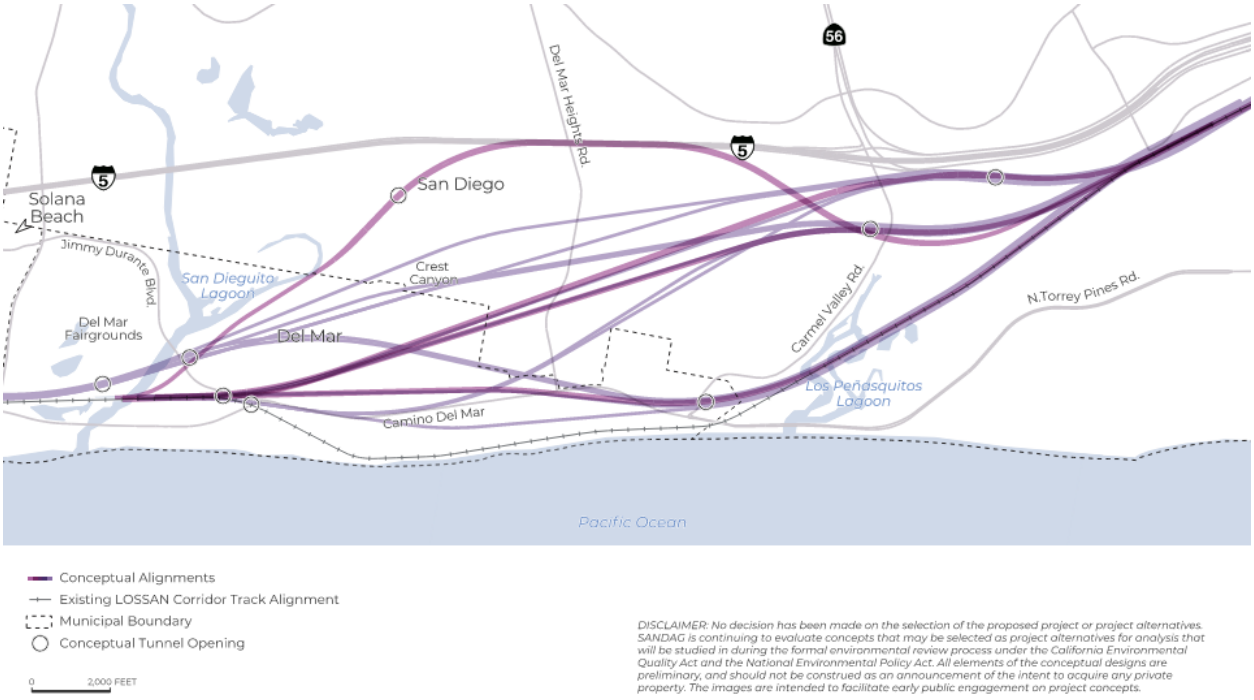
As to the first design constraint, SANDAG worked with BNSF and NCTD to reduce the tunnel diameter to reflect current clearance requirements for tunnels considering BNSF, SCRRA, and California Public Utilities Commission (CPUC) standards that would accommodate all current and future operations along the rail corridor (rather than accommodating the clearance requirements provided in the shared use agreement between BNSF, NCTD, and MTS).[1] An amended shared use agreement would be necessary to serve as formal approval for use of the revised clearance assumptions. For the second design constraint, the profile adjustments could allow for significant reductions in ROW impacts at the portal locations, reduce the impacts on the local roadway system, and decrease potential visual impacts due to the lower profile of the railroad, with the introduction of flood walls and other mitigation measures to protect the track infrastructure during peak storm events.[2]

In addition to these modifications, other potential portal locations were considered to address feedback on potential impacts on the community and private property owners and to take advantage of the design criteria modifications, with these potential portal locations leading to further refinement of previous conceptual alignments. Although not noted above as a removed project constraint, alternatives were also considered that would impact the proposed Del Mar fairgrounds special events platform. Three alternative north portals (north portal in fairgrounds, north portal within CDM, and north portal over Jimmy Durante) and one south portal (south portal within knoll near I-5) location were evaluated for feasibility. Based on the additional potential portal locations, several conceptual alignments as depicted in Figure ES-1 have been determined to be geometrically viable and are proposed for further consideration.

[1] North County Transit District (NCTD) standards do not include a composite dynamic car envelope, so Southern California Regional Rail Authority (SCRRA) standards were used instead.

[2] Due to the reduced tunnel diameter, a single bore option should be considered as a viable alternative and carried forward for further evaluation.

## Figure ES-1 Conceptual Alignments




When the alternatives are advanced beyond the current 10 percent conceptual engineering, potential cost savings, project delivery methods, and construction phasing 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 are viable options and should be carried forward for further evaluation.

# 1 Project Description

This project is part of a larger program of improvements to be carried out on the LOSSAN Rail Corridor 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 documents the analysis of conceptual alternatives for relocating the existing single-track alignment of the LOSSAN Rail Corridor through the City of Del Mar and City of San Diego, where the rail line runs along a terrace on the coastal bluffs, to a future double tracked alignment between the south side of the San Dieguito Lagoon basin (near the Del Mar Fairgrounds) and the north end of Sorrento Valley in the City of San Diego. The conceptual alternatives analyzed would replace the existing LOSSAN Rail Corridor alignment along the coastal bluffs with a new alignment away from the bluffs, primarily located within tunnels through the coastal hill of Del Mar and on aerial structures and berm through Los Peñasquitos Lagoon. The relocation of the tracks would eliminate safety and operational risks caused by bluff erosion and provide greater track capacity and a higher operating speed for trains that use the corridor, enabling projected increases in service.

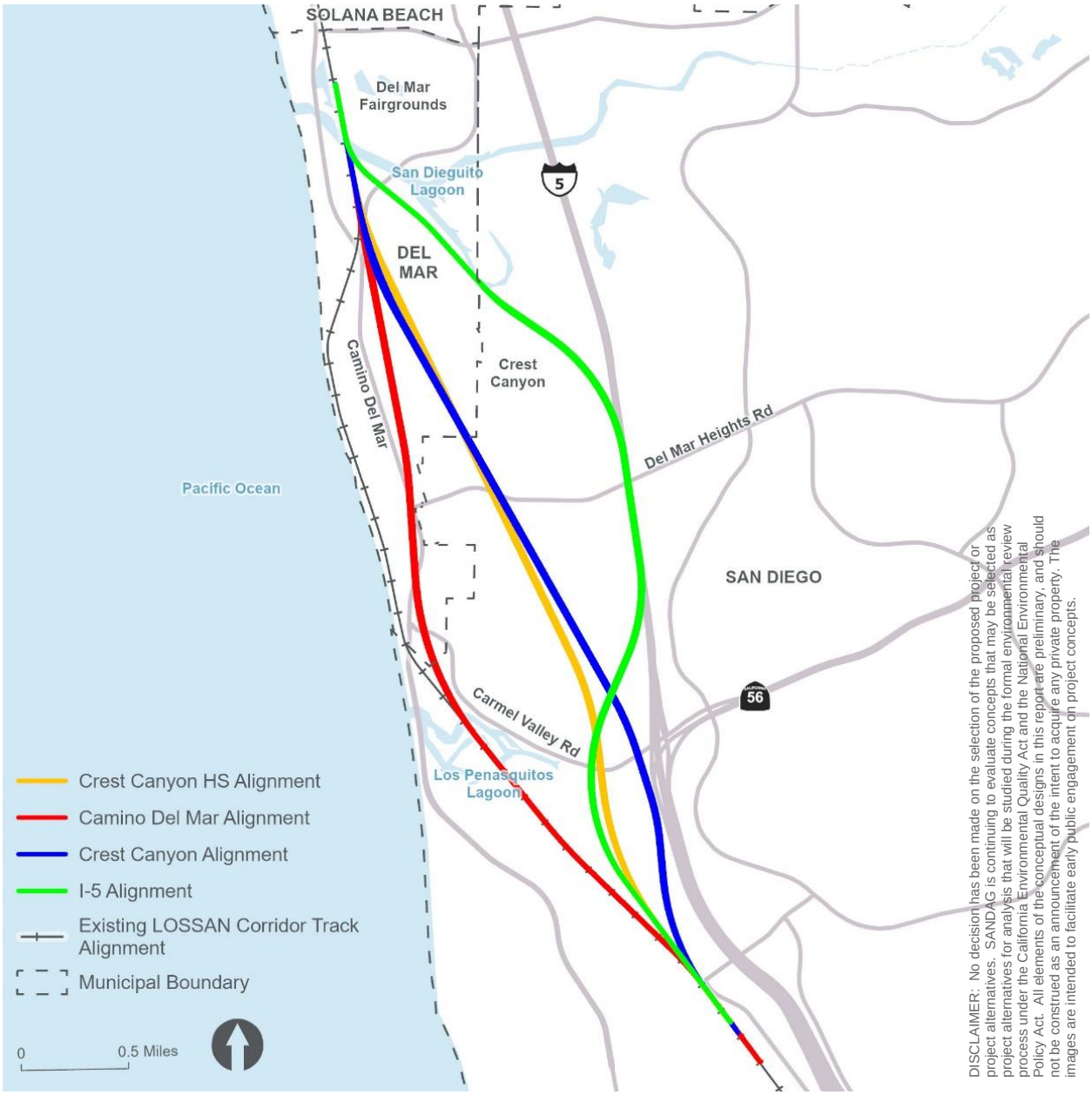
Five tunnel alignment alternatives were initially developed in a 2017 study performed for SANDAG: *Conceptual Engineering and Environmental Constraints for Double Track Alignment Alternatives Between Del Mar Fairgrounds and Sorrento Valley* (HNTB 2017). In the current conceptual alternatives analysis, the initial five alignment designs were refined to achieve higher operating speeds up to 110 miles per hour and then analyzed to determine their effectiveness in meeting the project's preliminary evaluation criteria. Conceptual alignments were evaluated based on defined planning, construction, post-construction/operation, and community impact considerations. At the conclusion of the evaluation process, two alignments were carried forward for additional evaluation. In addition, four additional potential portal locations were added to the analysis for future consideration.

## 1.1 Project Location

The project study area is located in San Diego County in the Cities of Del Mar and San Diego. The segment of track to be relocated is between MP 242.8 and MP 247.8 of the San Diego Subdivision, which is part of the LOSSAN Rail Corridor, and the project would also require modifications to the signal system between MP 242.1 and MP 249.25. Ownership of the San Diego Subdivision is split between NCTD (north of MP 245.6) and MTS (south of MP 245.6). Figure 1-1 shows the limits of the San Diego Subdivision with the project study area identified, and Figure 1-2 shows the five conceptual alternatives that were evaluated. These alignments are discussed further in Section 3.3.

## Figure 1-1. Project Location

**Figure 1-2. Study Alignments**




Notes: Two options for the Crest Canyon Alignment were studied, crossing either above or below Carmel Valley Road.

## 1.2 Project Reporting Structure

The project is guided by two distinct reporting groups. First is the PDT, which consists of transportation agencies and railroad partners who meet on a monthly basis to track project progress and provide feedback, such as that used to evaluate and score the different conceptual tunnel alignment alternatives to relocate the railroad tracks off the bluffs. The PDT was responsible for selecting analysis criteria, providing weighting for each criterion, reviewing relevant information about the proposed alternatives, scoring each alternative using the criteria and weighting, and ultimately determining which alternatives to carry forward for further 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 eastern part of the 351-mile LOSSAN Rail Corridor, linking San Diego, Los Angeles, and San Luis Obispo. The LOSSAN Rail Corridor is the second busiest intercity passenger rail corridor in the United States (U.S) and supports commuter (COASTER), intercity (Pacific Surfliner), and BNSF freight rail services. The San Diego Subdivision, which is the easternmost segment of the LOSSAN Rail 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, and 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 (double track), totaling 15.8 miles of single track and 44.3 miles of double 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 a single main track. At 5.65 miles, it is the longest remaining segment of single main track on the corridor in San Diego County. The west end of this single-track section is located at CP Valley (MP 242.18), approximately three-quarters of a mile east of the Solana Beach Station. The east end of this single-track section is located at CP Torrey (MP 247.83), just west of the Sorrento Valley Station. In Del Mar, there is a 2675-foot-controlled siding between CP Crosby at MP 243.36 and CP Del Mar at MP 243.92 that only passenger trains are permitted to use.

SANDAG is continuing to advance plans to construct the San Dieguito Double Track and Special Events Platform Project, which would reduce the length of the existing single-track bottleneck between Solana Beach and Del Mar by constructing 2.1 miles of second main track between CP Valley and CP Del Mar. The San Dieguito River Bridge is near the end of its service life (constructed in 1916), requires frequent and expensive maintenance and is often flooded during high tide events. The project includes:

1. Construction of a new double track bridge across the San Dieguito Lagoon (replacing the 100-year-old plus wooden trestle San Dieguito River Bridge, which is near the end of its design life);
2. Reconstruction of the CP Valley interlocker as a universal crossover;
3. Elimination of the existing Del Mar controlled siding to provide room for the second main track at that location;
4. Improved lagoon flows and coastal habitat protection;
5. A new underpass to connect the Crest to Coast trail to the beach; and,
6. A new special events platform located adjacent to the Del Mar Fairgrounds at approximately MP 243. The new double track bridge will be elevated above the 100-year flood plain to reduce potential flooding to the railroad bridge and track during high tide events. The special events platform is anticipated to be used during the horse racing seasons at the Del Mar Racetrack and other special events at the Del Mar Fairgrounds to reduce vehicular traffic congestion and provide improved and reliable transit options for special event attendees.

The San Dieguito Double Track and Special Events Platform (SDDT) Project is environmentally cleared and in final design, and the project is assumed in the design of the conceptual alternatives and is expected to be fully constructed by the time the SDSVDT project is implemented. The SDDT

project has been integrated into several conceptual alignments that have been studied in this alternatives analysis.

### 1.3.3 Maximum Operating Speeds and Movement Authority

The maximum operating speed on the San Diego Subdivision in San Diego County is 90 miles per hour for intercity passenger and commuter trains (Amtrak and COASTER, respectively) and 55 miles per hour for freight trains. The section of the San Diego Subdivision in the study area, adjacent to the Del Mar bluffs, contains segments with speed restrictions. 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 Number 5, effective July 13, 2020. Trains must operate at lower than the maximum authorized speed in various locations where dictated by physical conditions or operating requirements. Trains also slow down at approaching stations where they are scheduled to stop then accelerate after the station stop. As a result, the average speed of a passenger train is lower than the maximum authorized speed.

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

| East End MP | West End MP | Reason for speed restriction | Maximum Authorized Speed (miles per hour) | | Diverging Authorized Speed (miles per hour) | |
|---|---|---|---|---|---|---|
| | | | Passenger | Freight | Passenger | Freight |
| 242.24 | 243.47 | — | 90 | 55 | | |
| *243.36* | *CP Crosby* | *Turnout to siding track* | | | *20* | *Prohibited* |
| *243.92* | *CP Del Mar* | *Turnout to siding track* | | | *20* | *Prohibited* |
| 243.47 | 244.11 | Curve exceeding 2 degrees where line passes beneath the CDM overpass | 65 | 55 | | |
| 244.11 | 244.39 | Curve exceeding 4 degrees west of the Coast Boulevard at-grade crossing | 50 | 45 | | |
| 244.39 | 245.52 | This segment of rail line parallels the Del Mar bluffs and includes two curves exceeding 1 degree | 80 | 55 | | |
| 245.52 | 245.76 | 4-degree curve where line passes beneath the Torrey Pines Road overpass | 55 | 50 | | |
| 245.76 | 247.77 | — | 90 | 55 | | |

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

| East End MP | West End MP | Reason for speed restriction | Maximum Authorized Speed (miles per hour) | | Diverging Authorized Speed (miles per hour) | |
|---|---|---|---|---|---|---|
| | | | Passenger | Freight | Passenger | Freight |
| 247.77 | 249.63 | Civil speed restriction that includes the two MT sections between CP Torrey and CP Sorrento, including through the Sorrento Valley Station | 60 | 55 | | |
| *247.83* | *CP Torrey* | *East end MT-2* | | | *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* |

Notes:
*Italicized* text signifies the location of a turnout.
CDM=Camino Del Mar; CP=control point; MP=milepost; MT=main track

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. Automatic train stop (ATS) inductors are installed between the county line and CP Sorrento, which allows passenger trains to operate up to 90 miles per hour where permitted. ATS inductors installed within 100 feet of a wayside signal are operative ATS, which means they are connected to the wayside signal system. Other ATS inductors are also installed but are not connected to the wayside signal system. These locations are inert ATS and are strategically placed to provide warning to train operators of an upcoming reduction in speed of 20 miles per hour or greater. 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 data, a fiber optic communication network, data from the wayside signaling system, and an on-board control system on each locomotive that enforces speed restrictions and train control requirements.

### 1.3.4 Crossings

There is one at-grade crossing within the study area, which is the crossing of Coast Boulevard and the San Diego Subdivision at MP 244.10 in the City of Del Mar. The crossing is in a quiet zone, and according to the most recent FRA grade-crossing inventory report dated February 28, 2022, the crossing had an average annual daily traffic volume of 4,100 vehicles in the year 2021. Table 1-2 provides a description of the at-grade crossing within the study area. Information provided in the table was obtained through Google Earth, the CPUC Crossing Inventory, and NCTD. Additionally, as a condition of the Del Mar Bluffs Stabilization Project 5 federal consistency certification, a new pedestrian rail crossing will be constructed near 7th Street or 11th Street as informed by the Coastal Connections Conceptual Planning Study to allow pedestrians safe, legal access to the beach. The

San Dieguito Double Track and Special Events Platform Project will also construct a protected underpass at MP 243.25 that allows safe pathway for the Crest to Coast trail patrons.

**Table 1-2. Crossings**

| Crossing Name | Location or City | MP | U.S. DOT or CPUC Number | Number of Tracks | Warning Devices | Ped. Gates | Quiet Zone | Ped. Only |
|---|---|---|---|---|---|---|---|---|
| Coast Boulevard | Del Mar | 244.10 | 026834F | 1 | 2 No. 9A | None | Yes | No |
| Coastal Connections (Planned) | Del Mar | TBD | TBD | 1 | TBD | TBD | TBD | Yes |
| Crest to Coast Trail Undercrossing (Planned) | Del Mar | 243.25 | TBD | 2 | None | None | N/A | Yes |

Notes:
CPUC=California Public Utilities Commission; MP=milepost; TBD=to be determined; U.S. DOT=United States Department of Transportation

### 1.3.5 Stations/Platforms

There are no existing passenger rail stations within the study area. Historically, intercity passenger trains had stopped at a station in downtown Del Mar, located east of the Coast Boulevard at-grade crossing. Service to the Del Mar station ended in 1995 with the opening of a multimodal transit facility in Solana Beach, 2 miles west of the former Del Mar station. Solana Beach is served by the LOSSAN Rail Corridor Agency's Pacific Surfliner intercity passenger trains and NCTD's COASTER commuter trains. The SANDAG San Dieguito Double Track and Special Events Platform Project includes the construction of a new special event station platform at approximately MP 242.80. It is anticipated that COASTER commuter trains and Pacific Surfliner intercity passenger trains would stop at the station during the racing season at the Del Mar Racetrack and during other events at the Del Mar Fairgrounds to provide improved transit options for special event attendees and reduce vehicular traffic congestion.

### 1.3.6 Additional Operational Considerations

The alignment in Del Mar between the Coast Boulevard at-grade crossing and the Torrey Pines Road overpass includes a 1.6-mile segment of track that runs along a terrace built in the Del Mar bluffs, approximately 50 to 70 feet above the beach. This segment of track has experienced temporary closures and temporary speed reductions resulting from bluff collapses, erosions, and repair work carried out to stabilize the bluffs and protect the rail corridor from more significant damage. Four bluff stabilization projects have been completed since 2003 with the construction of Phase 4 recently completed in 2021. Two future phases are currently planned, with Phase 5 funded for construction in 2023. Phase 5 will focus on addressing additional seismic and stabilization needs, installing additional support columns, and replacing aging drainage structures.

East of the Torrey Pines Road overpass, the single-track corridor crosses the Los Peñasquitos Lagoon. The crossing includes four single track concrete bridges over water, with lengths ranging between 84 and 280 feet. The concrete bridges were built in 2016, replacing older wooden trestles.

While the stabilization projects address safety and operational concerns with a 30-year design life, the projects do not provide a long-term solution for sea level rise and erosion. In addition, the alignment

across the Los Peñasquitos Lagoon is below the 100-year flood plain. The combination of single track and slower track speeds through the study area creates one of the most significant bottlenecks on the entire corridor and presents a substantial impediment to expanding train service without a significant investment in additional track capacity.

## 1.4 Current Rail Services

Three rail services operate on the San Diego Subdivision portion 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 2022 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 are comprised of 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 Rail 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 are comprised of 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 May 2022 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 (2 trains daily in each direction) and San Luis Obispo (2 daily trains north and 1 daily train south; a second southbound train from San Luis Obispo has a guaranteed connection at Los Angeles with a connecting Surfliner train to San Diego).

Before 2020, Pacific Surfliner had an average daily ridership of approximately 2,300 people in San Diego. 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 U.S. 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 weekday 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 7 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.

## 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 onto a new alignment away from the coastal bluffs, primarily located within tunnels through the cities of Del Mar and San Diego. Two studies are summarized. The Los Angeles-San Diego Final Program EIR/EIS and Record of Decision published in 2007 records the decisions the U.S. Department of Transportation (U.S. DOT) made for proposed improvements to the LOSSAN Rail Corridor between Los Angeles and San Diego under the federal environmental review process at the initial programmatic phase of environmental review. A subsequent study published by SANDAG in 2017, *Conceptual Engineering and Environmental Constraints for Double Track Alignment Alternatives Between Del Mar Fairgrounds and Sorrento Valley*, analyzed the feasibility of five potential options for relocating the existing San Diego Subdivision onto a new alignment with a double track tunnel away from the Del Mar bluffs (HNTB 2017). The study included conceptual engineering and preliminary construction costs for each alignment option.

### 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 EIR/EIS for LOSSAN Rail Corridor Improvements, which was followed by a Record of Decision released by 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 and address the expected growth in travel demand in the Southern California region resulting from a projected increase in population. The overall goal of the proposed improvements 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 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. The following objectives were established by Caltrans 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 eliminated alternatives that considered use of the existing alignment through Del Mar, owing to the high construction and operational impacts and costs of improving the existing alignment, and carried forward alternatives proposing tunnel options that deviated from the existing alignment. Two tunnel options were carried forward in the Program EIR/EIS as preferred alternatives for further evaluation for the Del Mar area:

- CDM Tunnel Number 1: This alternative would relocate the San Diego Subdivision to a double tracked alignment via a tunnel underneath CDM. The tunnel would begin at Jimmy Durante Boulevard and daylight at Carmel Valley Road, where tracks would then connect with the existing LOSSAN alignment across Los Peñasquitos Lagoon. The existing rail track on the Del Mar bluffs would be removed from service.
- Tunnel under I-5: This alternative would relocate the San Diego Subdivision to a double tracked alignment via a tunnel that would run under I-5 and daylight along the southern bluffs of the San Dieguito Lagoon. Tracks would reconnect with the existing LOSSAN Rail Corridor at-grade track near the Del Mar Racetrack. The existing rail track on the Del Mar bluffs would be removed from service. This option was developed and carried forward for further evaluation at the request of the U.S. Fish and Wildlife Service and the California Department of Fish and

Game, which requested that alternatives be evaluated that would bypass the existing rail crossing of Los Peñasquitos Lagoon.

### 1.5.2 Conceptual Engineering and Environmental Constraints for Double Track Alignment Alternatives Between Del Mar Fairgrounds and Sorrento Valley

Following the publication of the Program EIR/EIS, SANDAG completed a feasibility study of potential options for a new double track rail tunnel alignment through the City of Del Mar and the City of San Diego. SANDAG's *Conceptual Engineering and Environmental Constraints for Double Track Alignment Alternatives Between Del Mar Fairgrounds and Sorrento Valley* was released in December 2017 (HNTB 2017). The purpose of this study was to summarize the feasibility of double track alignments previously considered, including tunnel segments, and provide an analysis of the relationship between the future double track alignments and the proposed near-term San Dieguito Double Track Project. This report also provided preliminary construction costs for each of the alternatives based on Federal Transit Administration (FTA) database information, as well as a summary of future steps and considerations to further develop the conceptual alternatives. The report did not include a detailed alternatives analysis, project-specific environmental analysis of proposed tunnel alternatives, or selection of a preferred tunnel alignment alternative.

The alignment alternatives analysis between MP 243 and MP 248 provided conceptual engineering for three primary alignments and two modified alignment options between the Del Mar Fairgrounds and Sorrento Valley. In addition to the two Program EIR/EIS alignments, beneath CDM and I-5, a potential alignment through Crest Canyon was added as a third alternative. Each alignment was approximately 5 miles in length. Tunnel segment lengths varied from approximately 10,000 feet to 13,000 feet. Each option included a connection through Los Peñasquitos Lagoon to the Sorrento Valley Station. The CDM tunnel option was proposed to be constructed using a cut-and-cover box section. The top of the box structure would be 10 to 70 feet below the roadway. The Crest Canyon and I-5 tunnel options were proposed to be constructed using bored sections. The Crest Canyon tunnel segment would reach depths of approximately 250 below the existing ground. The I-5 tunnel segment varied from 30 to 120 feet below the freeway elevation. Each of the three primary alignments extended south from the future San Dieguito River Bridge Replacement structure. A secondary option for the northerly segment was added for the Crest Canyon and I-5 alignments that would reconstruct part of the San Dieguito River Bridge outside of the proposed special events platform on a curve across the river. The study assessed the overall advantages and disadvantages of each alignment alternative in terms of land use, local transportation, train operations, environmental concerns, geotechnical considerations, project costs, and other factors.

# 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
- 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 for the continued safety and reliability of the LOSSAN Rail Corridor Del Mar segment and the overall economic and environmental health of the San Diego region. Significant erosion in this area has caused emergency repairs and poses a risk to safety and reliability of rail operations.

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 the 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.

Realigning the tracks off the bluffs and double tracking this segment of the corridor supports the regional plan goals by enhancing safety and reliability, increasing capacity, reducing travel times, and reducing vehicle miles traveled, which translates into reduced greenhouse gas emissions. It also supports efforts to plan for sea level rise and erosion, thereby avoiding the loss of significant public access and beach resources.

Both freight and passenger rail traffic are expected to grow significantly in the coming years, further increasing the need to double track this segment of the corridor. 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. Without reducing the threat of track outages caused by slope instability and increasing the speed and track capacity on the corridor, future increases in train service will not be possible without a degradation in overall service reliability.

The project will improve travel mobility and reliability in Southern California by decreasing trip times and improving the LOSSAN Rail Corridor rail system in a cost-effective and environmentally sensitive

manner that plans for sea level rise and erosion and maximizes public access and beach resources. Within the project's study area, the LOSSAN Program EIR/EIS eliminated alternatives that considered use of the existing alignment through Del Mar, owing to the high construction and operational impacts and costs of improving the existing alignment, and carried forward alternatives proposing tunnel options away from the existing alignment on the coastal bluffs. In addition, alternatives within the existing alignment would hamper efforts to plan for sea level rise and erosion, result in the loss of significant public access and beach resources and fail to reach the desired operating speeds. The proposed alternatives include tunnel options that deviate from the existing alignment consistent with the intentions described above.

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

- Relocate the tracks away from the eroding coastal bluffs to a location less affected by sea level rise.
- Encourage rail ridership on the LOSSAN Rail Corridor to reduce vehicle miles traveled and associated greenhouse gas emissions by providing a double track alignment to improve rail service, enable greater frequency of trains, allow operation at 110 miles per hour, and avoid delays caused by train meets in the segment.
- Develop an alignment that results in no net loss in Los Peñasquitos Lagoon wetlands acreage.

# 3 Alternatives Analysis

## 3.1 Design Standards and Assumptions

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

- Appendix J: Basis of Design Report for Track, Grade Crossings and Signals (December 2021)
- Appendix K: Basis of Design Report for Tunneling (January 2022)
- Appendix L: Basis of Design Report for Noise and Vibration (December 2021)
- LOSSAN Design Criteria Manual Volume III, Draft 4 (July 2017)
- LOSSAN Engineering Standard Drawings (April 2020)

Table 3-1 summarizes the initial design criteria and key assumptions most relevant to the development and evaluation of the alternatives. After the evaluation and selection of alternatives to carry into 10 percent conceptual engineering, some constraints were revised for further refinement, as described in Section 3.5.

**Table 3-1. Initial Key Design Criteria and Assumptions**

| Design Criteria/Assumption | Description |
|---|---|
| Design speed | Passenger: Maximum 110 miles per hour<br>Freight: Maximum 60 miles per hour |
| Track spacing | Minimum 15-foot track centers on tangent outside of tunnels<br>Minimum 70-foot track centers inside bored tunnels |
| Horizontal alignment | Horizontal curves shall be designed to accommodate the maximum design speeds where possible |
| Vertical profile | Grades shall not exceed 2 percent compensated<br>Sags within tunnels and associated approach structures shall be avoided where possible |
| Tunnel clearance | 33-foot internal tunnel diameter to accommodate the Reserved Freight Rail Easement, as described in the NCTD/BNSF Shared-Use agreement and LOSSAN ESD-2101 |
| Grade crossings | All roadway crossings within project limits shall be grade separated |
| Tunnel boring | The beginning and end of a bored tunnel shall be located such that at least a tunnel diameter of ground cover is provided above[a] |

**Table 3-1. Initial Key Design Criteria and Assumptions**

| Design Criteria/Assumption | Description |
|---|---|
| Fire/life safety | Emergency ventilation shall be provided by two ventilation facilities at either end of the alignment with no intermediate ventilation shafts. Cross passages shall be provided at no more than 800-foot intervals. Evacuation walkways shall be provided per National Fire Protection Association 130<br><br>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:<br><br>• Emergency ventilation system, including fans, dampers, sound attenuators, ducts, and shafts<br>• Normal power and emergency power, including substations, transformers, and switchgear<br>• Emergency management panels (fire command center)<br>• Hydrant and fire department connections at grade<br>• Standpipe systems and hose valves<br>• Gas suppression in select areas/rooms<br>• Egress stairs<br>• Emergency lighting and its uninterrupted power supply<br>• Communications systems rooms<br>• Heating, ventilation, and air conditioning rooms<br>• Train control room |
| San Dieguito Bridge and Special Events Platform | Conceptual alternatives shall be, to the degree practicable, aligned with the San Dieguito Double Track Phase 2 Project. Refer to Section 1.3.2 for additional project details |
| Track subgrade elevation within sea level rise area of influence | Above 100-year flood profile from recent hydraulic modeling interpolated for 7.1-foot[b] sea-level-rise within San Dieguito Lagoon<br><br>Above FEMA 100-year base flood elevation + 7.1-foot sea-level-rise within Los Peñasquitos Lagoon |
| Track subgrade at portals | Above FEMA 500-year flood elevation |

Notes:

a 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.

b Based on 2018 CCC Sea Level Rise Policy Guidance. Refer to Appendix D, 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

Workshops were conducted with the PDT to develop evaluation criteria to determine which two conceptual alternatives would be advanced to 10 percent conceptual engineering for purposes of this planning study. In October 2020, the 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 ranking 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 judgement of PDT and subject matter experts (i.e., rail planning and engineering, structural engineers, environmental planners, rail operations and maintenance, and public relations). Table 3-2 provides a summary of the planning 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, noise and vibration, and visual impacts |
| Potential ROW impacts<br>(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 |
| 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, visual impacts, and beach and fairgrounds access |
| Connectivity and travel demand | Provides connectivity and access to future mobility hubs like University Town Center and Sorrento Mesa and | Qualitative analysis based on comparing potential connections to future mobility hubs and transit modes |

### Table 3-2. Evaluation Criteria

| Evaluation Criteria | Description | Evaluation Method |
|---|---|---|
| | includes the potential to connect with other transit services like higher-speed rail | 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 Coast Boulevard grade crossing and the perceived risk of flooding |
| Capital costs | Minimized capital costs | Construction estimate based on high-level costs primarily generated from FTA cost database utilizing similar projects; as of February 2021 (soft costs were calculated utilizing percentages from the 2017 study) |
| 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. O&M costs within tunnels are assumed to be generally the same. |

Notes:

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

Following the workshop, these criteria were weighted against each other by ranking them in order of importance from 1 to 11. Each public agency represented within PDT was given an opportunity to rank the criteria independently, and the results were averaged to determine their overall weight. Input was provided by SANDAG, NCTD, MTS, and SCRRA. The results of this exercise are summarized in Table 3-3.

**Table 3-3. Criteria Weighting Table**

| Evaluation Criteria | Weight (percent) |
|---|---|
| Travel time | 14 |
| Potential environmental consequences | 9 |
| Potential ROW impacts | 5 |
| Constructability, construction impacts, and duration | 7 |
| Other community impacts | 4 |
| Connectivity and travel demand | 13 |
| Safety improvements | 15 |
| Capital costs | 8 |
| Railroad operation impacts (during construction) | 5 |
| Operational complexity (post-construction) | 9 |
| Operation and maintenance costs | 10 |

Notes:
ROW=right-of-way

## 3.3 Design Alternatives

The conceptual alignments from the previous alternatives analysis study completed by SANDAG in 2017 were analyzed, and high-level refinements were incorporated using the new information obtained from the operational feasibility study described in Section 5.3 and FRA Class 6 basis of design criteria, which allow for increased operating speeds of up to 110 miles per hour. The five alignments: CDM, CCHS, Crest Canyon Above Carmel Valley Road, Crest Canyon Below Carmel Valley Road, and I-5, as well as their respective refinements are discussed in the sections below.

### 3.3.1 Camino Del Mar

#### 2017 Study Evaluation

The original CDM alternative was a cut-and-cover box structure that had most of the alignment following under CDM within public ROW. From north to south, the alignment left the existing railroad ROW at Jimmy Durante Boulevard and entered a cut-and-cover box structure that followed under CDM. Towards the south end of the alignment, after Del Mar Heights Road, the cut-and-cover box depth increases from 10 feet to 60 feet to the top-of-box—requiring significant shoring to construct or transition to a Sequential Excavation Method (SEM)/New Austrian Tunneling Method type tunnel. The alignment daylighted in the hillside east of North Torrey Pines Road Bridge, where it transitioned to a bridge structure along the existing ROW through Los Peñasquitos Lagoon.

Because the original alignment was confined to the public ROW under CDM, the alignment speeds were constrained to 50 miles per hour passenger and 35 miles per hour for freight, resulting in the longest run time of all the alternatives. Additionally, the alignment could result in significant impacts on traffic and businesses along CDM during construction, as well as potential impacts on existing utilities and potential permanent impacts on private properties along CDM.

### Proposed Refinements

As part of the refinements, the following changes to the alignment were incorporated:

- Flatten and eliminate curves to increase speeds to a maximum of 110 miles per hour passenger and 60 miles per hour freight by deviating from CDM but maintaining similar portal locations
- Change the tunnel configuration from a cut-and-cover tunnel to a twin bored tunnel type with cross passages to reduce potential impacts on private property owners
- Raise the at-grade and bridge portions of the alignment to clear the 100-year flood elevation accounting for 7.1-foot sea level rise within the estimated sea level rise area of influence
- Keep portals above the FEMA (Federal Emergency Management Agency) 500-year flood elevation or 7.1-foot sea level rise above the 100-year flood elevation, whichever is highest

### Revised Alignment Description

The revised CDM conceptual alignment (Figure 3-1) would extend a total of 4.6 miles from the southerly abutment of the proposed San Dieguito River Bridge to the north end of Sorrento Valley. The conceptual alignment follows the existing railroad ROW from the San Dieguito Bridge south for approximately 1600 feet. At that point, the conceptual alignment leaves the railroad ROW and crosses Jimmy Durante Boulevard on a graded section to the U-structure transitioning to a cut-and-cover box that transitions to the tunnel portal. The bored-tunnel segment would be approximately 1.8 mile in length, at depths up to 130 feet below existing ground to top-of-tunnel and consist of twin 33-foot diameter tunnels with 70-foot track centers. The bored tunnel transitions back through a cut-and-cover box section under Carmel Valley, and then a U-structure would transition to a bridge section across the Los Peñasquitos Lagoon. The railway would continue south on two single track bridge structures over McGonigle Road before entering back into the existing railroad ROW. The railway would continue south on two single track bridge structures until it transitions to a berm section before reaching existing Bridge 247.7, which would be replaced with two single track bridges. The railway then continues south on berm to the project limits.

### Key Alignment Features

- Jimmy Durante Boulevard would be grade separated with the railroad alignment.
- The twin 33-foot diameter tunnels with 70-foot track centers would be constructed to accommodate the railway with emergency walkways on both sides of each track. Cross passages would be constructed every 800 feet between the two running tunnels to allow for evacuation into the non-event tunnel in case of an emergency.
- The conceptual alignment would pass under private property between Jimmy Durante Boulevard and Carmel Valley Road.

- Track centers transition from 20 feet south of Bridge 243 to 70 feet in the tunnel to 25 feet across the Los Peñasquitos Lagoon and tie back into the existing alignment at 15-foot track centers.
- It is assumed the existing berm would be removed at proposed bridge locations to allow for environmental impact mitigation.
- The turnout at CP Torrey would be removed, and the tracks would tie-in into the double track alignment near MP 248.25.
- The CDM alignment results in a reduction of 0.3 mile of total length from the existing alignment along the Del Mar Bluffs.
- Based on the conceptual engineering and preliminary analysis, commercial and residential properties adjacent to Jimmy Durante Boulevard and residential properties in the vicinity of the portals could be impacted, primarily at the proposed north portal.
- Subsurface easements could be required for the tunnel segment underneath private residences and commercial property.

## Proposed Operations

Maximum speeds of 110 miles per hour for passenger trains and 60 miles per hour for freight trains would be maintained throughout the alignment. The minimum horizontal degree of curvature used is approximately 50 minutes with 2 inches of superelevation. The minimum slope used would be 0.5 percent in the tunnel to allow for positive drainage with a vertical crest curve.

While a universal crossover is not required for operations, placing a universal crossover between future CP Valley and existing CP Rose should be evaluated further to provide operational flexibility. A universal crossover consists of two adjacent opposite-hand crossovers that allow trains to move from either track to the other. CP Sorrento, which already has a single crossover, is designed to accommodate a second crossover reducing future design and construction efforts if selected.

## Travel Time Analysis

Table 3-4 summarizes the run times between Solana Beach and Sorrento Valley Station for both diesel-locomotive and zero-emissions trains in both all-stop and limited-stop service scenarios for CDM. Both all-stop and limited-stop trains service the Solana Beach Station, while only all-stop trains service the Sorrento Valley Station. Refer to Section 5 for additional details regarding the operational analysis conducted as part of the overall SD-LOSSAN study.

**Table 3-4. Camino Del Mar Alignment Travel Time Savings**

| Service Scenarios | Configuration | Travel Time Solana Beach to Sorrento Valley (Minutes) | Travel Time Savings Against Current Alignment (Minutes) |
|---|---|---|---|
| All Stop (COASTER) | Current Alignment<br>Charger + 5 Coaches | 9 | — |
| | Proposed Alignment<br>Charger + 5 Coaches | 7.2 | 1.8 |

**Table 3-4. Camino Del Mar Alignment Travel Time Savings**

| Service Scenarios | Configuration | Travel Time Solana Beach to Sorrento Valley (Minutes) | Travel Time Savings Against Current Alignment (Minutes) |
|---|---|---|---|
| | Proposed Alignment<br>ZEMU | 6.2 | 2.8 |
| Limited Stop (Amtrak Surfliner) | Current Alignment<br>Charger + 7 Coaches | 10.3 | — |
| | Proposed Alignment<br>Charger + 7 Coaches | 7.5 | 2.8 |
| | Proposed Alignment<br>ZEMU | 5.8 | 4.5 |

Notes:

[a] Travel times for limited-stop service with current equipment are longer between the specified project limits as the trains stop at Solana Beach 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

## Alternative Evaluation

Table 3-5 summarizes the pros and cons of the CDM conceptual alignment alternative as it relates to the planning evaluation criteria in Section 3.2.

**Table 3-5. Camino Del Mar Alignment Evaluation**

| Pros | Cons |
|---|---|
| Tied for fastest travel time (1.8- to 4.5-minute time savings against current alignment) | Property interests outside of the existing railroad ROW could be required, particularly at the north and south portal locations |
| No impact on the proposed San Dieguito Bridge structure replacement | Requires major realignment of Jimmy Durante Boulevard |
| Maximizes use of existing rail corridor within the lagoon | Requires Carmel Valley Road to be re-routed or temporarily closed during construction |
| Lowest potential ROW costs/impacts | Requires bridge and berm construction adjacent to live railroad through Los Peñasquitos Lagoon |
| Eliminates at-grade crossing at Coast Boulevard | Longest length of alignments in the lagoon, less opportunities for lagoon rehabilitation |
| Lowest capital costs (~$2.39B) | Potential visual impacts from the need to grade separate Jimmy Durante Boulevard, any associated mitigation measures will be further examined in the environmental review phase of the project. SANDAG will implement feasible noise and vibration mitigation measures to reduce long-term impacts to within established thresholds |

### Table 3-5. Camino Del Mar Alignment Evaluation

| Pros | Cons |
|---|---|
| No significant difference in operations and maintenance requirements in the tunnel compared with other alternatives | Increased maintenance costs compared with others due to longest length of bridge in saltwater lagoon |

Notes:

ROW=right-of-way

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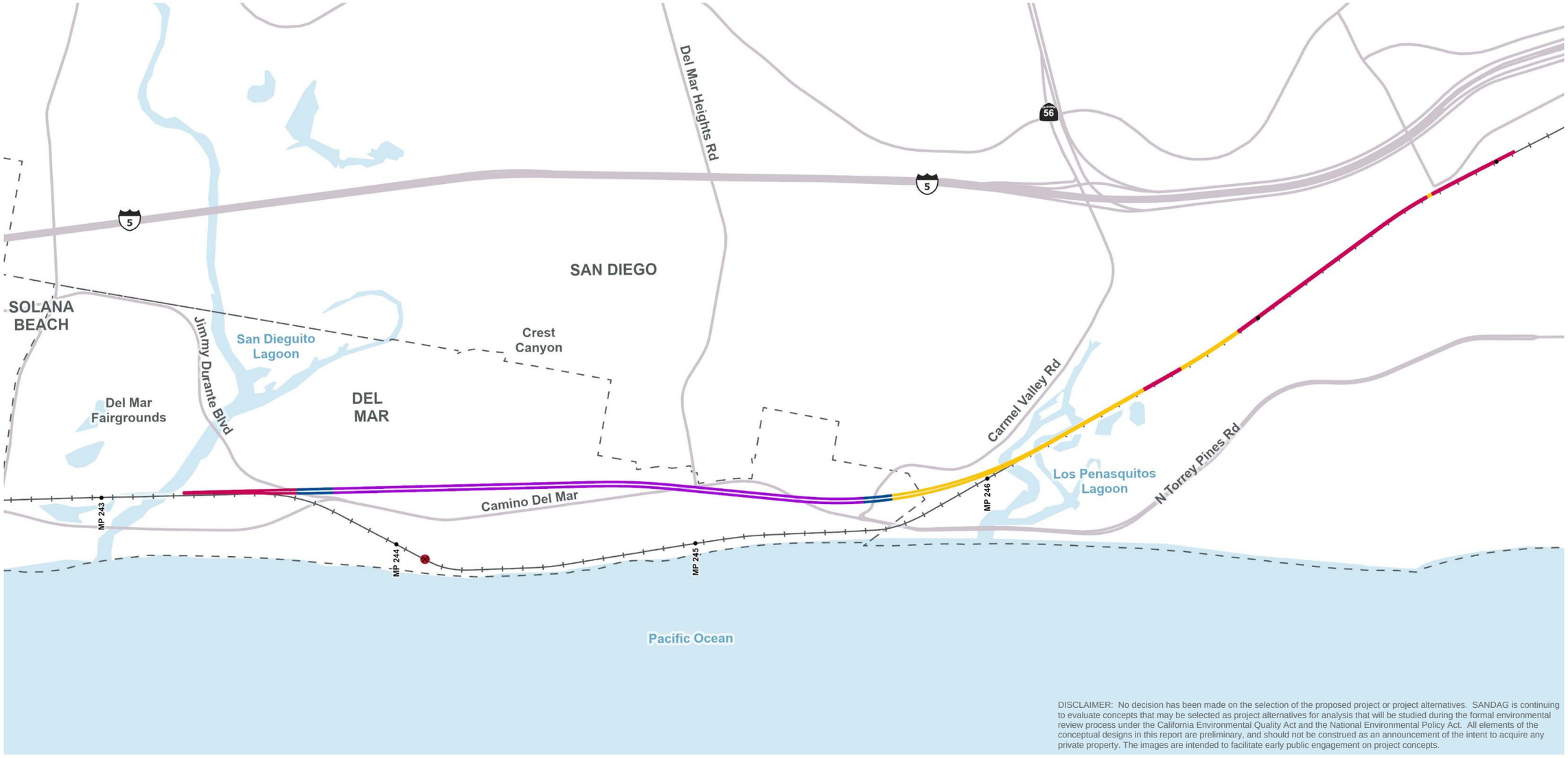
**Figure 3-1. Camino Del Mar Alignment**



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### 3.3.2 Crest Canyon Higher Speed

#### 2017 Study Evaluation

From the north, the original CCHS alignment followed the railroad ROW until it crossed Jimmy Durante Boulevard and entered the north portal, where it transitioned to a bored tunnel. The alignment daylighted via the south portal between Portofino Drive and Caminito Pointe Del Mar, where it transitioned to a bridge structure across Los Peñasquitos Lagoon. The alignment speeds were 90 miles per hour for passenger and 60 miles per hour for freight, the current maximum allowable speeds on the corridor within the San Diego Subdivision. The proposed tunnel was a triple bored section where the third tunnel would be used for emergency vehicular access. This tunnel configuration is an uncommon solution, which would result in significantly higher costs for tunnel construction, wider portals, and additional ROW impacts.

#### Proposed Refinements

As part of the alignment refinement effort, the following changes to the alignment were incorporated:

- Flatten curves to increase speeds to a maximum of 110 miles per hour passenger and 60 miles per hour freight
- Change tunnel type from twin bored tunnel with center emergency egress bored tunnel to twin bored tunnel with cross passages to reduce potential impacts on private properties
- Raise the at-grade and bridge portions of the alignment to clear the 100-year flood elevation accounting for 7.1-foot sea level rise within the estimated sea level rise area of influence
- Keep portals above the FEMA 500-year flood elevation or 7.1-foot sea level rise above the 100-year flood elevation, whichever is highest

#### Revised Alignment Description

The general approach to the revised CCHS conceptual alignment is very similar to the original alternative. The conceptual alignment, as illustrated on Figure 3-2, would extend a total of 4.5 miles from the southerly abutment of the proposed San Dieguito River Bridge to the north end of Sorrento Valley. The conceptual alignment follows the existing railroad ROW from the bridge south for approximately 1000 feet. At that point, the conceptual alignment leaves the railroad ROW and crosses Jimmy Durante Boulevard on a graded section to the U-structure, transitioning to a cut-and-cover box that transitions to the tunnel portal. The bored tunnel segment would be approximately 2.6 miles in length at depths up to 290 feet below existing ground to top-of-tunnel and consist of twin 33-foot diameter tunnels with 70-foot track centers. The bored tunnel transitions back through a cut-and-cover box section and U-structure to a bridge section over Carmel Valley Road. The railway would continue south on two single track bridge structures until it transitions to a berm section before reaching existing Bridge 247.7, which would be replaced with two single track bridges. The railway then continues south on berm to the project limits.

#### Key Alignment Features

- Jimmy Durante Boulevard would be grade separated from the railroad alignment.
- The twin 33-foot diameter tunnels with 70-foot track centers would be constructed to accommodate the railway with emergency walkways on both sides of each track. Cross

passages would be constructed every 800 feet between the two running tunnels to allow for evacuation into the non-event tunnel in case of an emergency.

- The conceptual alignment would pass under private property between Jimmy Durante Boulevard and Carmel Valley Road.
- Track centers transition from 20 feet south of Bridge 243 to 70 feet in the tunnel to 21 feet at the south end of Los Peñasquitos Lagoon, then down to 15 feet to tie into existing tracks.
- It is assumed the existing berm within the lagoon would be removed to allow for environmental impact mitigation.
- The turnout at CP Torrey would be removed, and the tracks would tie-in into the double tracked alignment near MP 248.25.
- The CCHS alignment results in a reduction of 0.4 mile of total length from the existing alignment along the Del Mar Bluffs.
- The alignment would be on aerial structure over Carmel Valley Road.
- Based on the conceptual engineering and preliminary analysis, commercial and residential properties adjacent to Jimmy Durante Boulevard and residential properties in the vicinity of the proposed north portal could be impacted. The proposed south portal is located on an undeveloped parcel with an open space easement.
- Subsurface easements could be required for the tunnel segment underneath private residences, commercial property, and potentially state property.

## Proposed Operations

Maximum speeds of 110 miles per hour for passenger trains and 60 miles per hour for freight trains would be maintained throughout the alignment. The minimum horizontal degree of curvature used is approximately 50 minutes with 2 inches of superelevation. The minimum slope used would be 0.5 percent in the tunnel to allow for positive drainage with a vertical crest curve.

While a universal crossover is not required for operations, placing a universal crossover between future CP Valley and existing CP Rose should be evaluated further to provide operational flexibility. It is noted that CP Sorrento is designed to accommodate a second crossover, reducing future design and construction efforts if selected.

## Travel Time Analysis

Table 3-6 summarizes the run times between Solana Beach and Sorrento Valley Station for both diesel-locomotive and zero-emissions trains in both all-stop and limited-stop service scenarios for CCHS. Refer to Section 5 for additional details regarding the operational analysis conducted as part of the overall SD-LOSSAN study.

**Table 3-6. Crest Canyon Higher-Speed Alignment Travel Time Savings**

| Service Scenarios | Configuration | Travel Time Solana Beach to Sorrento Valley (Minutes) | Travel Time Savings Against Current Alignment (Minutes) |
|---|---|---|---|
| All Stop (COASTER) | Current Alignment<br>Charger + 5 Coaches | 9 | — |
| | Proposed Alignment<br>Charger + 5 Coaches | 7.2 | 1.8 |
| | Proposed Alignment<br>ZEMU | 6.2 | 2.8 |
| Limited Stop (Amtrak Surfliner) | Current Alignment<br>Charger + 7 Coaches | 10.3 | — |
| | Proposed Alignment<br>Charger + 7 Coaches | 7.6 | 2.7 |
| | Proposed Alignment<br>ZEMU | 5.8 | 4.5 |

Notes:
ZEMU=zero-emission multiple unit

## Alternative Evaluation

Table 3-7 summarizes the pros and cons of the CCHS conceptual alignment alternative as it relates to the planning evaluation criteria in Section 3.2.

**Table 3-7. Crest Canyon Higher Speed Alignment Evaluation**

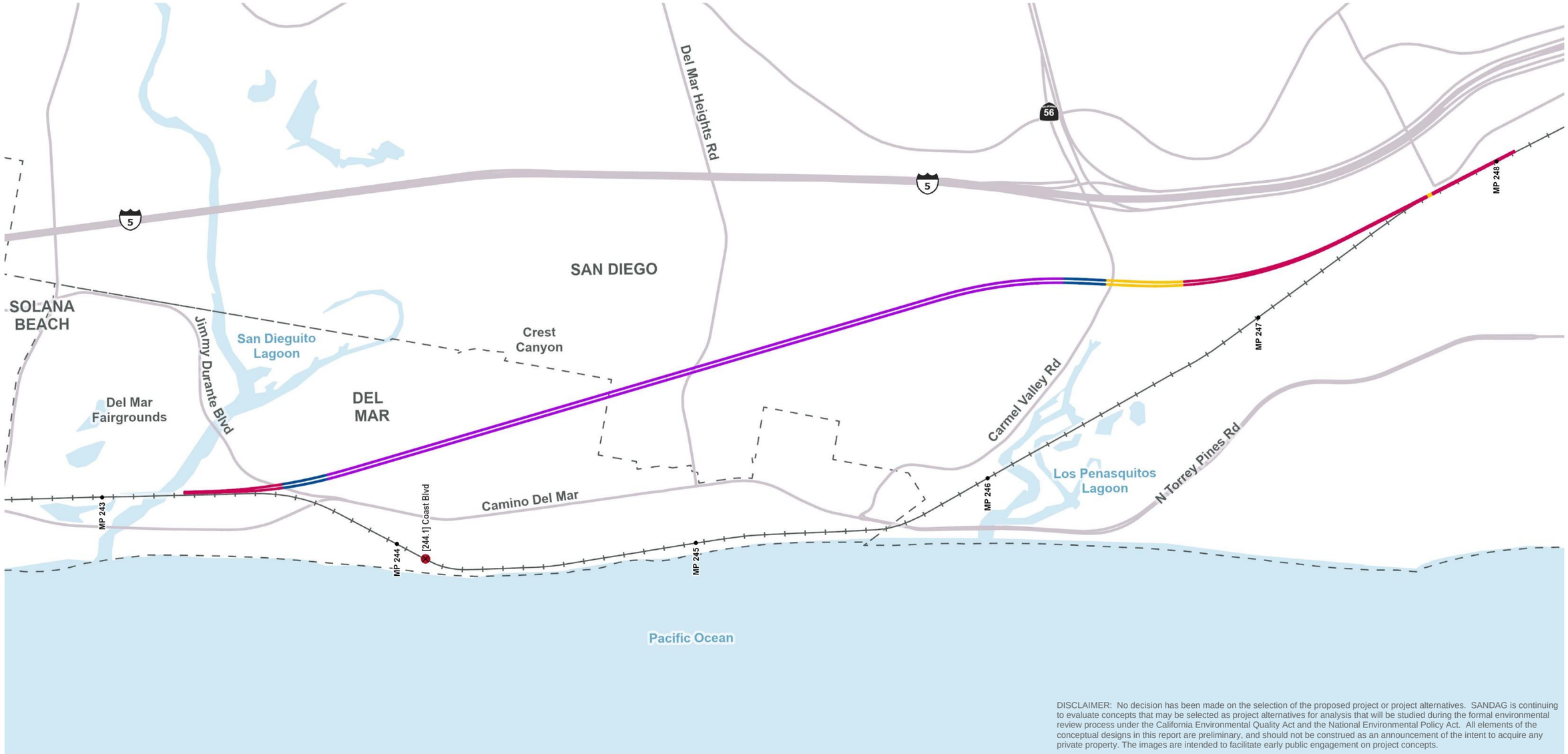
| Pros | Cons |
|---|---|
| Tied for fastest travel time (1.8- to 4.5-minute time savings against current alignment) | Requires major realignment of Jimmy Durante Boulevard |
| No impact on the proposed San Dieguito Bridge structure replacement | Potential visual impacts from the need to grade separate Jimmy Durante Boulevard, any associated mitigation measures will be further examined in the environmental review phase of the project. SANDAG will implement feasible noise and vibration mitigation measures to reduce long-term impacts to within established thresholds |
| Eliminates at-grade crossing at Coast Boulevard | Property interests outside of the existing railroad ROW could be required, particularly at the north and south portal locations. The proposed south portal location is located on an undeveloped parcel with an open space easement |
| Second lowest capital costs (~$2.52B) | — |

### Table 3-7. Crest Canyon Higher Speed Alignment Evaluation

| Pros | Cons |
|---|---|
| Minimizes impacts on lagoon due to shorter length of alignment within lagoon | — |
| No significant difference in operations and maintenance requirements in the tunnel compared with other alternatives | — |

Notes:
ROW=right-of-way

**Figure 3-2. Crest Canyon Higher Speed Alignment**



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## 3.3.3 Crest Canyon

### 2017 Study Evaluation

From the north, the original Crest Canyon alignment required approximately 600 feet of the proposed San Dieguito River Bridge to be removed and reconstructed to allow for the alignment to begin on a sharp curve with maximum speeds of 60 miles per hour for passenger and 50 miles per hour for freight. The alignment crossed over Jimmy Durante Boulevard on a bridge and entered an open trench before reaching the north portal, where it transitioned to a bored tunnel that attempted to stay within undeveloped lands for as long as possible. The alignment daylighted via the south portal between Portofino Drive and Caminito Pointe Del Mar, where it transitioned to a bridge structure across Los Peñasquitos Lagoon. The first two curves for this alternative were 55/40 and 60/40 miles per hour (passenger/freight, respectively). The speeds then increase to 90/60, the current maximum allowable speeds on the corridor within the San Diego Subdivision. The proposed tunnel was a triple bored section, where the third tunnel would be used for emergency vehicular access. This tunnel configuration is an uncommon solution, which would result in significantly higher cost for the tunnel construction, wider portals, and additional ROW impacts.

The original Crest Canyon alternative was very similar to the CCHS alternative but was slower and found to be more expensive, based on the 2017 report.

### Proposed Refinements

With the intended result of this alternatives analysis being to provide higher-speed solutions, refinements to Crest Canyon would result in a conceptual alternative that looks like the CCHS alternative without impacting the fairgrounds special events platform. Therefore, another Crest Canyon alternative with two profile variations was evaluated that resulted in the following changes:

- Flatten curves to increase speeds to a maximum of 110 miles per hour passenger and 60 miles per hour freight
- Change tunnel type from triple bored tunnel, where the third tunnel would be used for emergency egress, to twin bored tunnel with cross passages to reduce ROW impacts
- Raise the at-grade and bridge portions of the alignment to clear the 100-year flood elevation accounting for 7.1-foot sea level rise within the estimated sea level rise area of influence
- Keep portals above the FEMA 500-year flood elevation or 7.1-foot sea level rise above the 100-year flood elevation, whichever is highest
- Relocate portal to the east and closer to I-5 with two variations on profiles, one to go over and one to go under Carmel Valley Road

### Crest Canyon Above Carmel Valley Road

#### *Alignment Description*

The Crest Canyon above Carmel Valley Road conceptual alignment would extend a total of 4.5 miles from the southerly abutment of the proposed San Dieguito River Bridge to the north end of Sorrento Valley. The conceptual alignment follows the existing railroad ROW from the bridge south for approximately 1400 feet. At that point, the alignment leaves the ROW and crosses Jimmy Durante Boulevard on a graded section to the U-structure and cut-and-cover box to the tunnel portal. The bored

tunnel segment would be approximately 2.5 miles in length at depths up to 300 feet below existing ground to top-of-tunnel and consist of twin 33-foot diameter tunnels with 70-foot track centers. The bored tunnel transitions back through a cut-and-cover box section, and a U-structure would transition the tunnel to a bridge section over Carmel Valley Road and the Los Peñasquitos Lagoon. The railway would continue south on two single track bridge structures until it transitions to a berm section before reaching the existing Bridge 247.7, which would be replaced with two single track bridges. The conceptual alignment then continues south on berm to the project limits.

*Key Alignment Features*

- Jimmy Durante Boulevard would be grade separated from the railroad alignment.
- The 33-foot diameter tunnels with 70-foot track centers would be constructed to accommodate the railway with emergency walkways on both sides of each track. Cross passages would be constructed every 800 feet between the two running tunnels to allow for evacuation into the non-event tunnel in case of an emergency.
- The conceptual alignment would pass under existing private property near Jimmy Durante Boulevard and Carmel Valley Road.
- Track centers transition from 20-feet south of Bridge 243 to 70 feet in the tunnel to 15 feet to tie-in into existing tracks.
- It is assumed the existing berm within the lagoon would be removed to allow for environmental impact mitigation.
- The turnout at CP Torrey would be removed, and the tracks would tie into the double tracked alignment near MP 248.25.
- The Crest Canyon above Carmel Valley Road alignment results in a reduction of 0.4 mile of total length from the existing alignment along the Del Mar Bluffs.
- The alignment would be on aerial structure over Carmel Valley Road.
- Based on the conceptual engineering and preliminary analysis, this proposed alignment could impact the greatest number of private properties in comparison with the other alternatives. Commercial and residential properties adjacent to Jimmy Durante Boulevard and residential and commercial properties in the vicinity of both portals could be impacted.
- Subsurface easements would be required for the tunnel segment underneath private residences, commercial property, and state property.

*Proposed Operations*

Maximum speeds of 110 miles per hour for passenger trains and 60 miles per hour for freight trains would be maintained throughout the alignment, except for the last two curves before CP Torrey, which would see passenger speeds reduced to 100 miles per hour due to geometric constraints. The minimum horizontal degree of curvature used is approximately 50 minutes with 2 inches of superelevation. The minimum slope used would be 0.5 percent in the tunnel to allow for positive drainage with a vertical crest curve.

- While a universal crossover is not required for operations, placing a universal crossover between future CP Valley and existing CP Rose should be evaluated further to provide

operational flexibility. It is noted that CP Sorrento is designed to accommodate a second crossover, reducing future design and construction efforts if selected.

### *Travel Time Analysis*

Table 3-8 summarizes the run times between Solana Beach and Sorrento Valley Station for both diesel-locomotive and zero-emissions trains in both all-stop and limited-stop service scenarios for CCHS. Refer to Section 5 for additional details regarding the operational analysis conducted as part of the overall SD-LOSSAN study.

**Table 3-8. Crest Canyon Above Carmel Valley Road Alignment Travel Time Savings**

| Service Scenarios | Configuration | Travel Time Solana Beach to Sorrento Valley (Minutes) | Travel Time Savings Against Current Alignment (Minutes) |
|---|---|---|---|
| All Stop (COASTER) | Current Alignment<br>Charger + 5 Coaches | 9 | — |
| | Proposed Alignment<br>Charger + 5 Coaches | 7.2 | 1.8 |
| | Proposed Alignment<br>ZEMU | 6.2 | 2.8 |
| Limited Stop (Amtrak Surfliner) | Current Alignment<br>Charger + 7 Coaches | 10.3 | — |
| | Proposed Alignment<br>Charger + 7 Coaches | 7.6 | 2.7 |
| | Proposed Alignment<br>ZEMU | 5.8 | 4.5 |

Notes:
ZEMU=zero-emission multiple unit

### *Alternative Evaluation*

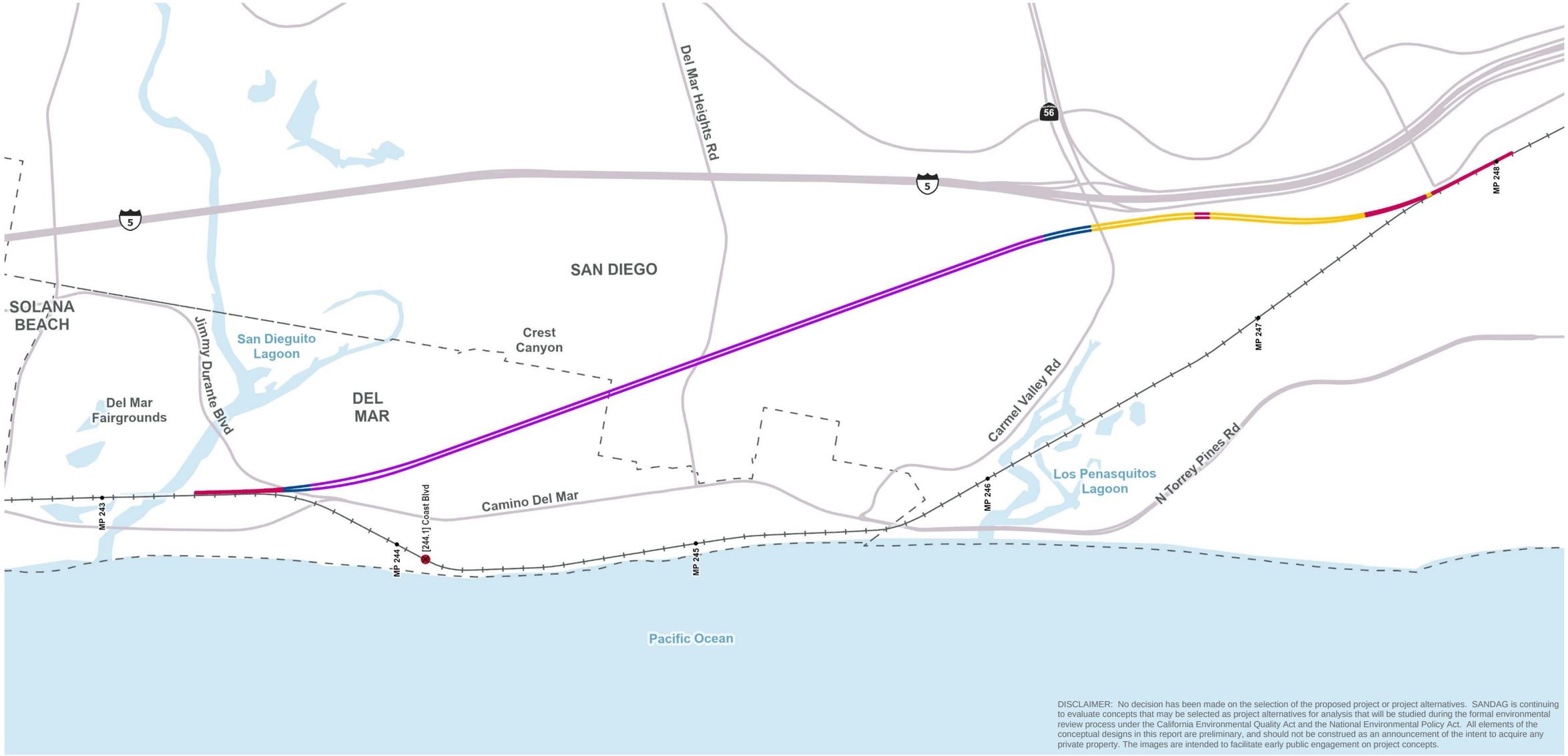
Table 3-9 summarizes the pros and cons of the Crest Canyon Above Carmel Valley Road conceptual alignment alternative as it relates to the planning evaluation criteria in Section 3.2.

### Table 3-9. Crest Canyon Above Carmel Valley Road Alignment Evaluation

| Pros | Cons |
|---|---|
| Tied for fastest travel time (1.8- to 4.5-minute time savings against current alignment) | Requires major realignment of Jimmy Durante Boulevard |
| No impact on the proposed San Dieguito Bridge structure replacement | Potential visual impacts from the need to grade separate Jimmy Durante Boulevard, any associated mitigation measures will be further examined in the environmental review phase of the project. SANDAG will implement feasible noise and vibration mitigation measures to reduce long-term impacts to within established thresholds |
| Eliminates at-grade crossing at Coast Boulevard | Based on the conceptual engineering and preliminary analysis, this alignment could impact the greatest number of private properties and the highest ROW costs, in comparison with the other alternatives. Property interests outside of the existing railroad ROW could be required, particularly at the north and south portal locations. Third highest capital costs (~$2.53B) |
| Minimizes impacts on lagoon due to shorter length of alignment within lagoon | — |
| Shortest amount of bridge in saltwater lagoon | — |
| No significant difference in operations and maintenance requirements in the tunnel compared with other alternatives | — |

Notes:
ROW=right-of-way

**Figure 3-3. Crest Canyon Above Carmel Valley Road**



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## Crest Canyon Below Carmel Valley Road

### *Alignment Description*

The Crest Canyon below Carmel Valley Road conceptual alignment would extend a total of 4.6 miles from the southerly abutment of the proposed San Dieguito River Bridge to the north end of Sorrento Valley. The conceptual alignment follows the existing railroad ROW from the bridge south for approximately 1400 feet. At that point, the conceptual alignment leaves the ROW and crosses Jimmy Durante Boulevard on a graded section to the U-structure and cut-and-cover box to the tunnel portal. The bored tunnel segment would be approximately 3 miles in length at depths up to 400 feet below existing ground to top-of-tunnel and consist of twin 33-foot diameter tunnels with 70-foot track centers. The conceptual alignment would pass under existing private property and continue under Carmel Valley Road and the park and ride. Once out of the floodway, a cut-and-cover box section and a long, open trench of approximately 2300 feet in length would transition the tunnel to an at-grade section before reaching existing Bridge 247.7, which would be replaced with two single track bridges. The conceptual alignment then continues south on berm to the project limits.

### *Key Alignment Features*

- The track profile would not meet design criteria for the track subgrade within Los Peñasquitos Lagoon and would require the tracks to be protected through use of flood walls and other mitigation measures.
- Jimmy Durante Boulevard would be grade separated from the railroad alignment.
- The 33-foot diameter tunnels with 70-foot track centers would be constructed to accommodate the railway with emergency walkways on both sides of each track. Cross passages would be constructed every 800 feet between the two running tunnels to allow for evacuation into the non-event tunnel in case of an emergency.
- The existing berm within the lagoon could be removed to allow for environmental impact mitigation.
- Track centers transition from 20 feet south of Bridge 243 to 70 feet in the tunnel to 15 feet to tie into existing tracks.
- The turnout at CP Torrey would then be removed and the tracks would tie into the double tracked alignment near MP 248.25.
- The Crest Canyon below Carmel Valley Road alignment results in a reduction of 0.3 mile of total length from the existing alignment along the Del Mar Bluffs.
- Based on the conceptual engineering and preliminary analysis, commercial and residential properties adjacent to Jimmy Durante Boulevard and residential and commercial properties in the vicinity of the north portal could be impacted. The south portal would be located in undeveloped land adjacent to the I-5 freeway.
- Subsurface easements would be required for the tunnel segment underneath private residences, commercial property, and state property.

### *Proposed Operations*

Maximum speeds of 110 miles per hour for passenger trains and 60 miles per hour for freight trains would be maintained throughout the alignment, except for the last two curves before CP Torrey, which would see passenger speeds reduced to 100 miles per hour due to geometric constraints. The minimum horizontal degree of curvature used is approximately 50 minutes with 2 inches of superelevation. The minimum slope used would be 2 percent in the tunnel, and a vertical sag curve with a sump pump would be required to pass under Carmel Valley Road. While a universal crossover is not required for operations, placing a universal crossover between future CP Valley and CP Rose should be evaluated further to provide operational flexibility.

### *Travel Time Analysis*

Table 3-10 summarizes the run times between Solana Beach and Sorrento Valley Station for both diesel-locomotive and zero-emissions trains in both all-stop and limited-stop service scenarios for CCHS. Refer to Section 5 for additional details regarding the operational analysis conducted as part of the overall SD-LOSSAN study.

**Table 3-10. Crest Canyon Below Carmel Valley Road Alignment Travel Time Savings**

| Service Scenarios | Configuration | Travel Time Solana Beach to Sorrento Valley (Minutes) | Travel Time Savings Against Current Alignment (Minutes) |
|---|---|---|---|
| All Stop (COASTER) | Current Alignment<br>Charger + 5 Coaches | 9 | — |
| | Proposed Alignment<br>Charger + 5 Coaches | 7.2 | 1.8 |
| | Proposed Alignment<br>ZEMU | 6.2 | 2.8 |
| Limited Stop (Amtrak Surfliner) | Current Alignment<br>Charger + 7 Coaches | 10.3 | — |
| | Proposed Alignment<br>Charger + 7 Coaches | 7.6 | 2.7 |
| | Proposed Alignment<br>ZEMU | 5.8 | 4.5 |

Notes:
ZEMU=zero-emission multiple unit

### *Alternative Evaluation*

Table 3-11 summarizes the pros and cons of the Crest Canyon Above Carmel Valley Road conceptual alignment alternative as it relates to the planning evaluation criteria in Section 3.2.

### Table 3-11. Crest Canyon Below Carmel Valley Road Alignment Evaluation

| Pros | Cons |
|---|---|
| Tied for fastest travel time (1.8- to 4.5-minute time savings against current alignment) | Requires major realignment of Jimmy Durante Boulevard |
| No impact on the proposed San Dieguito Bridge structure replacement | Requires tunneling through a liquefaction zone |
| Eliminates at-grade crossing at Coast Boulevard | Potential visual impacts from the need to grade separate Jimmy Durante Boulevard, any associated mitigation measures will be further examined in the environmental review phase of the project. SANDAG will implement feasible noise and vibration mitigation measures to reduce long-term impacts to within established thresholds |
| No bridges in saltwater lagoon | More operational complexity and higher operations and maintenance costs due to sag in profile and need for sump pump |
| South portal would be away from residences and so would have less potential for noise/vibration and visual impacts. | More operational and maintenance requirements due to longer tunnel sump pump requirement |
| South portal does not require acquisition of homes or businesses | Second highest construction costs (~$2.62B) |
| Minimizes impacts on lagoon due to shorter length of alignment within lagoon | Track profile at south portal is below the 500-year flood elevation and 100-year flood elevation plus 7.1 feet of sea level rise; Does not meet criteria in Table 3-1 and was perceived as safety concern |
| — | May impact large City of San Diego wastewater and potable water lines |
| — | Limited options for routing exhaust in emergency ventilation scenario due to proximity to I-5 |
| — | Property interests outside of the existing railroad ROW could be required, particularly at the north portal |

Notes:
ROW=right-of-way

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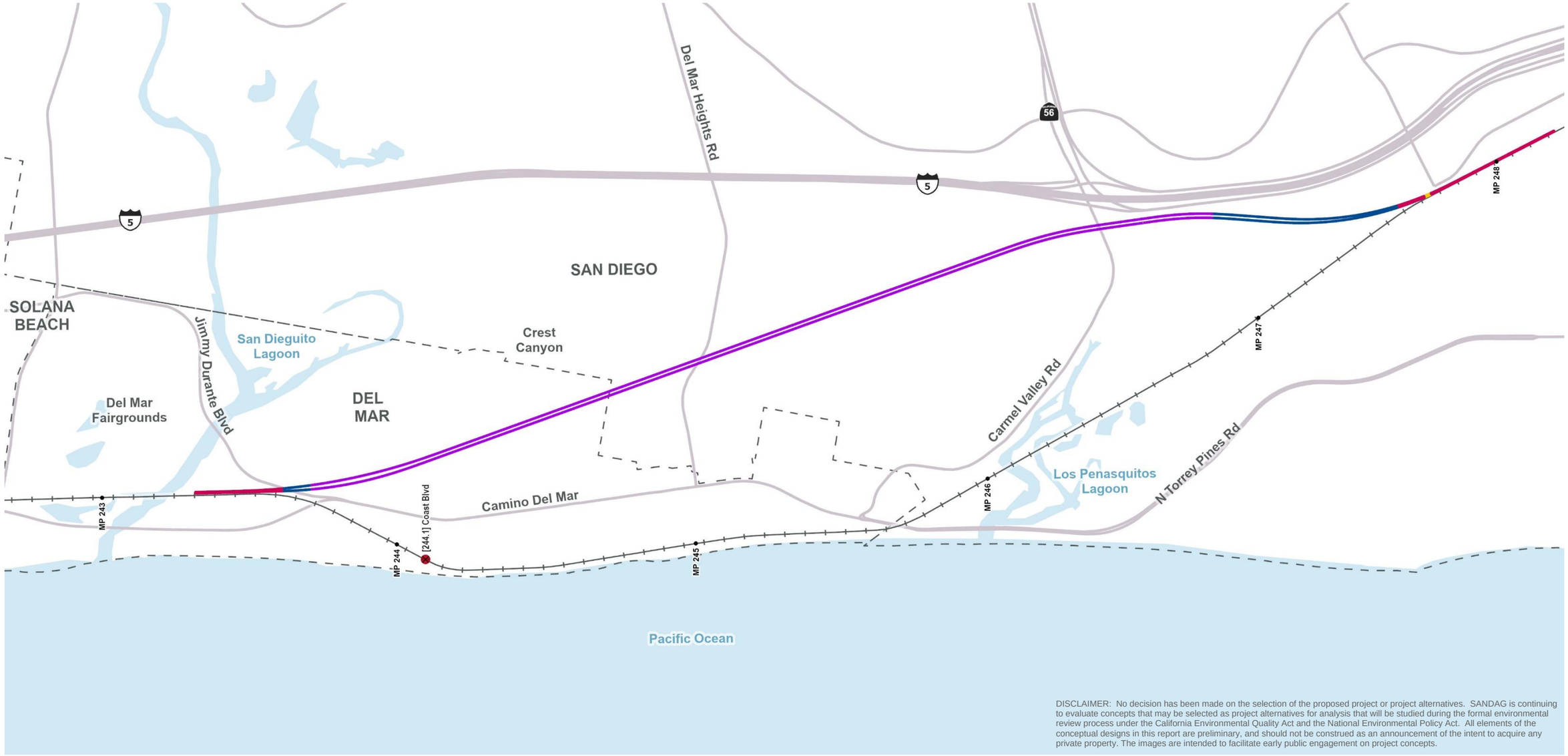
**Figure 3-4. Crest Canyon Below Carmel Valley Road**



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### 3.3.4 Interstate 5

#### 2017 Study Evaluation

The original I-5 alignment almost completely deviated from the existing ROW and had two alignment variations at the north end.

The first alignment variation, designated I-5, crossed Jimmy Durante Boulevard approximately 10 feet above the street and required a reconfiguration of Jimmy Durante Boulevard. The alignment then entered the north portal, where it transitioned to a short-bored tunnel followed by an open trench, a bridge, and then a bored tunnel which took the alignment under I-5.

The second alignment variation, designated I-5 East, required removal of approximately 650 feet of the proposed San Dieguito double tracked bridge to shift the alignment to the north and raise the tracks over Jimmy Durante Boulevard on bridge structure before it transitioned to an open trench and then a bored tunnel under I-5.

Both alternatives converged under I-5 and daylighted via the south portal between Portofino Drive and Caminito Pointe Del Mar, where they transitioned to a bridge structure across Los Peñasquitos Lagoon. Alignment speeds were limited to 60/40 miles per hour (passenger/freight, respectively) for both alignments. The proposed tunnel was a triple bored section where the third tunnel would be used for emergency vehicular access. This tunnel configuration is an uncommon solution which would result in significantly higher cost for tunnel construction, wider portals, and additional potential ROW impacts.

#### Proposed Refinements

The two variations were merged into one option while incorporating the following changes:

- Flatten curves to increase speeds to a maximum of 80 miles per hour passenger and 60 miles per hour freight. A 110 miles per hour alignment could not fit geometrically with this alternative without losing the intent of the alignment, which is to be located under I-5.
- Change tunnel type from twin bored tunnel with center emergency egress bored tunnel to twin bored tunnel with cross passages to reduce potential ROW impacts.
- Raise the at-grade and bridge portions of the alignment to clear the 100-year flood elevation accounting for 7.1-foot sea level rise within the estimated sea level rise area of influence
- Keep portals above the FEMA 500-year flood elevation or 7.1-foot sea level rise above the 100-year flood elevation, whichever is highest

#### Revised Alignment Description

The general approach to the revised I-5 conceptual alignment is very similar to the original I-5 East alternative. The conceptual alignment would extend a total of 5 miles from the south end of the proposed Del Mar Fairgrounds special events platform, within the last 900 feet of the proposed San Dieguito Bridge, to the north end of Sorrento Valley. The conceptual alignment would immediately curve to the north on a bridge structure over Jimmy Durante Boulevard for approximately 2200 feet as it follows the hillside adjacent to the San Dieguito Lagoon. The conceptual alignment would continue at grade briefly before going onto a second bridge. A segment of U-structure would transition into a cut-and-cover box before transitioning to a twin tunnel section. The bored tunnel segment would be approximately 2.2 miles in length at depths up to 220 feet below existing ground to top-of-tunnel. The

conceptual alignment would pass under I-5. A cut-and-cover box section and a U-structure would transition the tunnel to a bridge section over Carmel Valley Road. The railway would continue south on two single track bridge structures until it transitions to a berm section before reaching existing Bridge 247.7, which would be replaced with two single track bridges. The conceptual alignment then continues south on berm to the project limits.

## Key Alignment Features

- The conceptual alignment across the Los Peñasquitos Lagoon would provide clearance above the 100-year water surface elevation plus an additional 7.1 feet of sea level rise.
- The existing berm within the lagoon would be removed to allow for environmental impact mitigation.
- The turnout at CP Torrey would be removed, and the tracks would tie-in into the double tracked alignment near MP 248.25.
- The 33-foot diameter tunnels with 70-foot track centers would be constructed to accommodate the railway with emergency walkways on both sides of each track. Cross passages would be constructed every 800 feet between the two running tunnels to allow for evacuation into the non-event tunnel in case of an emergency.
- The I-5 conceptual alignment results in an addition of 0.1 mile of total length compared with the existing alignment along the Del Mar Bluffs.
- Track centers transition from 20 feet south of Bridge 243 to 70 feet in the tunnel to 15 feet to tie into existing tracks.
- The conceptual alignment would be on aerial structure over Carmel Valley Road.
- Based on the conceptual engineering and preliminary analysis, commercial and residential properties along the aerial structure portion of the alignment adjacent to San Dieguito Drive could be impacted. The south portal would be located on an undeveloped parcel with an open space easement. A Caltrans Encroachment Permit could be needed.
- Subsurface easements could be required for the tunnel segment underneath private residences.

## Proposed Operations

Maximum speeds of 80 miles per hour for passenger trains and 60 miles per hour for freight trains would be maintained throughout the alignment, except for the initial curve, which would be 55/40 miles per hour, respectively. The minimum horizontal degree of curvature used is approximately 50 minutes with 2 inches of superelevation. The minimum slope used would be 0.5 percent in the tunnel to allow for positive drainage with a vertical crest curve.

While a universal crossover is not required for operations, placing a universal crossover between future CP Valley and existing CP Rose should be evaluated further to provide operational flexibility. It is noted that CP Sorrento is designed to accommodate a second crossover, reducing future design and construction efforts if selected.

## Travel Time Analysis

Table 3-12 summarizes the run times between Solana Beach and Sorrento Valley Station for both diesel-locomotive and zero-emissions trains in both all-stop and limited-stop service scenarios for I-5. Refer to Section 5 for additional details regarding the operational analysis conducted as part of the overall SD-LOSSAN study.

**Table 3-12. I-5 Alignment Travel Time Savings**

| Service Scenarios | Configuration | Travel Time Solana Beach to Sorrento Valley (Minutes) | Travel Time Savings Against Current Alignment (Minutes) |
|---|---|---|---|
| All Stop (COASTER) | Current Alignment<br>Charger + 5 Coaches | 9 | — |
| | Proposed Alignment<br>Charger + 5 Coaches | 8.6 | 0.4 |
| | Proposed Alignment<br>ZEMU | 8.2 | 0.8 |
| Limited Stop (Amtrak Surfliner) | Current Alignment<br>Charger + 7 Coaches | 10.3 | — |
| | Proposed Alignment<br>Charger + 7 Coaches[a] | 8.5 | 1.8 |
| | Proposed Alignment<br>ZEMU | 7.8 | 2.5 |

Notes:

[a] In contrast to the existing alignment and other alternatives, where slower acceleration of heavier trainsets makes limited stop slower through the project limits, this alignment alternative has a longer distance and lower top speeds. Thus, the time penalty from taking longer to reach top speed after leaving Solana Beach is offset by the fact that the limited stop service does not have to decelerate to stop at Sorrento Valley.

ZEMU=zero-emission multiple unit

## Alternative Evaluation

Table 3-13 summarizes the pros and cons of the I-5 conceptual alignment alternative as it relates to the planning evaluation criteria in Section 3.2.

**Table 3-13. I-5 Alignment Evaluation**

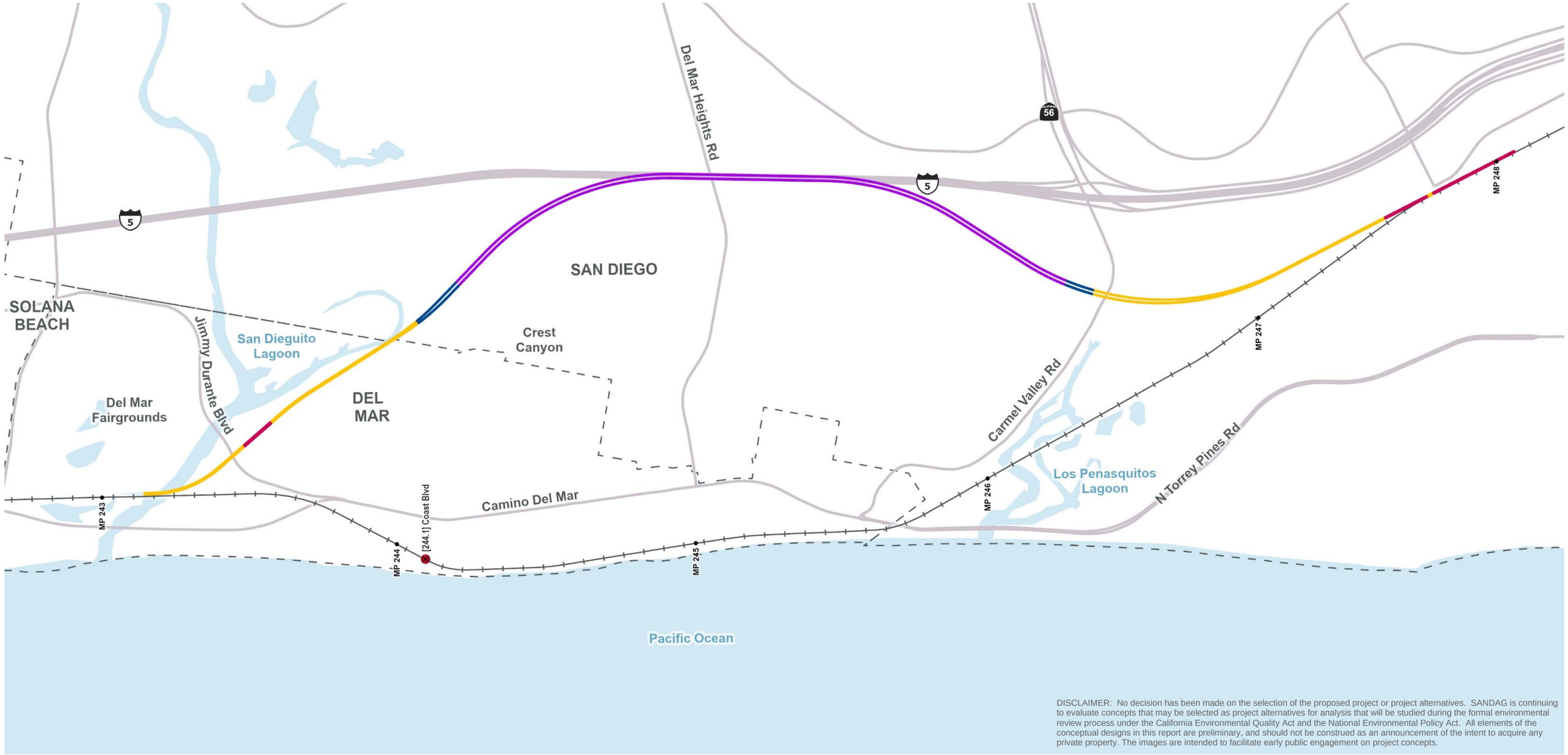
| Pros | Cons |
|---|---|
| Does not require reconstruction of Jimmy Durante Boulevard as track crosses over roadway | Slowest travel time due to length of alignment and speeds limited to 80/60 miles per hour (55/40 for first curve to protect special events platform), only 0.4- to 2.5-minute time savings against current alignment |
| Eliminates at-grade crossing at Coast Boulevard | Would require approximately 900 feet of the future San Dieguito double track bridge to be reconstructed within horizontal curve; does not meet criteria in Table 3-1 |

### Table 3-13. I-5 Alignment Evaluation

| Pros | Cons |
|---|---|
| Minimizes potential ROW impacts at the north and south portals | Potential for visual impacts due to the tall aerial structures along San Dieguito Drive, any associated mitigation measures will be further examined in the environmental review phase of the project. SANDAG will implement feasible noise and vibration mitigation measures to reduce permanent impacts to within acceptable limits |
| No significant difference in operations and maintenance requirements in the tunnel compared with other alternatives | Requires Caltrans permit to tunnel parallel to and under I-5, may not be possible to obtain permit; risk to schedule delay due to Caltrans interface |
| Minimizes impacts on lagoon due to shorter length of alignment within lagoon | Highest capital costs (~$3.07B); ~30 percent higher than CDM and ~20 percent higher than next highest alternative, Crest Canyon Below Carmel Valley Road |
| — | Difficult construction phasing due to impacts on San Dieguito Bridge, increasing risk to maintaining rail operations |
| — | Higher maintenance costs due to need to maintain curve on a bridge and maintenance of tall aerial structures, longest amount of ballasted track compared with others |
| — | May be more challenging to connect to a future branch line to Sorrento Mesa |
| — | Requires impacting the San Dieguito Lagoon to realign a section of the San Dieguito Bridge |
| — | Property interests outside of the existing railroad ROW could be required, including potential impacts on residential and commercial properties in the location of the proposed aerial structure near the north portal |

Notes:
Caltrans=California Department of Transportation; CDM=Camino Del Mar; ROW=right-of-way

**Figure 3-5. Interstate 5 Alignment**



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## 3.4 Alternative Rankings

At the second workshop in January 2021, the refined conceptual alignments, including the relative pros and cons of each conceptual alternative, were presented to the PDT. Representatives from SANDAG, NCTD, MTS, LOSSAN, SCRRA, and Caltrans were in attendance. The PDT worked as a group to assign scores from 1 through 5 to each conceptual alternative for all the planning evaluation criteria. A higher numbered score for a criterion represents a larger benefit or smaller impact. Using these scores and the weight of each criterion, an overall score was calculated for each conceptual alternative. Table 3-14 provides a summary of the scoring. At a follow up meeting, the PDT discussed which two conceptual alternatives should be studied further based on the scores. The CCHS conceptual alternative scored highest, as it provided the most benefit relative to the evaluation criteria. The Crest Canyon above Carmel Valley Road conceptual alignment scored second highest; however, rather than selecting two Crest Canyon alternatives with identical north portals and similar south portals, the group agreed the next highest scoring conceptual alternative, CDM, should be carried forward for additional analysis in this planning study, as there was only a two-point difference in scores. The CCHS and CDM conceptual alternatives were chosen to advance to 10 percent conceptual engineering.

**Table 3-14. Alternative Rating Results**

| Evaluation Criteria | Weight (percent) | CDM | Crest Canyon | | | I-5 |
|---|---|---|---|---|---|---|
| | | | Higher Speed | Above Carmel Valley Road | Below Carmel Valley Road | |
| Travel time | 14 | 5 | 5 | 5 | 4 | 1 |
| Potential environmental consequences | 9 | 1 | 4 | 4 | 3 | 2 |
| Potential ROW impacts | 6 | 4 | 3 | 1 | 3 | 1 |
| Constructability, construction impacts, and duration | 7 | 2 | 4 | 1 | 2 | 1 |
| Other community impacts | 4 | 2 | 3 | 1 | 3 | 2 |
| Connectivity and travel demand | 13 | 3 | 3 | 3 | 3 | 2 |
| Safety improvements | 15 | 5 | 5 | 5 | 4 | 5 |
| Capital costs | 8 | 5 | 4 | 3 | 2 | 1 |
| Railroad operation impacts (during construction) | 5 | 2 | 4 | 4 | 4 | 1 |
| Operational complexity (post-construction) | 9 | 4 | 4 | 4 | 1 | 4 |

**Table 3-14. Alternative Rating Results**

| Evaluation Criteria | Weight (percent) | CDM | Crest Canyon | | | I-5 |
|---|---|---|---|---|---|---|
| | | | Higher Speed | Above Carmel Valley Road | Below Carmel Valley Road | |
| Operation and maintenance costs | 10 | 2 | 3 | 3 | 1 | 2 |
| **Total score** | — | **345** | **396** | **347** | **281** | **223** |

Notes:
CDM=Camino Del Mar; ROW=right-of-way

## 3.5 Alternatives Advanced to Conceptual Engineering

Following the high-level refinements of the conceptual alternatives, CDM and CCHS were advanced to 10 percent level conceptual engineering, where further analysis was conducted.

Additional refinements to the conceptual alternatives were made as a result of feedback received during stakeholder outreach and the desire to minimize potential impacts on residential properties and to move the portals further from homes. These refinements were driven by the removal of specific constraints:

1. The tunnel diameter controlled by the freight rail easement in the shared use agreement between BNSF, NCTD, and MTS and current LOSSAN Design Criteria
2. The approach to track subgrade elevations in relation to peak storm events and sea level rise

Following a workshop with NCTD, BNSF, and SANDAG on August 25, 2022, it was agreed for this study that the tunnel diameter could be reduced to reflect current clearance requirements for tunnels considering BNSF, SCRRA, and CPUC standards that would accommodate all current and future operations along the rail corridor, rather than size the tunnel per the freight rail easement in the shared use agreement. Additional steps would be required in the next phase to amend the shared use agreement to better define the allowable clearances, particularly within tunnels. The amended shared use agreement would be necessary to serve as a formal approval.

Additionally, due to the reduced clearance requirements, a single bore tunnel configuration would be considered a viable alternative and was recommended to be reconsidered for evaluation. Both configurations, single and twin bore, are viable options and should be evaluated further as the project works towards the preferred alignment and configuration. A potential benefit of deferring tunnel configuration selection to later phases is that it could allow for contractor engagement (through an alternative delivery method) that could encourage innovation and competition prior to the selection of the preferred project. The 10 percent plans and subsequent sections of this report currently reflect the twin bore configuration as it has the more conservative footprint.

In addition to optimizing the tunnel diameter, the track profiles at the north portal were lowered south of the proposed San Dieguito Bridge. The profile adjustments could allow for a significant reduction in potential ROW impacts at the portal locations, reduce the impacts on the local roadway system, and decrease potential visual impacts. The introduction of flood walls and other mitigation measures would be required to protect the track infrastructure during peak storm events and sea level rise. Table 3-15

provides a summary of the updated design criteria carried into the updated conceptual engineering of CCHS and CDM.

Overall, the refinements to the twin bore configuration resulted in an approximate 80 percent reduction in potential impacts on private properties for CCHS and an approximate 70 percent reduction in potential impacts on private properties for CDM. Refer to Appendix M, Tunnel Optimization Memorandum, for more details regarding the tunnel optimization process, outcomes, and additional benefits.

The remainder of this section provides additional details regarding the updates to the alternatives related to the design criteria revisions and other changes made since the alternative's rankings process was completed.

**Table 3-15. Revised Key Design Criteria and Assumptions**

| Design Criteria/Assumption | Description |
|---|---|
| Track spacing | Minimum 15-foot track centers on tangent outside of tunnels<br>Minimum 56-foot track centers inside bored tunnels |
| Tunnel clearance | 28-foot internal tunnel diameter[a] to accommodate the following standards:<br>• BNSF Minimum Clearance Diagrams, Plan 2509<br>• CPUC General Order 26-D clearances for tunnels<br>• Metrolink Car (Equipment) Clearance Envelope, ES2103 with National Fire Protection Association Emergency Egress Walkway Envelope |
| Track Subgrade elevation within sea level rise area of influence | Protect against the 100-year flood profile from recent hydraulic modeling interpolated for 7.1-foot sea level rise within San Dieguito Lagoon through use of flood walls or a heightened U-structure walls[a] and FEMA 100-year base flood elevation + 7.1-foot sea-level-rise within Los Peñasquitos Lagoon[1] |
| Track subgrade at portals | Protect against the FEMA 500-year flood elevation through use of floodgates or other mitigation measures |

Notes:
[a] Would require a design exception
CPUC=California Public Utilities Commission; FEMA=Federal Emergency Management Agency

### 3.5.1 Camino Del Mar Revisions

Several refinements were made to the CDM alternative following the initial high-level updates presented as part of the alternative rankings process. As part of the development of the 10 percent conceptual engineering (see Appendix A for plans), the following changes to the alignment were incorporated:

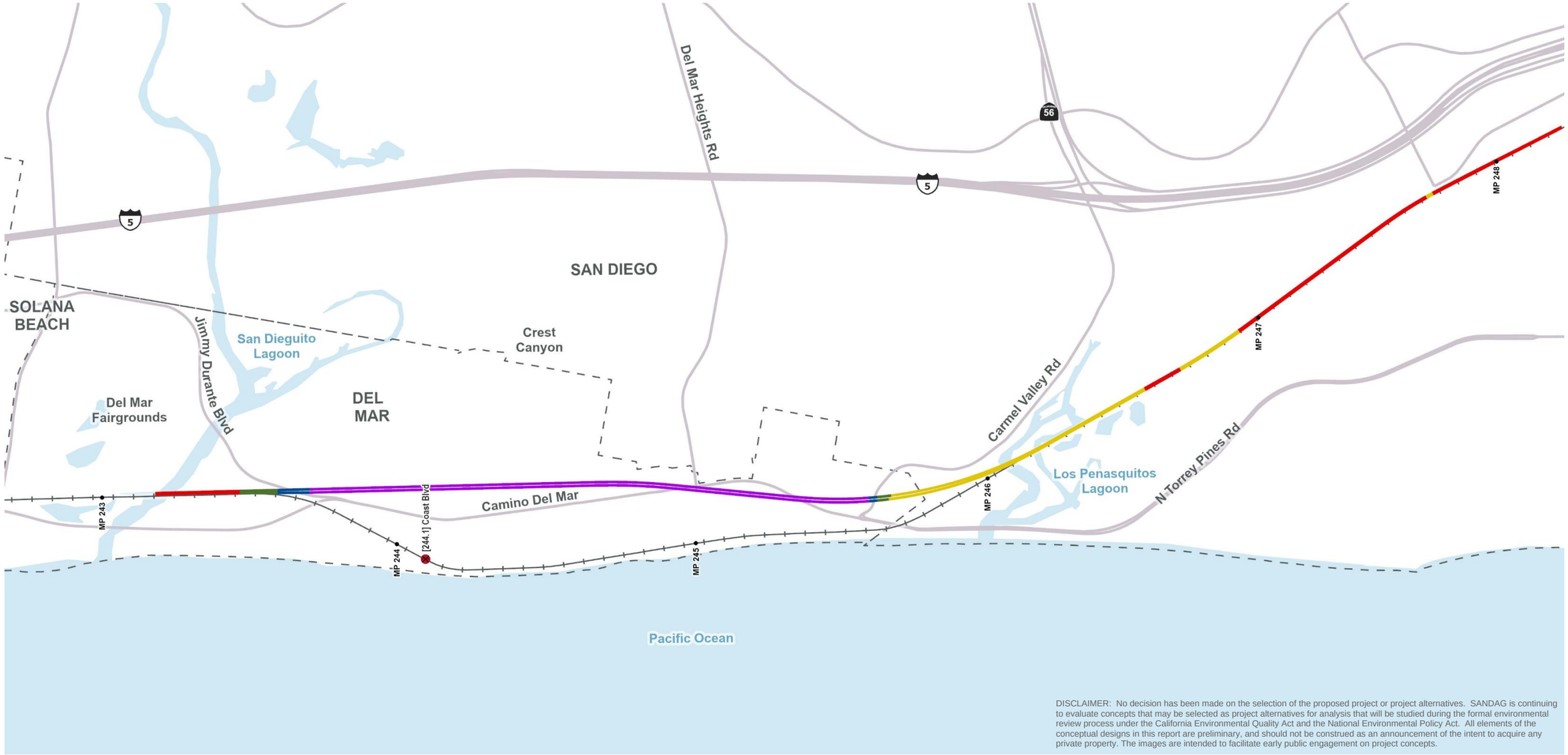
- Refined location and configuration of north and south portal locations considering permanent facilities and permanent and temporary access to each location
- Revised the use of structure and berms within the Los Peñasquitos Lagoon to balance use of structure and berm to help mitigate anticipated impacts within the lagoon
- Lowered the track profile after the proposed San Dieguito Bridge to enter the trench as quickly as possible to minimize potential ROW impacts and improve interface and potential impacts

on Jimmy Durante Boulevard; however, this required the use of a sag vertical curve necessitating the need for a sump pump within the tunnel

- Introduced the use of floodwalls and heightened U-structure to protect the tracks against peak storm events
- Reduced the track spacing to 56-foot track centers within the bored tunnel segment
- Extended the cut-and-cover section of the tunnel to start at the north side of Jimmy Durante Boulevard, thereby moving the portal entrance away from residences

See Figure 3-6 for an overview of the revised CDM conceptual alternative.

**Figure 3-6. Revised Camino Del Mar Alignment**



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### 3.5.2 Crest Canyon Higher Speed

Several refinements were made to the CCHS conceptual alternative following the initial high-level updates presented as part of the alternative rankings process. As part of the development of the 10 percent conceptual engineering (see Appendix A for plans), the following changes to the alignment were incorporated:

- Refined location and configuration of north and south portal locations considering permanent facilities and permanent and temporary access to each location
- Revised the use of structure and berms by adjusting the track profile within the Los Peñasquitos Lagoon
- Lowered the track profile after the proposed San Dieguito Bridge to enter the trench as quickly as possible to minimize potential ROW impacts and improve interface and potential impacts on Jimmy Durante Boulevard; however, this required the use of a sag vertical curve, necessitating the need for a sump pump within the tunnel
- Introduced the use of floodwall and a heightened U-structure to protect the tracks against peak storm events
- Reduced the track spacing to 56-foot track centers within the bored tunnel segment
- Extended the cut-and-cover section of the tunnel to start at the north side of Jimmy Durante Boulevard, thereby moving the portal entrance away from residences
- Shift the horizontal alignment closer to Jimmy Durante Boulevard to limit the potential impacts on residences

See Figure 3-7 for an overview of the revised CDM conceptual alternative.

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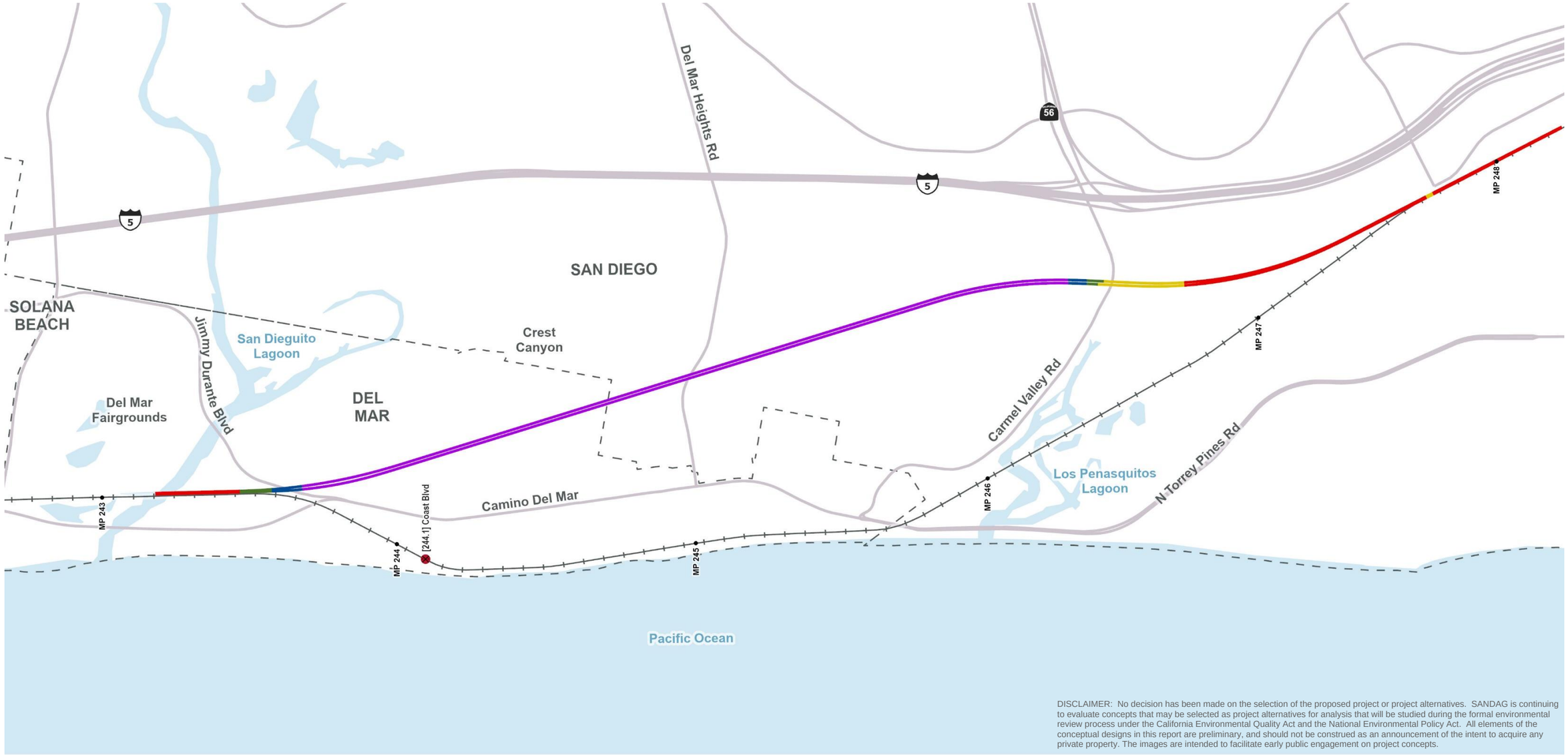
**Figure 3-7. Revised Crest Canyon Higher Speed Alignment**



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### 3.5.3 Summary

As part of advancing two alternatives to 10 percent level conceptual engineering, several design components of the CDM and CCHS conceptual alternatives were evaluated and compared in more detail. These components included potential impacts on private properties, utilities, roadway, and grade separation. Furthermore, considerations to railroad systems, tunneling, potential noise and vibration, drainage, construction, operations and maintenance, and project costs were evaluated. This additional analysis is covered in Sections 6 through 18. These conceptual alternatives are subject to further changes and refinements in the next phase of the project.

## 3.6 Other Potential Portal Locations

After submittal of the draft alternative analysis report and conceptual engineering plans in May 2021, additional refinements were considered to minimize potential impacts on property owners and to take advantage of changes in design criteria described in the previous section. In response to stakeholder feedback and community presentations, other potential portal locations were considered that would provide an alternative Del Mar fairgrounds special events platform and a modified approach to sea level rise. As a result, three new north portal locations and one new south portal location were identified to determine feasibility and to perform a comparative analysis with the CCHS and CDM 10 percent conceptual engineering portal locations. A general overview of the conceptual alignment alternatives and portal locations evaluated can be found within Figure 3-8. The portal numbering and lettering referenced in the paragraphs below refer to the locations identified within the figure.

At the northern end of the project limits, three new portal locations were analyzed to compare with the 10 percent conceptual engineering portal location under Jimmy Durante Boulevard (Option A). The focus for selecting the new portal locations was to reduce the potential impact on private residential properties surrounding the portal locations. The new north portal locations include placement within the Del Mar Fairgrounds (Option 1), over Jimmy Durante Boulevard (Option 2), and another within CDM (Option 4).

At the southern end of the project limits, one additional location was analyzed within a knoll near the I-5 freeway (Option 3). This location was selected to bring the portal further away from residential properties, reduce impact on the Los Peñasquitos Lagoon, and to avoid impacting the parcel being considered for the CCHS southern portal (currently protected from development as a condition of Coastal Development Permit Number F8341). The 10 percent conceptual engineering portal locations include the CCHS southern portal near Portofino (Option B) and the CDM southern portal near Torrey Pines and Carmel Valley Road (Option C).

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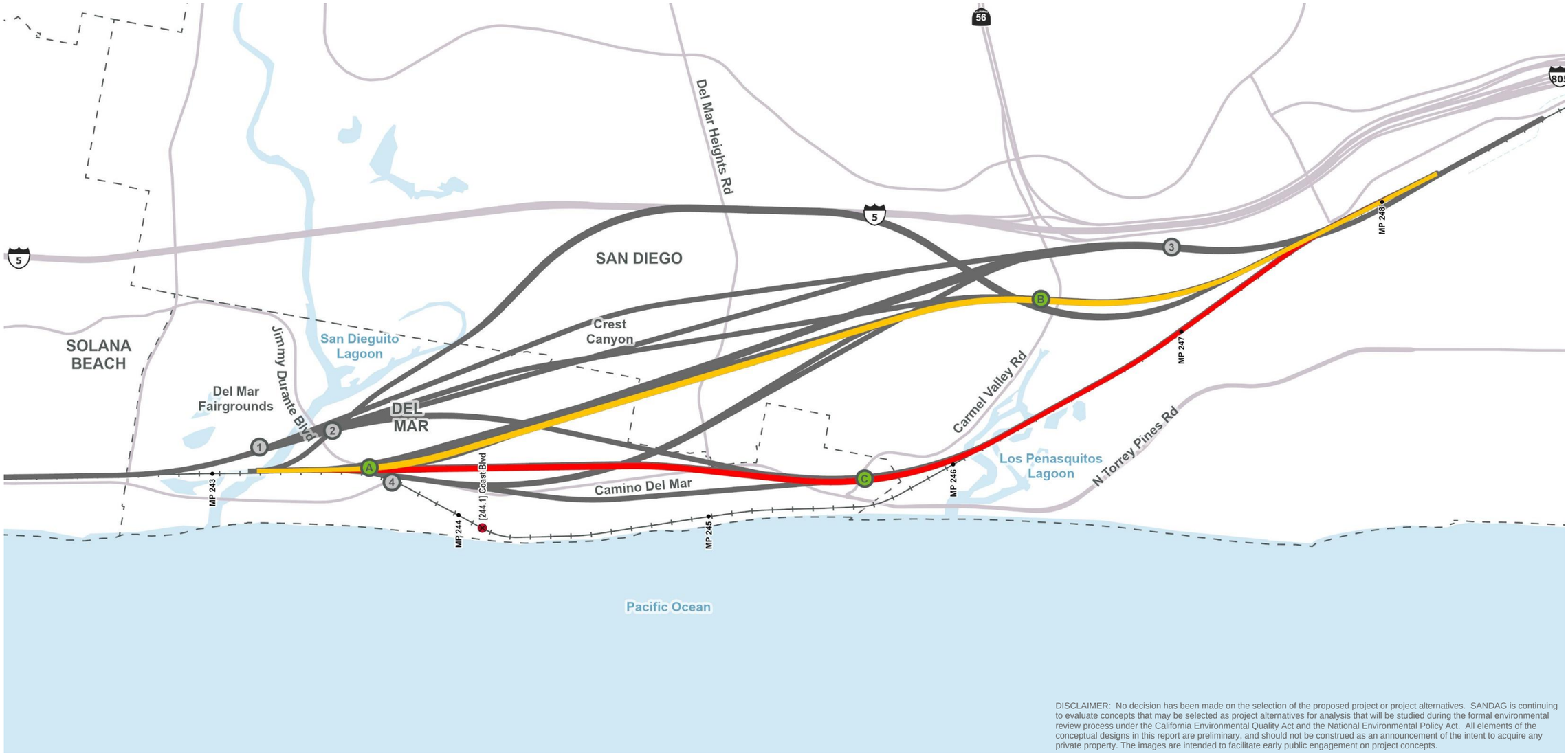
**Figure 3-8. Alternative Alignments and Conceptual Portal Locations**



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### 3.6.1 North Portal in Fairgrounds

The intent of considering the north portal within the Del Mar Fairgrounds (see Exhibit 1 in Appendix I) is to minimize potential impacts on residential properties. Entering below grade within the fairgrounds would move the portal north of the San Dieguito River and minimize temporary and permanent impacts on private residences and surrounding roadways. This conceptual alternative would allow staging and permanent impacts to be contained within the southern portion of the fairgrounds parking lot. The primary constraint with this conceptual alternative is crossing under the San Dieguito River at an appropriate depth to maintain a cover of approximately one tunnel diameter and channel functionality. The river is constrained at this location to a channel width of approximately 250 feet.

To limit the extents of track profile changes within the existing trench through Solana Beach, which would require a deepened trench, a cut-and-cover tunnel section under the San Dieguito River was considered to reduce the cover requirement of the tunnel, allowing for a shallower track profile. For reference, this would result in the need to lower the tracks approximately 10 feet at the Via de la Valle overcrossing. Cofferdams within the river would be required to dewater and provide access for the cut and cover installation. The river crossing would be phased to maintain flow during construction. In this scenario the bored tunnel section would begin immediately south of the river before crossing Jimmy Durante Boulevard. North of the cut-and-cover segment, a new special events platform would be constructed within a trench section in the Del Mar Fairgrounds parking lot. The trenched section would also require protection from sea level rise and peak storm events, creating the potential for additional permanent impacts and the need to reconfigure this area of the fairgrounds parking lot.

Other track profiles were considered to minimize temporary impacts on the San Dieguito River and permanent impacts on the fairgrounds; however, they were considered impractical. One such option considered a bored tunnel under the fairgrounds. This was considered impractical as it would have required significantly deepening the existing trench through most of Solana Beach, including a very costly lowering of the Solana Beach Station. Additionally, the fairgrounds special events platform would need to be relocated into the tunnel requiring the construction of a mined station which would add significant costs. The other option considered a cut-and-cover section through the majority of the fairgrounds with the alignment transitioning to a bored tunnel immediately north of the San Dieguito River. This also was considered impractical as it would have required lowering the tracks an additional 40 feet at Via de la Valle while utilizing a 2 percent grade. This would necessitate lowering the existing trench beginning immediately south of the Solana Beach station. Finally, both options have significant constructability concerns due to the magnitude of profile change within the existing Solana Beach trench.

Table 3-16 summarizes the pros and cons of the north portal within the fairgrounds option.

**Table 3-16. North Portal in Fairgrounds Evaluation**

| Pros | Cons |
|---|---|
| Moves the north portal location away from private residences, reducing potential noise and vibration impacts | Requires cofferdam within San Dieguito River to construct cut-and-cover tunnel section; there is environmental concern related to tidal muting and water quality impacts. |
| Does not require reconstruction of Jimmy Durante Boulevard as track crosses under roadway | Requires eventual abandonment of the newly built San Dieguito Lagoon Bridge and Special Events Platform. These would be replaced with an open cut trench that bisects the fairgrounds within a horizontal spiral/curve with slope; there would likely be seasonal restrictions on construction impacting fairgrounds operations. |
| Based on the preliminary analysis, portal might not impact residential properties | Requires deepening existing trench north into Solana Beach |
| — | Requires reconstruction of Via De La Valle overpass |
| — | Impacts on planned Steven's Creek culvert |
| — | Requires challenging construction phasing to maintain operations within existing trench; potential to impact future 15-minute service and potential to significantly extend construction duration |
| — | Potential permanent impacts on the southern parking lot within the Del Mar Fairgrounds and could require permanent property interests on the fairground's property |
| — | Significantly more expensive than the 10 percent design north portal location due to long trench structure with platforms, reconstruction of Via de la Valle, cut-and-cover in the San Dieguito River requiring a cofferdam, and reconstruction of the San Dieguito Double Track and Special Events Platform (assumed to be constructed at the time of implementation of this project) |
| — | Deeper tunnel portal results in longer portal structures that would require flood walls |

### 3.6.2 North Portal Over Jimmy Durante

The north portal for this conceptual alternative would be located west of Jimmy Durante Boulevard and immediately south of San Dieguito Drive, see Exhibit 2 in Appendix I. The key benefit for this concept includes bridging over Jimmy Durante Boulevard to limit impact on the local roadway network during construction.

To accommodate this portal location, the track alignment would begin to diverge from the existing alignment within the San Dieguito Lagoon and would traverse the southern parking lot of the Del Mar Fairgrounds. The track alignment for this segment, approximately 3,500 feet, would remain elevated through the fairgrounds to bridge over the San Dieguito River and Jimmy Durante Boulevard. A new special event platform would be required along the elevated alignment in the Del Mar Fairgrounds southern parking lot. Based on the conceptual engineering and preliminary analysis, residential

properties at the portal site, including a potential development of affordable housing units, could be impacted.

Table 3-17 summarizes the pros and cons of the north portal over Jimmy Durante Boulevard option.

**Table 3-17. North Portal Over Jimmy Durante**

| Pros | Cons |
|---|---|
| Does not require reconstruction of Jimmy Durante Boulevard as track crosses over roadway | Based on the conceptual engineering and preliminary analysis, residential properties at the portal site, including a potential development of affordable housing units, could be impacted |
| Tunnel portal would be well above the flood elevation with sea level rise to cross over Jimmy Durante Boulevard | Requires reconstruction of the newly built San Dieguito Lagoon Bridge and Special Events Platform in the fairgrounds within a horizontal spiral/curve |
| — | Potential for noise/vibration at the north portal and visual impacts due to the need for an aerial structure near these same residences |
| — | Likely seasonal restrictions on construction impacting the local roadway network to minimize impacts on coastal access and fairgrounds operations. |
| — | Potential permanent impacts on the southern parking lot within the Del Mar Fairgrounds and could require permanent property interests on the fairground's property |
| — | Based on current estimate for the San Dieguito Double track proposed bridge and events platform, this option would be significantly more to reconstruct the bridge and platform with a longer bridge than the 10 percent portal location |

### 3.6.3 North Portal within Camino Del Mar

This conceptual alternative would provide a slight variation to the current north portal under Jimmy Durante Boulevard utilized within the CDM and CCHS alignments. The variation would include a shift in the alignment away from the private residences towards the center of CDM, see Exhibit 3 in Appendix I. Based on the conceptual engineering and preliminary analysis, this portal location would avoid potential impacts on the private residences east of CDM but could have a larger impact on the local roads and railroad operations during construction.

Portal construction would be in close proximity to the intersection of CDM and Jimmy Durante Boulevard, requiring temporary closures during construction, including temporary and permanent reconfiguration of the intersection and existing CDM bridge. Additionally, the proposed conceptual alignment would follow the existing track partially around a horizontal curve, limiting available space for a shoofly track. The proposed rail profile would be lowered within a trench with floodwalls in this area, creating the need for complex construction phasing to maintain existing rail operations during construction.

Table 3-18 summarizes the pros and cons of the north portal within CDM portal option.

**Table 3-18. North Portal within Camino Del Mar**

| Pros | Cons |
|---|---|
| Moves the north portal location away from private residences, reducing potential noise and vibration impacts | Requires challenging construction phasing to maintain railroad operations while constructing trench; potential to impact future 15-minute service |
| Based on the preliminary analysis, portal might not require acquisition of residential properties | Most impactful to local roads due to close portal proximity to Jimmy Durante Boulevard, and CDM overpass and would likely result in significant temporary impacts on local roadways. Likely requires rebuilding entire roadway interface in the permanent condition. |
| Utilizes the future San Dieguito Bridge and Special Events Platform as currently proposed | Likely seasonal restrictions on construction impacting the local roadway network to minimize impacts on coastal access and fairground's operations. |
| Likely comparable costs to current north portal location; to make a more conclusive comparison to determine the necessary roadway construction would require a higher level of design | Impacts the CDM overpass bridge |

Notes:
CDM=Camino Del Mar

### 3.6.4 South Portal within Knoll Near I-5

The south portal location within a knoll near I-5 was originally proposed as the Crest Canyon Below Carmel Valley Road alternative in the refinements of the original five alternatives that were part of the comparative analysis. It ultimately was not studied further as it was anticipated to cost more based on FTA-level unit costs due to the longer tunnel lengths, and it required the tracks to be in a trench below the 100-year flood elevation plus sea level rise, which did not meet the initial design criteria. Following feedback from the U.S. Fish and Wildlife service to move the portal as close to I-5 as possible and feedback from the Torrey Pines Community Planning Board to move the portal out of the open space easement within their community, this portal option is being reevaluated. This portal would be located within a knoll near the freeway, immediately south of the I-5 bridge over the Los Peñasquitos Lagoon, see Exhibit 4 in Appendix I. The key benefit of this location includes providing a portal that is farther from private residences and a reduction in impact on the Los Peñasquitos Lagoon.

This portal location would create the longest tunnel alignment, with a tunnel route length approximately 2,400 feet longer than the CCHS alignment. Additionally, this alternative would bore under Carmel Valley Road, placing the portal at an elevation below the 100-year storm with sea level rise. A long open trench with floodwalls would be required within the Los Peñasquitos lagoon to reach grade and protect the track from flooding. The trench has the potential to isolate the portion of the lagoon east of the alignment, so to maintain this area's connection to the lagoon, the cut-and-cover tunnel would be extended to allow hydraulic connectivity.

This portal location and subsequent staging area are situated furthest from residential and commercial properties. Vehicular access to and from this area may also have less impact on the surrounding community. The portal location creates the shortest length of exposed alignment within the lagoon and would relocate the alignment near the lagoon edge away from the main lagoon water passages. When

paired with the removal of the existing track embankment within the lagoon, this alternative would create additional flexibility for lagoon restoration.

Table 3-19 summarizes the pros and cons of the south portal within knoll near I-5 portal option.

**Table 3-19. South Portal within Knoll Near I-5**

| Pros | Cons |
|---|---|
| Moves the south portal location away from private residences, reducing potential noise and vibration, and overall construction impacts | Requires tunneling through a liquefaction zone |
| Based on the preliminary analysis, portal might not require acquisition of residential properties | More operational and maintenance requirements due to longer tunnel |
| No bridges in saltwater lagoon | Requires flood walls to protect tracks against peak storm events and sea level rise with longer transition through lagoon |
| Minimizes impacts on lagoon due to shorter length of alignment within lagoon | Comparable costs to 10 percent design south portal options, rough-order-magnitude costs of the 10 percent designs for CDM and CCHS indicate the lagoon bridges could be more costly than the tunneling on a per track foot basis |
| Moves southern part of alignment out of middle of lagoon and adjacent to I-5 | May impact large City of San Diego wastewater and potable water lines |
| Results in lowest impacts on coastal wetlands and waters of the U.S./wetlands and associated species | — |
| Substantially avoids any conflicts with implementation of the lagoon restoration plan | — |

Notes:
CCHS=Crest Canyon Higher Speed; CDM=Camino Del Mar; U.S.=United States

### 3.6.5 Summary

The three new north portal locations and one new south portal location were evaluated to determine feasibility and to perform a comparative analysis with the CCHS and CDM 10 percent design portal locations. As detailed herein, the additional locations were all found to be feasible. However, based on discussion with the PDT and feedback from SANDAG, two were found to be less practical due to significant construction challenges to maintain railroad operations and impacts on the Del Mar Fairgrounds, when compared with other potential portal location alternatives.

As a result, further evaluation of alternative portal locations should include the knoll near I-5 freeway (Option 3) and within CDM (Option 4).

## 3.7 Del Mar Bluffs Alternative

At a PDT meeting in March 2021, NCTD made a request to look at a double track alignment that would stay on the Del Mar Bluffs to show if it could be considered a viable alternative. While the California Coastal Commission (CCC) continues to recognize that the long-term solution to the bluff instability

through Del Mar is to relocate the tracks from the bluff to a tunnel (CCC 2022), a horizontal alignment on the bluffs was developed at a high level.

The existing alignment within the project limits has several speed restrictions. Just south of the San Dieguito Bridge, passenger operating speeds are restricted to 65 miles per hour where the alignment passes beneath the CDM overpass. The passenger operating speeds just north of the bluffs are restricted to 50 miles per hour due to a curve exceeding 4 degrees west of the Coast Boulevard at-grade crossing. At the south end of the bluffs, passenger trains are restricted to 55 miles per hour due to a 4-degree curve where the existing alignment passes beneath the Torrey Pines Road overpass. To provide similar travel times to CDM and CCHS alternatives and align with regional goals for the LOSSAN Rail Corridor, the alignment would need to accommodate 110 miles per hour passenger speeds through the limits of the project.

Figure 3-9 shows the resulting 110 miles per hour alignment. The single line is representative of a double track alignment and would have the following impacts:

- The CDM overpass would need to be re-built to accommodate the straightening of the existing ~2-degree, 30-minute curve.
- Roadway connectivity and coastal access would be difficult to maintain.
- To achieve higher operating speeds, the alignment would need to extend outside of the current rail ROW. Based on the conceptual engineering and preliminary analysis, a substantial number of private properties could be impacted to accommodate the straightening of the existing 4-degree curve.
- The North Torrey Pines Road overpass, a historic landmark, would need to be re-built to accommodate the straightening of the existing 4-degree curve.

A 110-miles per hour alignment on the bluffs would result in more significant impacts compared with the other conceptual alternatives, where the alignments would move inland. In addition, retaining the alignment on the bluffs does not address the current safety risk presently being addressed with multiple bluff stabilization projects, which would have the potential to continue in perpetuity to maintain safe operations. These impacts combined with the direction from CCC to relocate the track off the bluffs leads to the conclusion that an alternative double track alignment along the bluffs is not a desirable solution.

**Figure 3-9. Del Mar Bluffs Alternative**

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# 4 Public Involvement

## 4.1 Background

The LOSSAN Rail Corridor is an economic lifeline for the San Diego region and serves as a crucial link for national and international commerce. The corridor moves about 8 million passengers a year, as well as about $1 billion in goods.

Consequently, the public engagement process will cast a wide net across the region to parties with varying interests in the outcomes of the study. Rail users, whether passenger or freight, have a vested interest in outcomes, as do the communities along the alignment. A successful outreach effort will require the development of focused campaigns and messaging for each audience segment.

Prior to the initiation of the technical studies outlined in this document, a draft Public Outreach Plan was developed by the PDT in consultation with SANDAG. The plan considered a strategic approach to engaging key stakeholders, agency/operator/funding partners, and the public at large. A more detailed plan will be prepared to guide the process of specifically targeting these groups as project development progresses.

## 4.2 Engagement Process

The draft Public Outreach Plan defined specific points of engagement targeted to the various audiences as well as with key elected officials and community groups from the areas bordering the alignment. As the study moves into the preliminary engineering and environmental phase, the plan will be further refined, and outreach efforts will cast a wider net.

The primary goal of SANDAG's engagement campaign is to ensure that open and transparent communications are made to the general public and vested communities, providing both current project information and opportunities for feedback on proposed rail realignment alternatives for the SDSVDT segment. These efforts will be designed to encourage members of the public to provide valuable and insightful feedback that will benefit the entire SD-LOSSAN Rail Corridor as well as subsequent corridor-wide rail operations for both passenger and freight.

The next phase of engagement will continue to target key audience groups, such as community-based organizations, local businesses and their support organizations, environmental groups, and agency partners, while also extending a broader reach to members of the general public, including residents of Del Mar, the City of San Diego, and beyond.

## 4.3 Approach

The Public Outreach Plan lays the groundwork to communicate with target audiences early and often to ensure accurate facts about the SD-LOSSAN study and the proposed conceptual alignments are clearly understood. This will be accomplished with a series of defined tactics.

The first tactic is to develop a project-specific message platform. Public outreach efforts will center around messaging that conveys factual and timely project information while remaining mindful of sensitive community issues. These messages will incorporate the LOSSAN Rail Corridor plans that SANDAG outlined in the 2021 Regional Plan, such as:

- The LOSSAN Rail Corridor is the nation's second-busiest passenger rail corridor. It is the economic lifeline for our region, moving nearly 8 million passengers and $1 billion worth of goods a year.
- It also plays a vital role in our nation's defense by providing direct rail access to several key military bases.
- Future rail line improvements would:
    - Increase track capacity and support increased passenger and freight frequencies,
    - Reduce travel times to compete with automobile travel when compared with driving the parallel I-5 corridor; and
    - Improve resiliency and enhance safety, adaptability, and social equity.

The second tactic envisioned is to present at and/or host key stakeholder and community meetings. The PDT will seek and schedule opportunities to share progress updates and important milestones with business, environmental, and community groups, which will likely be grouped by type and geographic location. Opportunities may also arise to host ad hoc meetings if requested. Rail realignment progress updates can be presented at existing recurring community meetings, such as City Council and Community Planning Group meetings, in addition to meetings that focus solely on the project.

Thirdly, a variety of communication methods will be employed to provide timely, ongoing, consistent, and understandable information to the public. This includes holding informational/listening sessions at local venues and events, such as setting up a table at the Del Mar Farmers Market, sending informational mailers, distributing fliers, further developing and enhancing the Social Pinpoint webpage: sandag.mysocialpinpoint.com/railalignmentstudy, updating sandag.org and KeepSanDiegoMoving.com/LOSSAN, and creating a comprehensive educational and engaging social media campaign.

## 4.4 Summary of Public Outreach

### 4.4.1 Progress to Date: Focus on Stakeholder Outreach and Community Presentations; Online Messaging Directed at the General Public

Outreach efforts to date have focused on meetings with partner agencies, key stakeholders, and community groups, and presentations at community group and partner agency meetings as the technical team has worked to further refine potential conceptual realignment alternatives. Presentations on study progress have been featured at public meetings, including: Del Mar City Council, Torrey Pines Community Planning Board, and Board of Directors meetings for NCTD, LOSSAN, and SANDAG thus far.

The SANDAG Public Affairs team has disseminated rail realignment messaging through internet-based platforms to provide an easily searchable online foundation of information to the public before beginning more widespread engagement during the next project phase. An interactive website

on the Social Pinpoint platform was launched to help inform any interested parties on the study's progress to date, and the new site and project fact sheet were also linked on SANDAG's KeepSanDiegoMoving.com/LOSSAN website. The Social Pinpoint website includes maps of potential alignments, a Frequently Asked Questions section, a draft timeline for project milestones, and downloadable copies of public presentations given by the PDT.

Additionally, social media messaging was deployed throughout 2022 and 2023 regarding funding awarded for the LOSSAN Corridor; recognition of key elected officials at the federal, state, and local levels who provided support for the future realignment; as well as general information and safety-focused messaging pertaining to the project.

### 4.4.2 Anticipated Future Public Outreach Timeline

As realignment alternatives are narrowed and refined, more widespread public outreach will take place to communicate findings and solicit feedback that will inform the analytical process. Table 4-1 provides a tentative timeline of key public outreach activities that are planned.

**Table 4-1. Timeline of Planned Outreach Activities**

| Activity | Start Date |
|---|---|
| Develop outreach and media materials | Ongoing/as needed |
| Stakeholder briefings:<br>• SANDAG Board of Directors, committees, and working groups<br>• NCTD, and LOSSAN Boards of Directors and working groups<br>• San Diego Community Planning Groups<br>• Del Mar City Council<br>• Various elected officials | Ongoing since 2020 |
| Present at existing public meetings, such as City Council and Agency Board Meetings | Ongoing since Spring 2021 |
| Host Meetings with business, environmental, and other key stakeholder groups | Ongoing since 2022 |
| Attend local community events to hold information/listening sessions, e.g., Del Mar Farmers Markets | Ongoing since late 2022 |
| Create and launch social media campaign | Ongoing since late 2022 |
| Host community events such as public open houses, workshops | Fall 2023 through project construction |

Notes:
LOSSAN=Los Angeles-San Diego-San Luis Obispo; NCTD=North County Transit District; SANDAG=San Diego Association of Governments

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# 5 Rail Service Operations Analysis

## 5.1 California State Rail Plan Operations Vision

The 2018 California State Rail Plan is a strategic plan with operating and capital investment strategies that are intended to result in a coordinated and integrated statewide passenger rail travel and heavy freight rail system (Caltrans 2018). The rail plan was developed by Caltrans, with extensive input from stakeholders and public outreach. The final plan is approved by CalSTA. Caltrans also receives advice from the California Transportation Commission and submitted the final approved Rail Plan to the Legislature, the Governor, CPUC, California High Speed Rail Authority, and California Transportation Commission.

California is the fifth-largest economy in the world, with an annual gross domestic product of more than $2.4 trillion. California businesses export roughly $162 billion worth of goods to more than 225 foreign countries annually. The state's extensive rail network supports this robust and important economy with an eye towards minimizing impacts on air quality compared with other modes.

By 2040, the state's freight railroad loads will have increased by 38 percent, compared with 2013. As such and considering this growth, freight rail capacity growth will benefit freight operations resulting in fewer delays from passenger train movements. Passenger rail service will benefit from a more integrated operations network while adding frequency and higher levels of service with travel times competitive with that of the automobile.

The ability of the state's freight railroads to deliver these benefits will depend on the preservation and enhancement of the railroads' main lines. Understanding the need to preserve and enhance the current rail system is the primary goal of the Rail Plan and the primary factor which underpins the vision behind the strategic elements of the Rail Plan. Accordingly, the plan envisions an evolving partnership between the state, regions, and the freight railroads to:

1. Identify projects that will eliminate bottlenecks and use existing corridors more intensively, enhancing the capabilities of both freight and passenger trains.
2. Make shared investments that improve the performance and utility of freight and passenger operations through strategic identification of infrastructure projects that provide benefits to all operators, implement quiet zones and grade separations, and foster the use of cleaner and quieter locomotives that will make railroads better neighbors.
3. Make use of significant new federal and state funding programs such as those emanating from the Federal Government-Based Infrastructure Investment and Jobs Act, including new programs such as MEGA and the Federal-State Partnership Program, both of which support large capital investment projects as well as involving existing programs such as Rebuilding American Infrastructure with Sustainability and Equity. Additionally, the state has made a significant investment through Senate Bill 1 oriented programs, such as the Trade Corridor Enhancement Program, to implement the identified rail system improvements.

Coordinated, ongoing planning allows state and regional agencies responsible for rail services to have a conversation with communities about how best to meet these diverse and often competing needs. Investing in rail will increase the mode share of freight and passenger rail and will support a growing economy while lowering statewide transportation costs, integrating rail travel networks with existing state highways and airports, improving safety, lowering greenhouse gas emissions, and enhancing mobility and overall quality of life. Highways and local roads will benefit from having their capacity used

for high-value trips that cannot be made by rail, and airports will benefit from having their capacity available for higher-profit, long-distance flights.

Locally, California cities and towns will benefit from the private investment that follows station-area development. Although investments are clearly indicated between now and the 2040 horizon year of the Rail Plan, the exact nature of the specific capital investments needed, as well as the phasing of network improvements, requires further input from local communities, current and future rail system users, and businesses, to ensure that impacts of network development are acceptable, costs are justifiable, and benefits are widespread.

To accommodate the projected growth in demand for freight and passenger transportation, the state Rail Plan established a strategic framework for implementing capital projects and adding frequencies in phases tied to the plan's short-term (2022), mid-term (2027), and long-term (2040) vision for service. Specific service goals and improvements in each planning horizon were identified for nine distinct geographic service areas in California, one of which is labeled "LOSSAN South" and encompasses the portion of the LOSSAN Rail Corridor between Los Angeles/Anaheim and San Diego.

The short-term (2022) service goal for the LOSSAN South region envisions hourly intercity passenger rail service and half-hourly local service between San Diego and Los Angeles, after completion of double track projects in the San Diego region, capacity improvements between Fullerton and Los Angeles, and other infrastructure improvements. The mid-term (2027) service goal for the LOSSAN South region envisions half-hourly intercity passenger rail service and half-hourly local service between San Diego and Los Angeles, along with a new maintenance and layover facility in the San Diego region. The long-term (2040) service goal for the LOSSAN South region envisions half-hourly intercity passenger rail service and half-hourly local service between San Diego and Los Angeles, with integrated transit connections for service to San Ysidro and to the San Diego Airport, and if feasible, half-hourly local rail service between San Diego and the Mexico border, possibly Tijuana, with customs and border pre-clearance.

This alternative analysis and the work supporting it is therefore aligned directly with the 2040 vision as it will lead to a final report which identifies investments to reach speed, frequency, and connectivity goals while undergoing rigorous technical review and public scrutiny. It should also be noted that the state is in the process of reviewing, revising, and updating the 2018 plan to incorporate additional project planning efforts that have occurred since the 2018 plan was released, as well as to incorporate additional stakeholder input.

## 5.2 LOSSAN Corridor-wide Service Optimization Analysis

The LOSSAN Rail Corridor Agency is conducting a LOSSAN Rail Corridor Optimization Study in cooperation with CalSTA, Caltrans, NCTD, SCRRA, Amtrak, BNSF, Union Pacific, and other stakeholders. The purpose of the optimization study is to develop short-range, mid-range, and long-term passenger service concepts and associated capital improvements that would enable corridor users to achieve planned service objectives.

As a subset of that effort, NCTD and BNSF Railway jointly funded a service optimization analysis for the southern portion of the LOSSAN Rail Corridor entitled the *San Diego Pathing Study* (DB Engineering & Consulting USA 2020). The study was released in November 2020. The *San Diego Pathing Study* builds on previous LOSSAN Rail Corridor service optimization work completed by NCTD and other LOSSAN stakeholders and supports efforts to holistically consolidate freight and passenger rail service needs into one executable operating plan that also aligns with the goals of the

2018 California State Rail Plan. The optimized service concepts defined in the study provide the following benefits:

- Customer-focused and integrated passenger rail system
- Frequent, pulsed all-day service
- Improved network connectivity
- Joint planning and schedule changes with other operators along the corridor
- Planned expansion

Using computer-based simulation modeling software, operating plans were developed for the near-term, mid-term, and long-term planning horizons that established consistent patterns of service throughout the day for COASTER commuter trains, Metrolink commuter trains, Amtrak Pacific Surfliner trains, and BNSF freight trains traveling between the Port of San Diego and the CP Atwood junction in Orange County. Specific types of trains were assigned specific train paths, or slots, which enabled trains to operate at consistent intervals, with station departure times occurring at the same minutes past the hour during the day. The train paths and service patterns were developed to enable commuter, intercity passenger, and freight trains to share the corridor infrastructure, complete their journeys with minimal conflicts or congestion delays caused by other trains, and accommodate projected increases in service frequency.

In addition, the pathing study identified and prioritized specific infrastructure improvements that would enable train volumes to increase in the near-term, mid-term, and long-term planning horizons. The project prioritization blueprint was designed to assist NCTD and its partners in advancing construction projects that would allow train frequencies to expand in accordance with service objectives established in the 2018 California State Rail Plan for the LOSSAN South Corridor. The projects would also improve the reliability of existing operations by reducing or eliminating chokepoints and other operating constraints.

Mid-term plans include infrastructure recommendations that enable an extension of COASTER commuter train service south to a new station at the Downtown San Diego Convention Center and an increase in BNSF freight train service from three daily round trips to five daily round trips. Improvements would also allow for hourly off-peak service in each direction for both COASTER commuter trains and Pacific Surfliner intercity passenger trains. To accommodate the proposed mid-term service levels, the San Dieguito Double Track and Special Events Platform Project on the existing alignment in Del Mar is assumed to be completed and placed in service.

Long-term plans include infrastructure recommendations that enable additional Pacific Surfliner and COASTER train frequencies, increase freight service to eight daily round trips, and accommodate the opening of a new LOSSAN intercity passenger train storage and servicing facility in National City.

Projects recommended by the study also would minimize grade crossing delays by extending signaling and PTC to improve rail speed and coordination with rail crossing gates.

With the completion of the *San Diego Pathing Study*, NCTD and its rail partners intend to work together with SANDAG, the LOSSAN Rail Corridor Agency, CalSTA, and other stakeholders to secure funding to implement the prioritized mid-term and long-term improvements that would expand the way people and goods are transported along the corridor and also help the region achieve state and national economic, transportation, and environmental goals. One early result of that collaboration was announced on December 8, 2020, when SANDAG and NCTD issued a press release stating that the

California Transportation Commission had awarded a $106 million grant to help fund the SD-LOSSAN Intermodal Improvement Program and a $202 million package of rail improvement projects to be carried out on the LOSSAN Rail Corridor in the San Diego region. The projects identified for funding and implementation by SANDAG were based on improvements recommended in the *San Diego Pathing Study* (NCTD 2020). The program of projects includes the Del Mar Bluffs Stabilization Project 5, the construction of the COASTER Downtown San Diego Convention Center Platform, Phase 1 of the San Dieguito Bridge located near the Del Mar Fairgrounds, and rail line improvements in Camp Pendleton.

## 5.3 SD-LOSSAN Design Speed Analysis

To understand the operational benefits of proposed improvements on the San Diego Subdivision and to inform the development of design criteria for those improvements, SANDAG commissioned a design-speed analysis. The study analyzed the operational feasibility of increasing line speeds on the San Diego Subdivision between Oceanside and the San Diego Santa Fe Depot to inform basis of design criteria for improvement projects, including the SDSVDT project (formerly referenced as the Del Mar Tunnel in the operation analysis). As part of the analysis, higher-track speeds, higher-speed zero emission rail vehicles with faster acceleration, and new tunnel alignments in Del Mar and Miramar were assessed for their impact on reducing technical runtimes. The technical runtimes (also known as pure running times) calculated included time allotted for train acceleration and braking for stations stops, but they excluded station dwell times. Technical runtimes also excluded schedule recovery times.

### 5.3.1 Operational Feasibility

The operational feasibility study investigated the benefits of faster runtimes and corridor resiliency that could be achieved if the LOSSAN Rail Corridor were realigned through two tunnels: one in the SDSVDT project segment described in this report and another through Miramar, which will be described in a subsequent alternatives analysis. Operational tests were not performed to compare the impacts of SDSVDT in isolation as part of this study. Tests were recorded on an improved speed alignment between the Solana Beach Station and the San Diego Old Town/Airport Station that included both a Del Mar tunnel alternative and Miramar tunnel alternative.

One SDSVDT alignment alternative was selected for travel time testing in the operational analysis as the representative alignment for the SDSVDT project. The alignment selected was the CCHS alternative, which begins south of the proposed Del Mar fairgrounds special events platform and is routed under the City of Del Mar and Del Mar Heights. The CCHS alternative tunnel alignment is approximately 4.8 miles long and reconnects to the corridor's present-day alignment at CP Torrey, just north of the Sorrento Valley Station. It is the shortest alternative under consideration for the SDSVDT alignment. In addition, the Miramar Torrey Pines alignment between Sorrento Valley and University City was selected for travel time testing in the operational analysis as the representative alignment for the Miramar tunnel project, bypassing the existing alignment that traverses the Miramar Hill for commuter trains.

The report evaluated two sets of propulsion vehicles: higher-speed diesel locomotives, which have been procured by Amtrak and NCTD, and zero-emissions vehicles, referred to as Zero-emission Multiple Units (ZEMU), which are gaining commercial viability.

Operational feasibility testing was carried out using the train performance calculator in the LOSSAN Long-Term Viriato Operations Model from the LOSSAN optimization study. Technical runtimes were tested on the following alignments:

- **Current alignment:** Technical runtimes for diesel-powered trains were tested on the current San Diego Subdivision alignment. The current alignment in the model assumed completion of infrastructure projects listed in SANDAG's *Infrastructure Development Plan* (IDP) that will increase track capacity and operating speeds on the existing corridor between Oceanside and San Diego.
- **Higher-speed alignment with main corridor tunnels:** Technical runtimes for diesel-powered trains and ZEMU trains were tested on a higher-speed Oceanside-San Diego alignment that replaced portions of the current alignment between Solana Beach and Old Town San Diego with the proposed SDSVDT and Miramar tunnel alignment options.

FRA Track Class speeds 5, 6, and 7 (90 miles per hour, 110 miles per hour, 125 miles per hour, respectively) were added to the model's speed profiles for the San Diego Subdivision, and speed tests were conducted for three type of trains:

- **Siemens Charger and 6 COASTER Bombardier cars with a maximum speed of 90 miles per hour:**[2] This train type was tested on the current alignment and the higher-speed alignment with main corridor tunnels.
- **Siemens Charger and 7 Surfliner cars with maximum speed of 110 miles per hour and 125 miles per hour:**[3] This train type was tested on the current alignment (at a top speed of 90 miles per hour) and the higher-speed alignment with main corridor tunnels at top speeds of 90 miles per hour, 110 miles per hour, and 125 miles per hour.
- **Stadler KISS EMU (Caltrain) with maximum speed of 110 miles per hour and Stadler KISS 200 EMU with a maximum speed of 125 miles per hour:**[4] This train type was tested on the higher-speed alignment with main corridor tunnels and the Sorrento Mesa Tunnel alignment options at top speeds of 110 miles per hour and 125 miles per hour.

Tests were performed between Oceanside and San Diego for all speed cases. Train runs were tested on the corridor using the following Pacific Surfliner and COASTER stopping patterns:

- Limited-stop Pacific Surfliner trains made intermediate station stops at the Solana Beach, University Town Center/Nobel (proposed), and Airport/Old Town stations.
- All stop COASTER commuter trains made intermediate station stops at the Carlsbad Village, Poinsettia, Encinitas, Solana Beach, University Town Center/Nobel (proposed), and Airport/Old Town stations. All stop trains modeled on the Sorrento Mesa Tunnel alignments also made an additional stop at the Sorrento Mesa station.

[2] NCTD advised that they may increase train consists from five to six cars.

[3] Surfliner coaches were modelled with a top speed of 125 miles per hour to test hypothetical speed cases. LOSSAN advised that they intend to run seven car consists in the future.

[4] The Stadler KISS unit was used to model the likely performance characteristics of a zero-emission multiple unit (ZEMU) in 2035. This assumption was agreed upon during the Project Development Team (PDT) meeting on November 13, 2020. SBCTA's Stadler FLIRT was not used as it has a maximum speed of 80 miles per hour. After a request from SANDAG to review a 125 miles per hour ZEMU, the Stadler KISS 200 was also modelled.

The tests for vehicles operating at a maximum speed of 125 miles per hour yielded no improvement in runtimes as the bi-level passenger cars hauled by the COASTER and Pacific Surfliner services limit speeds to 90 miles per hour and 110 miles per hour, respectively. Although the ZEMU trainset can operate at 125 miles per hour, preliminary analysis indicated that an increase in speed to 125 miles per hour does not lead to any further reductions in runtimes. This is mainly due to the short distances between stops and anticipated traffic mix on the corridor. The study concluded that increasing line speeds above FRA Track Class 6 (110 miles per hour) to FRA Track Class 7 (125 miles per hour) offered marginal benefit for limited-stop services and no advantages for all-stop services. The higher track speeds could not be fully utilized due to the frequent requirement for acceleration and braking to serve stations. The basis of design criteria for the SDSVDT alignments established a maximum speed of 110 miles per hour for passenger trains and 60 miles per hour for freight trains.

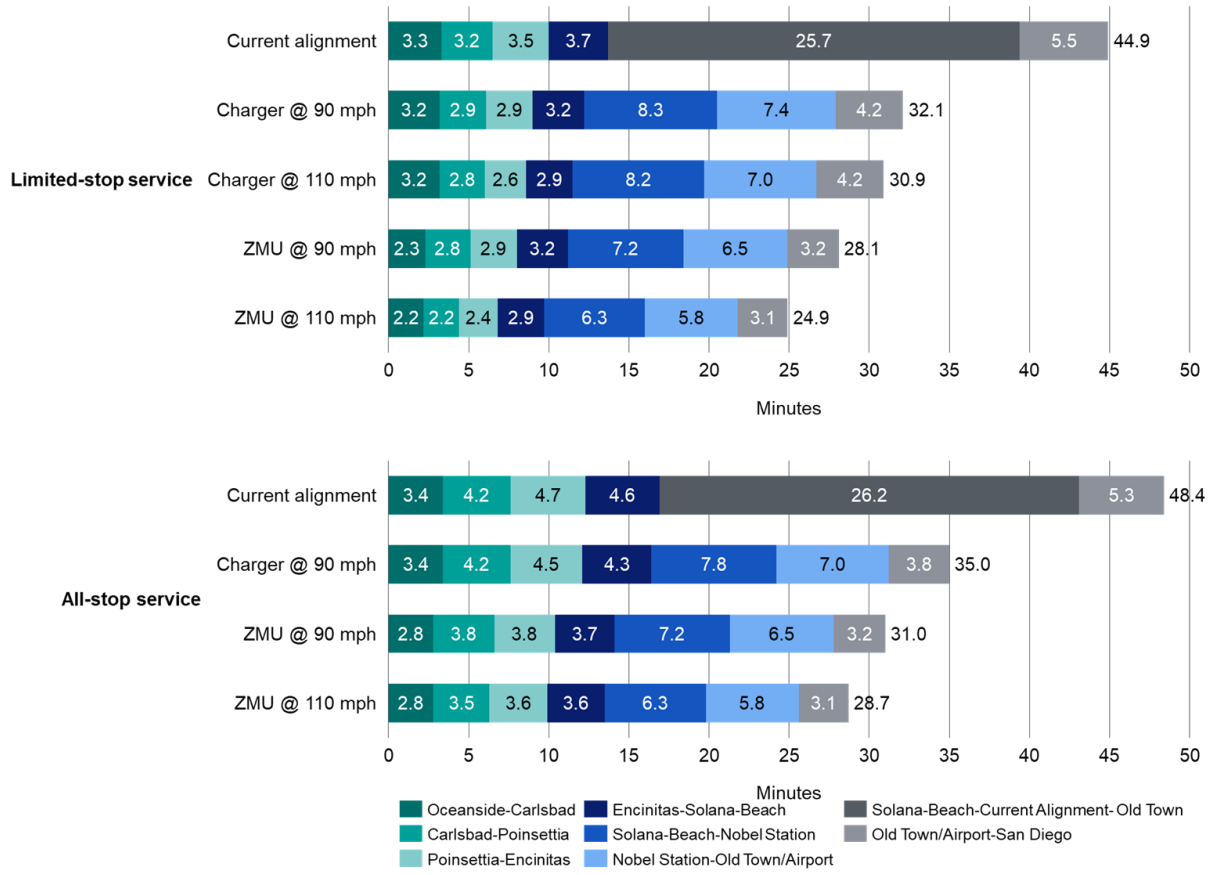
### 5.3.2 Reduced Travel Time Analysis

The construction of the Del Mar and Miramar tunnels shortened the technical runtimes between Solana Beach and the San Diego Old Town/Airport Station by approximately 10–11 minutes for a diesel-locomotive in both all-stop or limited-stop service scenarios and approximately 12 minutes for a ZEMU when compared with operations on the current alignment with completed SANDAG IDP projects.

The technical travel time with a ZEMU (referenced by Stadler KISS with a top speed of 110 miles per hour) would be 39 minutes and 46 minutes for a diesel-powered train (Siemens Charger + 6 bilevel coaches). These technical travel times compare favorably to an automobile-based drive time range, which is generally considered to be between 50 minutes to 1 hour and 25 minutes.

Figure 5-1 shows the technical runtimes between the stations for an all-stop and limited-stop service. The first row of the runtime comparisons measures the performance of the conventional diesel-powered train type on the current alignment between Oceanside and San Diego with upgrades already detailed in SANDAG's IDP. The subsequent rows measure the performance of the conventional train and a zero-emissions alternative train on the higher-speed alignment that includes a relocated ROW through SDSVDT (CCHS alternative) and the Miramar Tunnel (Torrey Pines alternative). Tests on the higher-speed alignment were run twice, once with a maximum authorized speed of 90 miles per hour and once with a maximum authorized speed of 110 miles per hour.

**Figure 5-1. Consolidated Technical Runtime Results**[5]




**Limited-stop service impacts**. Under the limited-stop service pattern, a Charger pulling seven Surfliner cars at a top speed of 90 miles per hour between Oceanside and San Diego achieved a total reduction in runtime of 12.8 minutes on the improved speed alignment when compared with the current alignment of completed SANDAG IDP projects. In the section of the corridor between the Solana Beach and Old Town/Airport stations, where the main alignment would be relocated through Del Mar and Miramar tunnels, a Charger pulling seven Surfliner cars at a top speed of 90 miles per hour saved 10.0 minutes of runtime.

When maximum authorized speeds on the higher-speed alignment were increased from 90 miles per hour to 110 miles per hour (Track Class 6), the Charger in limited-stop service saved an additional 1.2 minute of runtime between Oceanside and San Diego. In the segment of the higher-speed alignment between Solana Beach and the Airport/Old Town Station, which includes the proposed SDSVDT project and Miramar tunnel, a Charger operating at 110 miles per hour in limited-stop service saw a reduction in runtime of 0.5 minute when compared with operation at 90 miles per hour.

**All-stop service impacts**. Under the all-stop service pattern, a Charger pulling six COASTER cars at a top speed of 90 miles per hour between Oceanside and San Diego achieved a total reduction in runtime of 13.4 minutes on the improved speed alignment when compared with the current alignment with completed SANDAG IDP projects. In the section of the corridor between Solana Beach and the Old Town/Airport Station, where the main alignment would be relocated through Del Mar and Miramar

[5] The airport stop in future alignments is modelled at the location of the present-day Old Town Station to provide easier comparison for travel time savings resulting from the tunnel.

tunnels, a Charger pulling six COASTER cars at a top speed of 90 miles per hour saved 11.4 minutes of runtime. The travel time savings of 11.4 minutes between the Solana Beach and Old Town stations result from the faster and shorter tunnel alignment. Chargers in all-stop service were not tested at 110 miles per hour since the bi-level COASTER equipment has a maximum operating speed of 90 miles per hour.

Final travel time saving estimates will be refined through the SD-LOSSAN's *Future LOSSAN Corridor Improvements Technical Report*.

### 5.3.3 Equipment Technology and Performance

In addition to testing existing equipment, the operational analysis tested a ZEMU vehicle. As agencies and the state look beyond the existing Tier 4 emissions standards achieved by today's fossil fuel-powered locomotives, a desire for zero-emissions propulsion technology is set to dictate the next cycle of rail vehicle design.[6] This type of technology relies on alternative power sources, such as electrification, hydrogen power, and/or battery technology.

Hydrogen as a propulsion type is a new zero-emission technology. This propulsion technology only emits steam and condensed water. In a hydrogen vehicle, a hydrogen fuel cell is used to power an electric propulsion system. The converted energy is stored in lithium-ion batteries and can provide similar operating characteristics as purely electric vehicles, though this is dependent on the dimensions of the engine and batteries. The battery and ultracapacitor provide power for accelerating the train, and hydrogen powered vehicles are also equipped with a regenerative braking system. During braking, the regenerative braking system further charges the batteries and the ultracapacitor. Hydrogen trains require dedicated refueling infrastructure at maintenance facilities (CH2M Hill et. al 2018). Stadler Rail will deliver the first hydrogen-powered train in the U.S. for the San Bernardino County Transportation Authority (SBCTA). The SBCTA train comprises two cars with a hydrogen module between the cars. The train is expected to enter service in 2024 and will have a maximum authorized speed of 79 miles per hour (SBCTA n.d.).

Battery powered propulsion systems are seeing expanding application in a variety of fields due to recent advances in technology. Modern battery powered trains have a range of approximately 50 miles before recharging is required. The batteries can be charged during operation under catenary and at electrified terminus stations; batteries can also make use of a train's regenerative braking system for recharging. Current battery technology in passenger rail applications is useful to bridge gaps in networks that are already mostly electrified. At present, there are no bi-level multiple units with battery propulsion or with dual mode (catenary powered and batteries) on the market. Disadvantages of battery power include their weight, space consumption, and recharging time. The higher weight impacts vehicle acceleration, while recharging times require a carefully designed charging network to support operation.

Power provided by an overhead electrified contact system, commonly known as catenary, is a well-established technology. Catenary powered rail lines require secondary infrastructure such as substations, powered sidings, yards, and maintenance facilities. Electrification of existing rail corridors requires sufficient clearance for the wires: existing infrastructure, such as overpasses, underpasses, and tunnels, may need modification. Electrification of shared-use rail corridors that host freight services also requires coordination between the track infrastructure owner and freight and passenger

[6] Zero-emissions is supported by the Governor of California through Executive Order N-79-20.

rail operators to determine the feasibility and additional clearance requirements of installing an overhead catenary system.

The main benefit of catenary powered electric multiple units (EMU) is their potential for higher acceleration than conventional locomotives with trains of more than six cars. EMUs are relatively lightweight and can be powered at each axle, which provides high accelerating characteristics and is advantageous for lines with steep gradients. All major vehicle manufacturers have a portfolio of electric trains in single- and double-deck designs. Stadler is manufacturing the Stadler KISS EMU for Caltrain in Northern California. These trains comprise six cars with a maximum speed of 110 miles per hour.

While electrification using overhead catenary system is not under consideration for this study, the feasibility study considered the operational impact of ZEMU technology using a Stadler KISS EMU in runtime simulations because the hydrogen-powered Stadler FLIRT (Fast Light Intercity and Regional Train) multiple units to be used by SBCTA are limited to 79 miles per hour.

**Limited-stop service impacts**. Results indicate that a ZEMU vehicle operating at 90 miles per hour on the higher-speed alignment would provide an additional 4 minutes of runtime saving versus a Charger-based operation at 90 miles per hour in limited-stop service between Oceanside and San Diego. In the segment of the higher-speed alignment between Solana Beach and the Airport/Old Town Station, which includes the proposed SDSVDT project and Miramar tunnel, a ZEMU vehicle operating at 90 miles per hour in limited-stop service would provide an additional 2 minutes of runtime savings versus a Charger-based operation at 90 miles per hour.

At 110 miles per hour on the higher-speed alignment, the ZEMU vehicle would provide an additional 6 minutes of runtime saving versus a Charger-based operation at 110 miles per hour in limited-stop service between Oceanside and San Diego. In the segment of the higher-speed alignment between Solana Beach and the Airport/Old Town Station through the proposed Del Mar and Miramar tunnels, a ZEMU vehicle operating at 110 miles per hour in limited-stop service would provide an additional 3 minutes of runtime savings versus a Charger-based operation at 110 miles per hour. This increase in travel time savings results from the ZEMU's ability to accelerate to line speed faster than the Charger-hauled train.

**All-stop service impacts**. Results indicate that a ZEMU vehicle operating at 90 miles per hour on the higher-speed alignment would provide an additional 4 minutes of runtime saving versus a Charger based operation at 90 miles per hour in all-stop service between Oceanside and San Diego. In the segment of the higher-speed alignment between Solana Beach and the Airport/Old Town Station, which includes the proposed SDSVDT project and Miramar tunnel, a ZEMU vehicle operating at 90 miles per hour in all-stop service would provide an additional 1.1 minutes of runtime savings versus a Charger-based operation at 90 miles per hour.

At 110 miles per hour on the higher-speed alignment, the ZEMU vehicle would provide an additional 6.3 minutes of runtime saving versus a Charger-based operation at 90 miles per hour in all-stop service between Oceanside and San Diego. In the segment of the higher-speed alignment between Solana Beach and the Airport/Old Town Station through the proposed Del Mar and Miramar tunnels, a ZEMU vehicle operating at 110 miles per hour in all-stop service would provide an additional 2.7 minutes of runtime savings versus a Charger-based operation at 90 miles per hour. This increase in travel time savings results from the ZEMU's higher acceleration and deceleration capabilities.

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# 6 Right-of-Way Impacts

As explained in greater detail above, the PDT has substantially reduced potential impacts on private properties since the previous alternatives analysis was developed in 2017. The potential impacts on private properties will be further analyzed and refined as the design progresses into preliminary engineering.

Based on the 10 percent conceptual engineering, both CDM and CCHS alternatives could have similar impacts on residential and commercial properties at the proposed north portal locations. Subsurface easements could be required for the tunnel segments under residences.

At the south portal location, the CCHS portal could potentially be located on an undeveloped parcel owned by an adjacent homeowner's association encumbered by an open space easement in favor of the Los Peñasquitos Lagoon Foundation. South of the portal, the alignment would cross through the Los Peñasquitos Marsh State Reserve which is owned by the State of California until it ties back into the existing railroad ROW in Sorrento Valley.

Alternatively, the CDM south portal could potentially impact a private residential property adjacent to the Torrey Pines State Reserve and State of California property within the Torrey Pines State Reserve. South of the portal, the alignment would stay within the existing railroad ROW through Los Peñasquitos Lagoon until the end of the project limits in Sorrento Valley.

Based on a preliminary analysis, it is anticipated that CCHS would have higher costs associated with ROW (approximately 15 percent higher) compared with CDM. The potential costs should be evaluated further.

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# 7 Utility Impacts

The tunnel portal locations for each conceptual alternative were investigated to identify potential conflicts with existing utilities. All utilities and associated agencies which were identified as located within the portal locations on the Digalert.org website and City of San Diego Geographical Information System (GIS) websites were contacted, and each responded as to whether their utility was located within the respective portal vicinity. Responses were received from AT&T Transmission, AT&T Distribution, the City of Del Mar, the City of San Diego, MCI-Verizon, Southern California Gas Company, San Diego Gas and Electric (SDG&E), Crown Castle International, and Charter/Spectrum. The utilities associated with the City of Del Mar and City of San Diego encompass water, sewer, storm drain, and other city-owned improvements. The reference documents received from the facility owners consisted of as-built drawings and asset map exhibits. The asset maps provided were generally from the dry utility companies. It is noted that the utility effort completed does not include the evaluation of necessary temporary and permanent utilities to support tunnel construction and operations.

The as-builts, asset maps, and reference plans provided by the agencies and utility companies were reviewed to identify potential utility conflicts within the areas which are expected to be impacted by the proposed portal, including the portal approach structure, fill grading, and other permanent facilities. A utility conflict matrix (Appendix C) was developed for each portal area. The likelihood of each utility conflicting with the conceptual alternatives was evaluated based on its 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 depth. The disposition for each conflict was determined based on various considerations, including utility type and location. It was also based on the new depth which the utility would be at within the proposed project improvements, including grade filling. In general, the cost responsibilities shown on the matrix are typically carried out in one of two manners: the dry utility owners perform their own respective installations or modifications and are 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.”

## 7.1 Camino Del Mar Alternative

Two portal locations along the CDM conceptual alternative alignment were investigated to identify potential conflicts with existing utilities. The northern portal structure, identified as CDM-North, has a portal approach structure that would begin about 800 feet north of existing Jimmy Durante Boulevard. Construction required at this location would include grading fill to elevate the roadway over the cut-and-cover section for the tunnel portal, including retaining walls as need to support modified roadway grading. Other improvements associated with the portal, including a designated area for permanent facilities, were also included in this utility conflict investigation.

The southern portal is identified as the CDM-South portal that would cross under Carmel Valley Road approximately 500 feet east of its intersection with CDM Road. The portal area investigated for this existing utility assessment would not be located over the existing railway. The area includes Carmel Valley Road, an existing residential development on its north, and the Torrey Pines State Natural Reserve on its south side.

Approximately 1.7 mile separates both portals, and the area consists chiefly of areas developed for residential, commercial, and public uses. The portals would essentially be located at the northern and

southern boundary of the City of Del Mar. However, the City of San Diego was found to own utilities along Carmel Valley Road, as discussed below. The Digalert.org and the City of San Diego GIS websites were utilized in identifying and contacting potential agencies and utility companies which may have facilities located within each portal area.

### 7.1.1 Camino Del Mar North

The utility research performed for the vicinity of the CDM-North portal identified significant water and sewer improvements. Water lines range in sizes between 6 and 12 inches, including some smaller diameter lines used for local services. A 20-inch steel line was also found along Jimmy Durante Boulevard which is being utilized as a casing for a 12-inch waterline. The water line pipes varied in material types, such as polyvinyl chloride pipe (PVC), ductile iron, steel, and asbestos cement pipe (ACP). An abandoned 6-inch ACP line was also identified along Jimmy Durante Boulevard south of David Way. Water line depths were typically shallow and have been generally constructed between 3.0 and 5.5 feet deep.

City of Del Mar-owned sewer facilities were identified in the area per as-built plans. Pipe sizes ranged between 6 and 12 inches and included PVC, vitrified clay pipe, with some of these sections constructed as force mains. Sewer pipe depths ranged between 2 feet and 8 feet in instances where as-builts were referenced. In instances where the City of Del Mar's asset maps were referenced, the depths could not be determined and will need to be verified by potholing. Storm drains exist within the CDM-North portal area, with pipe sizes between 24 and 30 inches, and pipe materials include reinforced concrete pipe. The as-built and reference documents showed the pipes to be between 4 and 5 feet in depth.

Dry utilities, consisting of electric, gas, cable, telephone, fiber, and other communication companies, compose the remaining utilities within the CDM-North portal area. Although most of these utilities exist underground at shallow depths, some overhead utilities are present, such as SDG&E electrical and Spectrum (formerly Time Warner Cable) just north of the CDM/Jimmy Durante Boulevard merge. The overhead electric line alongside the south side of Jimmy Durante Boulevard poses a conflict with the proposed fill and portal trench.

### 7.1.2 Camino Del Mar South

The search for water line facilities within this portal area found pipeline sizes between 1 and 12 inches composed of ACP, reinforced plastic mortar, and PVC material. These water lines were typically constructed at a minimum depth of 3 feet and generally remain shallow. The larger diameter pipes can be found along Carmel Valley Road just east of CDM. Sewer lines ranged in sizes between 6 and 12 inches and are composed of ACP, vitrified clay pipe, and PVC. An existing force main extends along Carmel Valley Road to CDM. Sewer line depths within this portal area vary between 6 and 12 feet. Storm drain as-built and reference documents identified a 12-inch reinforced concrete storm pipe within the portal area which daylights in the vicinity of the portal structure and will likely require adjustment or relocation. A 24-inch reinforced concrete pipe storm drain line approximately 90 feet east of the 12-inch line discharges on the south side of Carmel Valley Road along the outer boundary of the proposed trench area.

Asset maps provided by AT&T indicate the presence of underground facilities along Carmel Valley Road and Torrey Pines Road. SDG&E transmission and distribution lines are also located in the area along CDM, Carmel Valley Road, and feeder streets with sizes between 0.5 and 12.0 inches. Several other utilities were found just outside the periphery of the portal area. An AT&T aerial line was identified along CDM between Carmel Valley Road and the bridge over the railroad to the south. Crown Castle

provided facility location information for their underground conduit just south of the Carmel Valley Road/CDM intersection. Charter-Spectrum have underground utilities along Torrey Pines Road and Ocean View Avenue. Finally, a 2.375-inch high-density polyethylene pipe MCI line was identified along the current railroad but outside of the defined CDM-South portal area.

## 7.2 Crest Canyon Higher-Speed Alternative

Two portal locations along the CCHS railway route conceptual alternative were investigated to identify potential conflicts with existing utilities. The north portal entrance, identified as CCHS-North, has a portal approach structure that would begin about 700 feet north of existing Jimmy Durante Boulevard. Construction required at this location would include grading fill to elevate the roadway over the cut-and-cover section of the tunnel portal. Other improvements that would be associated with the portal, including a designated area for permanent facilities, were also included in this utility conflict investigation.

The southern portal is identified as CCHS-South and would be a 600-foot structure located immediately north of Carmel Valley Road and about 1,400 feet west of I-5. Unlike the CCHS-North portal, this portal area would not be located over the existing railway. In general, the vicinity of the portal which was investigated is undeveloped, except for constructed roads along its exterior boundary. These roads consist of Carmel Valley Road, Portofino Drive, and Caminito Pointe Del Mar.

Approximately 2.50 miles separates both portals. The land in between consists of areas developed for residential, commercial, and public uses. It also includes portions of Torrey Pines State Natural Reserve area. The northern portal would be located within the City of Del Mar, whereas the southern portal would be within the City of San Diego. The Digalert.org and the City of San Diego GIS websites were utilized in identifying and contacting potential agencies and utilities which may be located within each respective portal area.

### 7.2.1 Crest Canyon Higher-Speed North

The utility research performed for the vicinity of the CCHS-North portal identified significant water and sewer improvements. Water lines range in sizes between 6 to 12 inches, including some smaller diameter lines used for local private services. A 20-inch steel line was also found along Jimmy Durante Boulevard which is being utilized as a casing for a 12-inch water line. The water line pipes varied in material types, such as PVC, ductile iron, steel, and ACP. A 6-inch ACP line was also identified along Jimmy Durante Boulevard south of David Way. Water line depths were typically shallow and have generally been constructed between 3.0 and 5.5 feet deep.

City of Del Mar-owned sewer facilities were identified to exist in the area per as-built plans. Pipe sizes ranged between 6 and 12 inches and included PVC and vitrified clay pipe with some of these sections constructed as force mains. Depths of these pipes range between 2 to 8 feet in instances where as-builts were referenced. Storm drains within the CCHS-North portal area have pipe sizes between 24 and 30 inches and the material is reinforced concrete pipe. The as-built and reference documents show pipes between 4 and 5 feet in depth.

The dry utilities, consisting of electric, gas, cable, telephone, fiber, and other communication companies, compose the remaining utilities within the CCHS-North portal area. Although most of these utilities are underground at shallow depths, some overhead utilities are present, such as SDG&E electrical and Spectrum (formerly Time Warner Cable) lines just north of the CDM/Jimmy Durante

Boulevard merge. The overhead electric line along the south side of Jimmy Durante Boulevard poses a conflict with the proposed fill and portal structure.

### 7.2.2 Crest Canyon Higher-Speed South

Although all utility information received form the various utility companies indicated the presence of facilities in the general vicinity of the proposed portal, none were found to conflict with the proposed portal structure footprint or associated permanent facilities, which are within existing open space bounded by Carmel Valley Road to the south, Portofino Drive to the west and north, and Caminito Pointe Del Mar to the east.

## 7.3 Summary

As noted in the utility conflict matrices developed for the portals, depths and specific locations for some utilities could not be conclusively determined from the documentation received from the respective agencies and utility companies. It is recommended that a subsurface exploration be performed on those utilities shown to be in conflict to adequately determine 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. Based on the findings from this initial utility impacts investigation, the utilities that have been identified as potential conflicts at each respective portal location appear to have the capacity to be relocated without being a significant detriment to the proposed portal work.

# 8 Railroad Systems

To support the analysis of the proposed CDM and Crest Canyon track re-alignments between Del Mar and Sorrento Valley, the rail systems discipline performed a preliminary assessment of the associated impacts on the wayside signal and crossing warning systems. The main challenge for the integration of rail systems for these new alignments is to minimize wayside signal infrastructure within the tunnels to the extent practical.

The installation of signal infrastructure within the tunnels presents many undesirable circumstances, such as access for routine monthly maintenance, increased response times to signal trouble calls, hi-railing to bring in heavier equipment, etc. It was determined that the strategic placement of wayside signal infrastructure in the tunnels was necessary to support efficient train operations and to reduce headways. Where signal infrastructure is required within the tunnel, it will be housed inside a signal room in the tunnel cross-passage section specifically designated for signal system infrastructure. Additionally, the signal system shall be designed in such a way that any single component failure within the system would impact only one track. In other words, each track and the associated signal system shall be designed and constructed as separate sub-systems with unique controllers and ancillary components. This will mitigate against unnecessary train delays in the event of a signal system failure inside the tunnel.

The following sections highlight the key features of the modified wayside signal system, impacts on existing grade crossings, and any other pertinent information as it relates to the performed analysis.

*Note: The following analysis assumes completion of the San Dieguito Double Track and Special Events Platform project as currently designed in the 100 percent package dated September 2021.*

For a schematic representation of proposed signal improvements associated with both the CDM and Crest Canyon realignments, refer to the Railroad Signal Schematics in Appendix N.

## 8.1 Camino Del Mar Alternative

The proposed re-alignment of the railroad track through CDM results in an approximately 9,950-foot-long tunnel from station 31+50 to 131+00, as shown in the Track Plan and Profile drawings in Appendix A. Assuming train speeds of 110 miles per hour passenger and 60 miles per hour freight and grades of no greater than 0.50 percent, ideal signal spacing between two consecutive blocks (aggregate block) should ideally be no less than 13,000 feet combined. The aggregate signal block of 13,000 feet allows a passenger train travelling at 110 miles per hour to pass a flashing yellow signal to safely reduce speed to stop at a red signal. This also allows for light freight trains (less than 90 tons per operative brake) travelling at 60 miles per hour to pass a flashing yellow signal to safely reduce speed to stop at a red signal.

*Exception: There is a grade of -1.60 percent at the north end of the tunnels going eastbound; preliminary analysis reveals that the transition to the subsequent +0.50 percent into the tunnel between the 243 and 244 intermediate signals levels out the signal block and is sufficient for safe braking and reduction distances.*

The proposed wayside signals for the CDM alternative are outlined in Table 8-1.

**Table 8-1. Camino Del Mar Alternative Proposed Wayside Signals**

| Station | Signal Name | Direction |
|---|---|---|
| 10+00 | 243 Intermediate Signals | Eastbound Only |
| 80+00 | 244 Intermediate Signals | Eastbound Only |
| 90+00 | 244 Intermediate Signals | Westbound Only |
| 150+00 | 246 Intermediate Signals | Bi-Directional |
| 240+00 | 247 Intermediate Signals | Bi-Directional Cantilever |

Signal blocks associated with this signal spacing are outlined in Table 8-2 and Table 8-3.

**Table 8-2. Eastbound Signal Blocks**

| From Signal | To Signal | Length (feet) |
|---|---|---|
| CP Valley | 243 Signals | 6,500 |
| 243 Signals | 244 Signals | 7,000 |
| 244 Signals | 246 Signals | 7,000 |
| 246 Signals | 247 Signals | 9,000 |
| 247 Signals | CP Sorrento | 7,600 |

Notes:
CP=control point

**Table 8-3. Westbound Signals Blocks**

| From Signal | To Signal | Length (feet) |
|---|---|---|
| CP Sorrento | 247 Signals | 8,200 |
| 247 Signals | 246 Signals | 9,000 |
| 246 Signals | 244 Signals | 6,000 |
| 244 Signals | 242 Signals | 10,000 |
| 242 Signals | CP Valley | 3,500 |

Notes:
CP=control point

As indicated in the tables above, there are no two consecutive blocks that are less than 13,000 feet combined for the proposed placement of wayside signals. While this signal spacing is sufficient from a preliminary safe braking perspective, constructing signal infrastructure within the tunnel structure and on elevated track sections would present some challenges.

The 243 signals are proposed just east of the Del Mar Fairgrounds Platform and associated bridge structure. This is a standard signal installation.

The 244 signals are proposed to be installed in the CDM Tunnel at roughly the center point. There is a proposed curve at this point in the tunnel between Station 80+00 and Station 90+00. In addition to the complexities involved with installing a wayside signal location in the tunnel, this signal location is being proposed as a split-pair, bi-directional intermediate signal location, similar to the existing 241 signals on the San Diego Subdivision. The split-pair installation is necessary to ensure adequate

visibility for approaching trains. The eastbound signal needs to be placed on the west end of the curve, and the westbound signal needs to be placed on the east end of the curve. This would ensure several thousand feet of tangent track as a train approaches the signals from either direction. The signal equipment for this location would be housed inside a signal room in the tunnel cross-passage section that connects both main tunnel bores and would be accessible by hi-rail vehicle only.

Another challenging signal installation is at Station 150+00. This proposed signal location is between the east end of the tunnel and Los Peñasquitos Lagoon. The proposed location is in approximately the same location as the existing 246 Signals, although the new track alignment would be elevated above ground level on a new bridge. Provisions would be necessary to accommodate the installation of wayside signals and associated infrastructure on this new bridge.

The existing CP Torrey would be removed in its entirety and would be replaced with a new bi-directional cantilever signal structure (247 Signals) at Station 240+00. A cantilever is needed to maximize signal preview for eastbound trains coming through Los Peñasquitos Lagoon and for westbound trains departing Sorrento Valley Station. The existing 248 signals (westbound-only) at the west end of Sorrento Valley Station would be retired.

The existing CP Del Mar, Coast Boulevard grade crossing and the 246 signals would be de-commissioned and completely removed as part of the CDM tunnel alternative. The removal of the 248 signals at the west end of Sorrento Valley Station would impact train detection circuits at Sorrento Valley Station west pedestrian crossing, Sorrento Valley Station east pedestrian crossing, and Sorrento Valley Boulevard. Modification to these circuits would be required to maintain in-service grade crossing warning systems.

A new fiber duct bank would be required between Station 10+00 and Station 245+00. This duct bank would be comprised of Qty. 4 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 Fire/Life Safety 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 system would determine train location using dead reckoning currently built into the onboard PTC equipment.

Refer to Section 13.4 of this document for proposed construction phasing. Estimates developed for railroad systems are based on the narrative above and the proposed phasing.

## 8.2 Crest Canyon Higher-Speed Alternative

The proposed re-alignment of the railroad track through Crest Canyon results in an approximate length 13,625-foot tunnel from Station 30+25 to 166+50, as shown in the Track Plan and Profile drawings in Appendix A. Assuming train speeds of 110 miles per hour passenger and 60 miles per hour freight and grades of no greater than 0.50 percent, ideal signal spacing between two consecutive blocks should be no less than 13,000 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. This also allows safe braking for light freight trains (less than 90 tons per operative brake) travelling at 60 miles per hour to pass a flashing yellow signal to safely reduce to a stop at a red signal.

*Exception: There is a grade of -1.75 percent at the north end of the tunnels going eastbound; preliminary analysis reveals that the transition to the subsequent +0.50 percent into the tunnel between*

*the 243 and 244 intermediate signals results in less than a -0.10 percent average grade in this signal block and is sufficient for safe braking and reduction distances.*

The proposed wayside signals for the CCHS alternative are outlined in Table 8-4.

**Table 8-4. Crest Canyon Higher-Speed Proposed Wayside Signals**

| Station | Signal Name | Direction |
|---|---|---|
| 10+00 | 243 Intermediate Signals | Eastbound only |
| 77+00 | 244 Intermediate Signals | Bi-directional |
| 145+00 | 245 Intermediate Signals | Eastbound only |
| 171+00 | 246 Intermediate Signals | Westbound only |
| 234+00 | 247 Intermediate Signals | Bi-directional cantilever |

Signal blocks associated with this signal spacing are outlined in Table 8-5 and Table 8-6.

**Table 8-5. Crest Canyon Higher-Speed Eastbound Signals Blocks**

| From Signal | To Signal | Length (feet) |
|---|---|---|
| CP Valley | 243 Signals | 6,500 |
| 243 Signals | 244 Signals | 6,700 |
| 244 Signals | 245 Signals | 6,800 |
| 245 Signals | 247 Signals | 8,900 |
| 247 Signals | CP Sorrento | 7,600 |

Notes:
CP=control point

**Table 8-6. Crest Canyon Higher-Speed Westbound Signals Blocks**

| From Signal | To Signal | Length (feet) |
|---|---|---|
| CP Sorrento | 247 Signals | 8,200 |
| 247 Signals | 246 Signals | 6,300 |
| 246 Signals | 244 Signals | 9,400 |
| 244 Signals | 242 Signals | 8,700 |
| 242 Signals | CP Valley | 3,500 |

Notes:
CP=control point

As indicated in the tables above, there are no two consecutive blocks that are less than 13,000 feet combined for the proposed placement of wayside signals. While this signal spacing is sufficient from a preliminary safe braking perspective, constructing signal infrastructure within the tunnel structure, U-structures, or on elevated track sections would present some challenges.

The 243 signals are proposed just east of the Del Mar fairgrounds special events platform and associated bridge structure. This is a standard signal installation.

The 244 signals are proposed to be installed in the Crest Canyon Tunnel at Station 77+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 a signal room in the tunnel cross passage that connects both main tunnel bores and would be accessible by hi-rail vehicle only.

The 245 eastbound-only signals are proposed to be installed in the Crest Canyon Tunnel at Station 145+00. There is tangent track for eastbound train movements for several thousands of feet; therefore, 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 passage that connects both main tunnel bores and would be accessible by hi-rail vehicle only.

Another challenging signal installation are the 246 westbound only signals at Station 171+00. This proposed signal location is just outside the east end of the tunnel. These signals are proposed to be installed on a portion of the new track alignment, which is in the U-structure. This location is approximate and may be shifted towards the bridge structure if necessary to achieve adequate signal preview. Depending on the track centers for the selected location, wayside signals and signal houses may be placed between the tracks. Additionally, a bracket signal (T-bracket mast) may be considered to improve signal visibility.

The existing CP Torrey would be removed in its entirety and would be replaced with a new bi-directional cantilever signal structure (247 Signals) at Station 234+00. The cantilever is needed to maximize signal preview for eastbound trains coming through Los Peñasquitos Lagoon and for westbound trains departing Sorrento Valley Station. The existing 248 signals (westbound-only) at the west end of Sorrento Valley Station would be retired.

Existing CP Del Mar, Coast Boulevard grade crossing, and the 246 signals would be de-commissioned and completely removed as part of the CDM tunnel alternative. The removal of the 248 signals at the west end of Sorrento Valley Station would impact train detection circuits at Sorrento Valley Station west pedestrian crossing, Sorrento Valley Station east pedestrian crossing, and Sorrento Valley Boulevard. Modification to these circuits would be required to maintain in-service grade crossing warning systems.

A new fiber duct bank would be required between Station 10+00 and Station 240+00. This duct bank would be comprised of 4 by 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 fire/life safety 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 system would determine train location using dead reckoning currently built into the on-board PTC equipment.

Refer to Section 13.4 of this document for proposed construction phasing. Estimates developed for railroad systems are based on the narrative above and the proposed phasing.

## 8.3 Summary

Both the CDM and Crest Canyon conceptual tunnel alternatives present some unique challenges with the integration of wayside signal infrastructure. Both alternatives propose the installation of wayside signals and associated infrastructure within the limits of the tunnel, in the U-structure, or on an elevated portion of the track structure. These installations are not typical for rail systems on the San Diego

Subdivision and considerations would have to be made by both rail systems and outside disciplines to support these installations.

Installations proposed between Solana Beach Station, Del Mar fairgrounds special events platform, and Sorrento Valley Station should be capable of providing less than 8.5-minute headways while providing safe braking for all types of trains. The removal of the at-grade crossing at Coast Boulevard is a great safety benefit to the railroad and local residents.

In summary, both conceptual alternatives are very similar installations from a wayside signal infrastructure perspective. They are also very similar from a safe braking and operations perspective. Both alternatives are nearly identical installations; however, the CDM alternative only places one signal house in the tunnel while the Crest Canyon alternative requires two signal houses in the tunnel. For this reason alone, the CDM alternative would be preferred to facilitate long-term maintenance of the systems, although both alternatives are feasible.

# 9 Grade Separations

Both the CCHS and CDM conceptual alignment alternatives leave the existing railroad ROW south of the proposed San Dieguito Bridge and cross Jimmy Durante Boulevard, requiring the roadway to be grade separated. The roadway would be raised to pass over the tracks, which would be in a cut-and-cover section where they intersect. Conceptual roadway designs were developed and are included as part of the 10 percent plans provided in Appendix A. Due to the similar proximity of the north portals for both CCHS and CDM track alternatives, one roadway profile was designed that would accommodate both options. Additionally, the current roadway concepts maintain the existing horizontal alignment and roadway merge configuration between Jimmy Durante Boulevard and CDM. Opportunities for refinements and optimization of local roadway circulation should be considered in the next phase.

To grade separate the roadway from the tracks, the roadway profile would start to rise approximately 700 feet south of the Jimmy Durante and San Dieguito Drive roundabout. Just south of the cut-and-cover section for the tracks, the existing CDM roadway merges with Jimmy Durante Boulevard. Under existing conditions, Jimmy Durante Boulevard splits north of the CDM bridge, with the southbound lane going under the bridge to provide access to an apartment complex before tying in with CDM adjacent to the northbound lanes. The conceptual roadway profile for the southbound lane would tie-in prior to the CDM bridge, while the northbound lane would tie-in just prior to Luzon Avenue.

The maximum amount the roadway would need to be raised is approximately 16 feet. The proposed roadway section maintains the existing width of the roadway. Retaining walls are currently anticipated along both sides of the roadway to not impact the adjacent homes on the east and the existing tracks to the west, which must remain in operation during construction.

Existing traffic and local access would need to be maintained during the construction of the grade separation and railroad improvements. Due to its proximity to the fairgrounds and beach, it is likely there would be seasonal restrictions on the construction of Jimmy Durante Boulevard related to coastal access and fairgrounds operations. The construction staging for the grade separation would need to consider existing traffic patterns and develop traffic control measures to maintain accessibility during construction. Refer to Section 13 of this report, Construction Considerations, for further detail.

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# 10 Summary of Noise and Vibration Analysis

The *Noise and Vibration Technical Memorandum* prepared in October 2022 by Entech (Appendix F) provided the noise and vibration findings for the project development.

The CCHS and CDM alternative could have potential noise and vibration impacts on the surrounding land use at the portal locations; SANDAG will implement feasible noise and vibration mitigation measures to reduce long-term impacts to within acceptable limits. 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, vents and a ventilation shaft could be a new source of noise without abatement features. Attenuators, fan enclosures, and other abatement features could be required at the portal locations to lower the exiting exhaust to meet the City of Del Mar and 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 passbys along at-grade tracks. Potential vibration levels and ground-borne noise would not be anticipated to exceed FTA and FRA threshold levels while trains are operating below the ground surface.

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# 11 Tunnel Considerations

## 11.1 Geotechnical Reports

The additional geotechnical efforts included development of two geotechnical reports prepared specifically for the SDSVDT project. These are included as Appendix E, Geotechnical Data and Reconnaissance Reports.

- Leighton Associates performed a geologic desk study and geologic reconnaissance for the Del Mar alternative alignments, reported in the *Geologic Reconnaissance Report, Del Mar Alternative Tunnel Alignments Conceptual Engineering Study*.
- Earth Mechanics Inc. performed a limited site investigation consisting of four borings, laboratory tests, in-situ, and seismic Primary and Secondary (P and S) wave tests.

## 11.2 Tunnel Geotechnical Considerations

### 11.2.1 Geologic Setting

The reports noted herein were developed to better define existing conditions and provide a picture of the anticipated geological 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. The coastal rock tends to be comprised of softer sedimentary rock. Refer to Appendix E for further details on the overall setting anticipated with the project limits.

### 11.2.2 Material Engineering Characteristics

As part of the desktop study completed by Leighton Associates, engineering characteristics of the anticipated geological conditions, identified the unique engineering characteristics to consider that include 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 included with Appendix E.

### 11.2.3 Seismic Hazards

Seismic Hazards are described in the Geological Reconnaissance Report included in Appendix E.

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. Following a relatively large earthquake, secondary effects associated with severe ground shaking could affect the site. Potential secondary effects include shallow ground rupture, soil liquefaction, dynamic settlement, seiches, and tsunamis.

### 11.2.4 Groundwater

Based on the available data, including groundwater encountered in Borings R21-002 and R21-004, groundwater is perched just above the contact with the Delmar Formation. Static groundwater is anticipated to be closer to sea level while having tidal fluctuations. Leighton Associates anticipate

groundwater at around +5 feet above mean sea level. To account for tidal influences, a high groundwater elevation of +10 feet above mean sea level and a low groundwater elevation of 0 feet below mean sea level should be utilized. The majority of the tunnel alignment would be above the anticipated ground water level of +10 feet.

Due to the potential impacts of groundwater on the proposed tunnel alignments, a more detailed investigation should be conducted to determine groundwater levels and pressures across the project area.

## 11.3 Ground Behavior and Risks during Tunneling

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

### 11.3.1 Ground Classification and Behavior

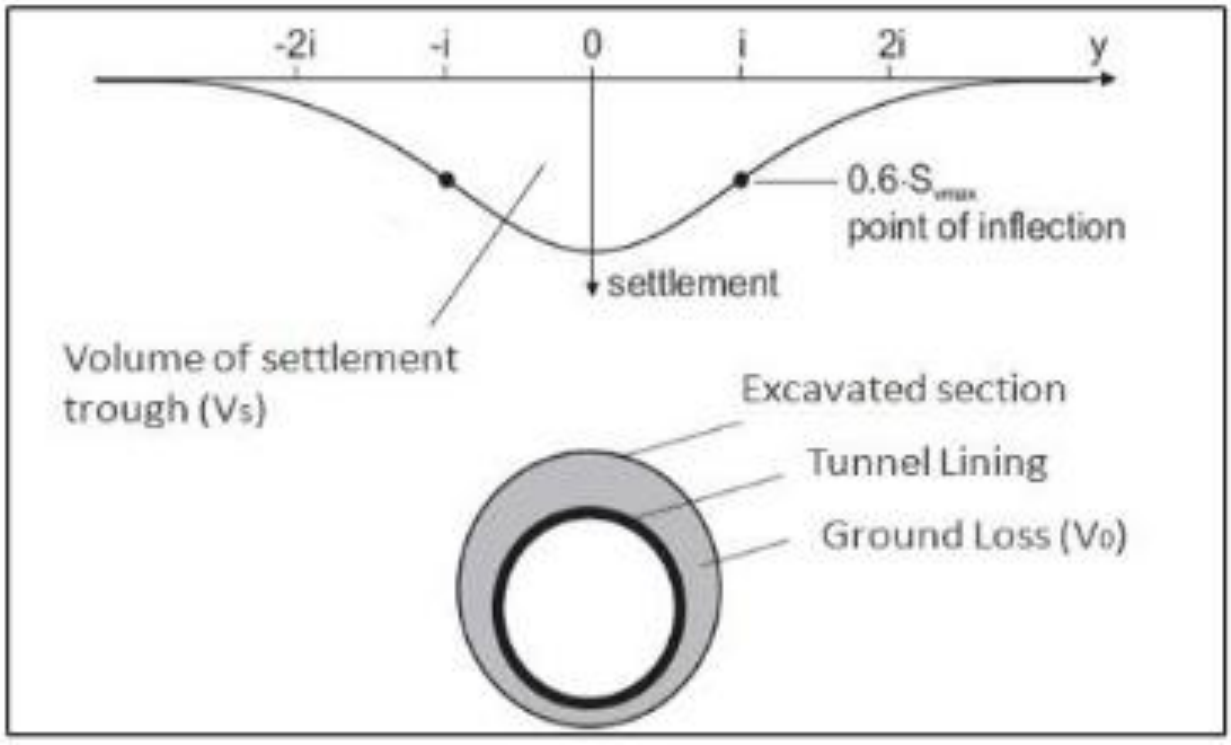
As discussed in the *Tunnel Basis of Design Report*, the alternative alignments would likely encounter consolidated sandstone of the Torrey Sandstone and sandstone and claystone of the Delmar Formation. These units should be generally stable and can be excavated with a tunnel boring machine (TBM). However, expansive clays within the Delmar Formation may cause invert heave, especially if groundwater is present. Torrey Sandstone may be subject to raveling over time if left exposed to wet conditions. In the 2014 geotechnical evaluation, it was also noted that weak claystone layers or clay filled fractures may be encountered in faulted ground (Ninyo and Moore 2014).

### 11.3.2 Control of Ground Movement (Settlement)

If the anticipated Torey Sandstone and Delmar Formation is extremely weathered, it may behave more like a soil in terms of ground movements. The amount of settlement (ground movement) 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 the soil movement that can propagate up to the surface.

This could 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 on Figure 11-1.

**Figure 11-1. Gaussian Curve for Transverse Settlement Trough above a Tunnel**




This propagation of soil movement may affect buildings and utilities. Typically, a settlement assessment report would be conducted, which would document the predicted amount of settlement and any impact on buildings and utilities. Mitigation measures may be required to control this ground movement, including ground improvement, utility protection, and/or utility relocation.

The control of this ground movement would principally be controlled by using a pressurized face tunneling method, such as an earth pressure balance TBM.

### 11.3.3 Stickiness and Clogging Potential for the Tunnel Boring Machines

Based on the expected ground conditions, the potential for clogging of a TBM for the project is considered low.

### 11.3.4 Abrasive Ground Conditions

The cutterhead of a TBM includes 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 failing 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. The Torrey Sandstone and silty sandstone beds within the Delmar Formation both contain quartz grains, which are the primary source of abrasion.

One of the most widely used rock abrasion tests is the Cerchar Abrasion Index test. This type of testing should be undertaken during future site investigation work in addition to petrographic analysis to help understand how abrasive the rock and soils are and what impact this could have on the performance of the TBM.

### 11.3.5 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 manmade. Examples of man-made obstructions include building foundations, oil wells, and utilities. Examples of geological obstructions include cobbles, boulders, and cemented concretions which are known to occur in the Torrey Sandstone and Delmar formations. Obstructions would need to be evaluated along the tunnel alignment during later stages of design.

As to geotechnical obstructions, the TBMs have cutting tools to excavate all soil/rock types anticipated. Man-made obstructions would be identified in later stages of design. The deep bored tunnel configuration eliminates the risk of the TBMs conflicting with building foundations along the alignment. Building foundations above the alignment will be reviewed to minimize impacts. Utility plans will also be reviewed in later stages of design to determine whether advanced utility relocation is needed. The location of oil and water wells will also be researched further; however, no oil wells are shown on the California Department of Conservation, Division of Geologic Energy Management Well Finder site within the alternatives analysis study area (California Department of Conservation, Division of Geologic Energy Management n.d.).

### 11.3.6 Gassy Ground

The tunnel alignment would be excavated within sedimentary type rocks, which are often associated with gassy or potentially 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 will need to be prepared, to ensure that sufficient ventilation is always provided in the tunnels.
- Monitoring devices will need to be installed on the equipment; these can automatically shut down electrical equipment if gases are detected.
- Monitoring devices will need to be provided to the workers; these can detect the gases if encountered, providing notification to the workers. Self-rescuer breathing equipment will also need to be provided.
- All equipment used underground will need to be Class 1, Division 2 certified (i.e., be explosion-proof) and approved for underground use.
- Safety training will be required for all those working underground.

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

## 11.4 Ground Behavior and Risks at Portals

The northern portal for the CDM conceptual alignment will be located near the intersection of CDM and Jimmy Durante Boulevard and is likely to be excavated though a combination of old paralic deposits and sandstone from the Delmar Formation. The southern portal could be located close to the

intersection of CDM and Carmel Valley Road and could be excavated in the Delmar Formation, Torrey Sandstone, or both.

Weak claystone layers or clay-filled fractures may be found in the faulted ground. Other potential concerns include the overall stability of any old paralic deposits, groundwater seepage, and the presence of expansive claystone.

The northern portal for the CCHS alignment would be located east of the intersection of CDM and Jimmy Durante Boulevard and could excavated through a combination of old paralic deposits and claystone and sandstone of the Delmar Formation. The southern portal would be located northeast of the intersection of Carmel Valley Road and Portofino Drive and will be excavated in the Torrey Sandstone. Potential concerns at these locations include the overall stability of any old paralic deposits, groundwater seepage, and the presence of expansive claystone.

The potential for slope failure at both portals would need to be considered in the subsequent engineering phases. Slope stability techniques such as bolts and/or shotcrete at the portal faces may be required.

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# 12 Summary of Drainage Considerations

The *Del Mar Alternatives Analysis Preliminary Drainage Report* (Appendix D) details design requirements and potential floodplain impacts associated with the two proposed conceptual alignment alternatives outlined above.

The conceptual alignment alternatives would begin and end in two separate watersheds, San Dieguito River and Los Peñasquitos, as well as their associated floodplains, and intersect areas potentially impacted by sea level rise. Potential flood risks influence proposed design features, such as portal elevations, berm 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 and risks to project elements.

In the areas anticipated to be affected by sea level rise, recommendations are made to protect the tracks against the 100-year flood event considering the effects of sea level rise through year 2100 through use of floodwalls and other mitigation measures.

Recent hydraulic analyses were reviewed and used to assess the design elevation based upon this standard. Tunnel portals are recommended to be protected against 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 San Dieguito and Los Peñasquitos and the compliance requirements related to the National Flood Insurance Program. The proposed alignments should minimize impacts on the FEMA floodplains. A recommended approach to FEMA compliance for each floodplain and alignment is provided in the drainage report.

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# 13 Construction Considerations

## 13.1 Construction Impacts

A range of impacts need to be assessed for the conceptual alternatives; these include impacts on 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 archeological resources:** historical, archeological, 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 vs. 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

## 13.2 Tunnel and Portal Structures Construction

### 13.2.1 Portals Structures

Portals structures 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 will be discussed when additional subsurface investigations are performed in the future.

### 13.2.2 Bored Tunnel

The majority of the proposed tunnel alignment will be excavated within the sedimentary rock associated with both the Torrey Sandstone and Delmar Formations. 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 will 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. TBMs will 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 tunnel will be excavated using a TBM, the cross passages 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 will be required to allow this break out 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.

## 13.3 Tunnel Construction Staging

Tunnel construction work sites could be required at each selected launch site or portal location to accommodate both temporary construction work and the permanent condition. Each site should be sized and identified in the environmental review phase.

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

For the future tunnels, it is envisaged that at least 10 acres of laydown area could be required for each TBM launch portal location to enable efficient construction of the tunnels. The potential sites shown in Appendix A are larger than 10 acres; however, because these sites are located on sloped terrain and are therefore likely to be less efficient when compared with a level construction area.

TBM tunneling requires a larger site compared with SEM tunneling. Given that it is expected TBMs would be used for each of the conceptual alignments, 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 on local streets and driveways
- Minimize the potential impacts on private 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 potential visual impacts on adjacent properties
- Increase clearance from the floodplain to the site boundary

Disposal/reuse of tunnel and other spoils will occur off site. Sites should be identified during the preliminary engineering phase of the project working with potentially affected stakeholders. Tunnel spoil would need to be dried and possibly treated before it can be disposed of or reused; typically, it cannot be used as engineered fill. The construction sites have been sized to allow for processing of tunnel spoil (drying) before it is transported. The tunnel spoil from earth pressure balance machines may require secondary treatment to make it suitable for haulage and beneficial reuse. The construction sites are generally located close to arterial roads and freeways to avoid muck haulage routes on local roads.

## 13.4 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. Construction will need to be phased to maintain operation of the tracks. In general, each alternative requires a change in the existing track profile to meet the requirements specified in the Basis of Design or specified herein. As such, the existing operations will be maintained as single track operations through the duration of the project. There are anticipated to be phases of construction that may require extending the length of single tracking to accommodate site constraints and to provide flexibility for cutovers.

Although specific construction phasing plans have not been developed, 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, rather depict a possible construction sequence.

### 13.4.1 Camino Del Mar Alternative

The CDM conceptual alternative would require multiple phases to complete construction. One potential scenario includes the following (Refer to Figure 13-1 for a schematic of this scenario):

1. In the first phase, a temporary left-hand No. 24 turnout would be installed just south of the project limits in order to keep both tracks through Sorrento Valley in operation. This would include establishing a temporary CP (CP Torrey). Operations would be maintained on the existing single mainline track within the project limits. The existing double track operations north of CP Del Mar would be maintained.

   The proposed Main Track 1 (MT-1; and segments of MT-2 clear of the operating track), berm, and bridges in Sorrento Valley and through Los Peñasquitos Lagoon would then be constructed. This would require the use of temporary shoring between the operational track and new track under construction, similar to the approach used on the Elvira to Morena Double Track Project. Both bored tunnels would also be constructed including portions of the

cut-and-cover and U-structure, not in conflict with current rail operations, and associated structures and support facilities.

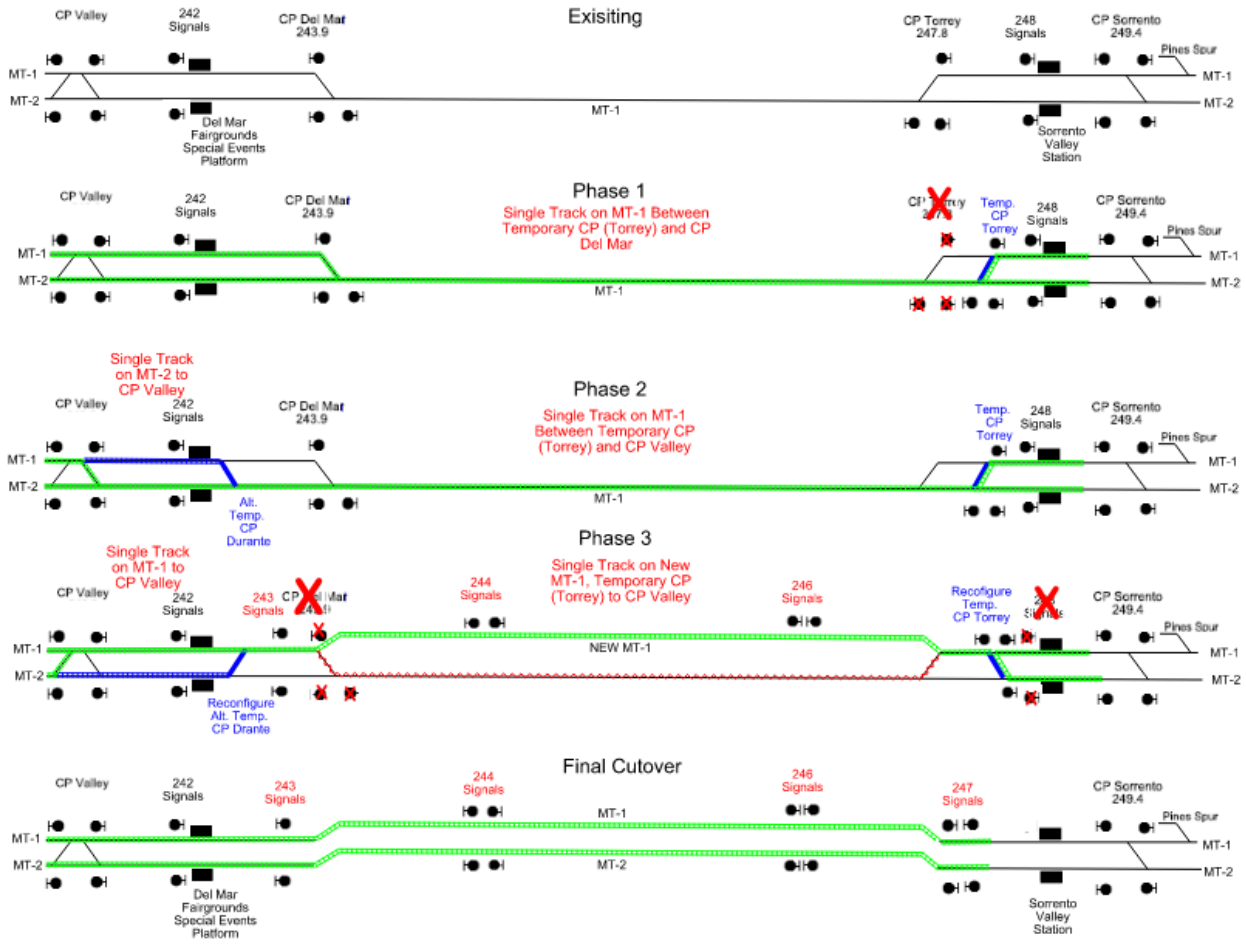
The Jimmy Durante Boulevard roadway grade separation would be constructed in coordination with the needs of the cut-and-cover section of the tunnel and associated access\laydown needs and assumed to be constructed in phases, working around the constraints of key stakeholders regarding roadway closures.

2. The second phase would require working at both tie-in locations to cutover MT-1 at the north and south ends. At the north end, all trains could switch onto MT-2 at CP Valley (constructed as part of the San Dieguito Double Track Project) and operate adjacent to the north portal footprint under single track operations in order to construct the remaining MT-1 improvements; however, this creates an additional length of single-track limits that rail operations may find unacceptable. An alternative to that would include construction of a temporary right-hand turnout, establishing a temporary CP (CP Durante) within the vicinity of the proposed northern tie-in. This would limit the additional length of single track closer to existing conditions. In addition, if extended single track limits to CP Valley are acceptable, it may be beneficial to consider a shoofly at the north end of the project limits to provide a larger footprint to improve efficiencies during this phase of construction and should be considered as the design evolves.

   Once complete, the operations would be cutover to MT-1. All trains would be operating on the new MT-1 through the new tunnel and bridge/berm through the lagoon to Sorrento Valley.

3. In the third phase, the proposed MT-2, remaining portal structures, berm, and bridges would be constructed. To support this phase, the temporary left-hand turnout at the south end would be removed, and a temporary right-hand No. 24 turnout would be constructed to support operations from MT-1. As this cutover is anticipated to be challenging given current absolute work window durations, a multi-step cutover could be considered over consecutive absolute work windows. This will need to be further evaluated in preliminary engineering efforts and should be coupled with the possible addition of the second crossover at CP Sorrento as mentioned in the alternatives discussion within Section 4 as a potential solution. At the north end, if extended single tracking was not acceptable, the temporary right-hand turnout would be removed, and a temporary left-hand turnout would be constructed, with similar cutover challenges as the south end. When complete, the temporary CPs would be removed, and the final track alignment would be completed at each tie-in location of the project limits. The operations would then be cutover to both mainline tracks.

**Figure 13-1 Camino Del Mar Potential Phasing Schematic**




## 13.4.2 Crest Canyon Higher-Speed Alternative

The CCHS conceptual alternative would require multiple phases to complete construction. One potential scenario includes the following (Refer to Figure 13-2 for a schematic of this scenario):

1. In the first phase, a shoofly and temporary bridge near MP 247.7 would be constructed to realign the existing tracks to the west, starting just north of the existing bridge and ending just south of the project limits. Due to the longer anticipated duration for tunneling in this alternative, the shoofly will allow most of the southern tie-in work to be completed concurrently. A temporary left-hand No. 24 turnout would be installed just south of the shoofly in order to keep both tracks through Sorrento Valley in operation. This will include establishing a temporary CP (CP Torrey). Operations would be maintained on the shoofly and the remainder of existing mainline track within the project limits. The existing double track operations north of CP Del Mar would also be maintained.

   The proposed mainline tracks, berm, and bridges in Sorrento Valley and through Los Peñasquitos Lagoon would then be constructed. Both bored tunnels would also be constructed including portions of the cut and cover and U-structure, not in conflict with current rail operations, and associated structures and support facilities.

   The Jimmy Durante Roadway grade separation would be constructed in coordination with the needs of the cut-and-cover section of the tunnel and associated access\laydown needs and

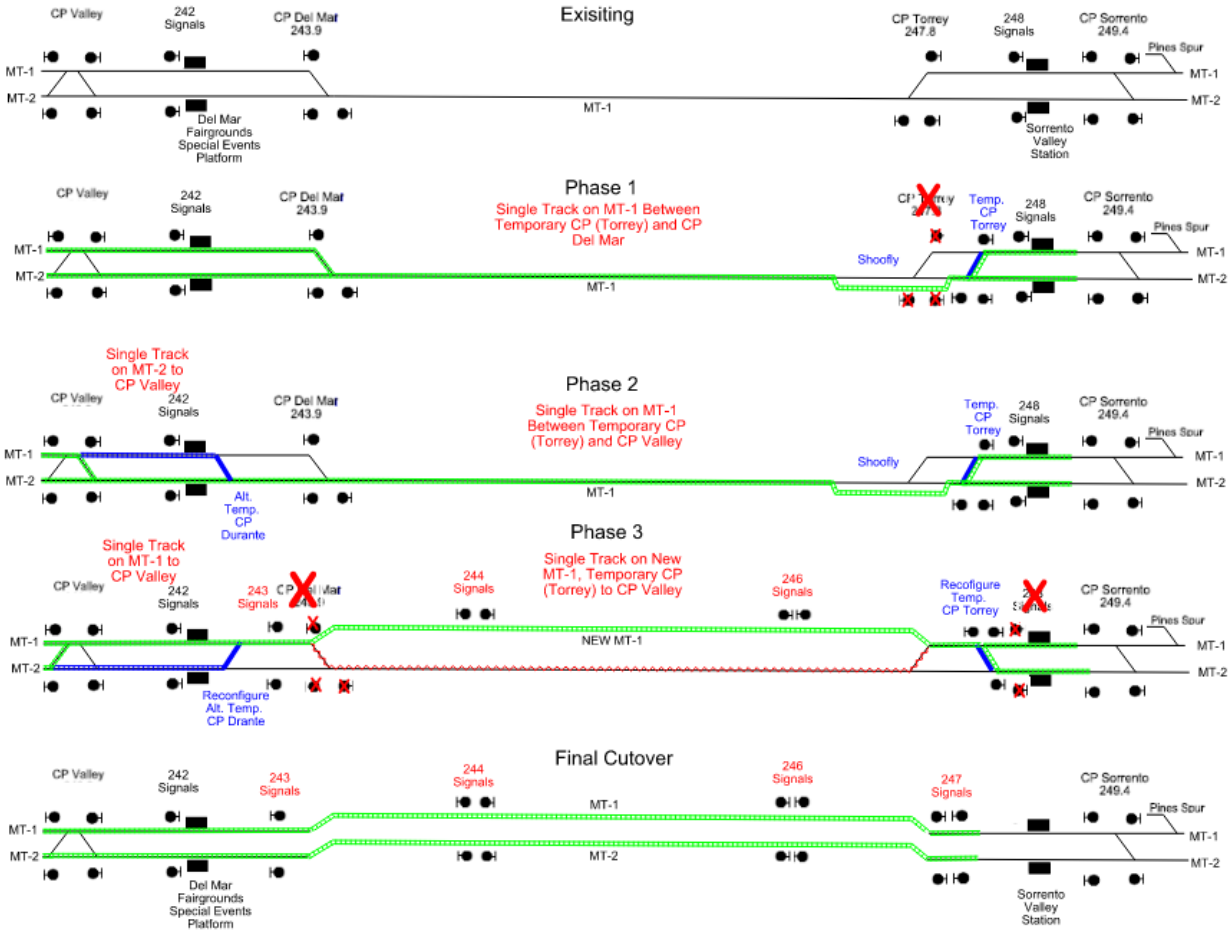
assumed to be constructed in phases, working around the constraints of key stakeholders regarding roadway closures.

2. The second phase would require working at both tie-in locations to cutover MT-1 at the north and south ends. At the north end, all trains could switch onto MT-2 at CP Valley (constructed as part of the San Dieguito Double Track Project) and operate adjacent to the north portal footprint under single track operations to construct remaining MT-1 improvements; however, as noted in the CDM alternative, operations may find this unacceptable and will need to be further analyzed. Similarly, a temporary right-hand turnout, establishing a temporary CP (CP Durante) within the vicinity of the proposed northern tie-in could be constructed. This would limit the additional length of single tracking, closer to existing conditions. As noted for the CDM alternative, it would be beneficial to construct a shoofly at the north end of the project limits to provide a large footprint to improve efficiencies during this phase of construction and should be considered as the design evolves. Due to the alignment and offset of this alternative in relation to the existing track, the shoofly design should be a more effective approach than the CDM alignment in providing a larger footprint for construction.

   Once complete, the operations would be cutover to MT-1. All trains would be operating on the new MT-1 through the new tunnel and bridge/berm through the lagoon to Sorrento Valley.

3. In the third phase, the proposed MT-2, remaining portal structures, berm, and bridges would be constructed. At the south end, with the removal of the shoofly, and temporary bridge, the temporary left-hand turnout would be removed, and a temporary right-hand number 24 turnout would be constructed. As this cutover is anticipated to be challenging given current absolute work window durations, a multi-step cutover could be considered over consecutive absolute work windows. This will need to be further evaluated in preliminary engineering efforts and should be coupled with the possible addition of the second crossover at CP Sorrento, as mentioned in the alternatives discussion within Section 4, as a potential solution. At the north end, if extended single tracking was not acceptable, the temporary right-hand turnout would be removed, and a temporary left-hand turnout would be constructed, with similar cutover challenges as the south end. When complete, the temporary CPs would be removed, and the final track alignment would be completed at each tie-in at the project limits. Once complete, the operations would be cutover to both mainline tracks.

**Figure 13-2 Crest Canyon Higher-Speed Potential Phasing Schematic**




## 13.4.3 Summary

In comparing the two conceptual alternatives, due to the location of the proposed tie-ins to the existing alignment at both ends of the project, and the similarities between both at these locations, it's anticipated that the phasing for both alternatives could be constructed with similar impacts on operations. However, due to the conceptual level of this evaluation, detailed phasing evaluations should be continued in subsequent efforts of project development and tied to the development of the construction schedule. The City of San Diego is in the process of a two-phase Los Peñasquitos Lagoon restoration project, which should be coordinated with the development of phasing and overall schedule of this project.

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# 14 Tunnel Operations and Maintenance Considerations

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

## 14.1 Operational Considerations

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

- Monitoring train operations within the tunnel
- Monitoring incident detection systems
- Inspecting critical areas to ensure a safe operating environment
- Checking that fire/life safety 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 tunnel and tunnel auxiliary structures

## 14.2 Tunnel Maintenance

An effective maintenance program will limit expenditure, minimize the amount of tunnel downtime, increase safety to the travelling 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 and trash in and around the tunnel and auxiliary facilities
- Washing tunnel structures, flushing drains and cleanouts, clearing track drainage, and changing lighting and lighting fixtures
- Servicing ventilation equipment, including testing and calibrations
- Leak repair and remediation
- Testing signals
- Inspecting track

### 14.2.1 Maintenance Rail Equipment

After consultation with NCTD on May 12, 2021, the following vehicles would be required for NCTD maintenance of the tunnel and tunnel systems:

- Three bucket trucks
- Three hi-rail vehicles
- Three utility terrain vehicles

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# 15 Environmental Compliance

## 15.1 National Environmental Policy Act

Three likely federal actions associated with the project would trigger the need to demonstrate compliance with the requirements of NEPA (42 U.S. Code 4321, et. seq.) and the act's implementing regulations (40 Code of Federal Regulations 1500 et. seq.). These actions are:

- Federal funding;
- Certificate issued by the Surface Transportation Board [49 U.S. Code 10901 (c)]; and,
- Permit Issued by the U.S. Army Corps of Engineers under Section 404 of the Clean Water Act and/or Section 10 of the Rivers and Harbors Act.

SANDAG has preliminarily determined an EIS is the appropriate document for compliance with NEPA. SANDAG should identify a federal lead agency as early as possible to confirm this approach.

## 15.2 California Environmental Quality Act

The California Environmental Quality Act (CEQA; California Public Resources Code Section 2100 et. seq.) and the Guidelines for Implementation of CEQA (California Code of Regulations Section 15000 et. seq.) apply to the project. SANDAG would be the lead agency for compliance with CEQA. SANDAG has determined that an EIR is the appropriate document for compliance with CEQA.

## 15.3 Regulatory Permitting

The following permits likely would be required because all conceptual alternatives would involve placement of fill in waters of the U.S., 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 404 permit)
- Coastal Zone Management Act Federal Consistency Certification
- Endangered Species Act Section 7 Consultation
- Magnuson-Stevens Fishery Conservation and Management Act Consultation
- National Historic Preservation Act Section 106 Consultation

Additional details regarding Environmental Compliance are provided in Appendix B.

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# 16 Project Schedule

The overall project schedule will be 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 2035 as shown in the 2021 Regional Transportation Plan. A detailed schedule for each activity has not been developed but were based upon providing reasonably anticipated durations considering the current alternatives. It is anticipated that construction durations will 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.

Table 16-1 below provides an estimated schedule. Construction is estimated to last up to 7 years.

**Table 16-1. Estimated Project Schedule**

| Activity Name | Start | End | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030-2035 |
|---|---|---|---|---|---|---|---|---|---|---|
| Preliminary Engineering and Environmental | Q1/2023 | Q4/2026 | | | | | | | | |
| Circulate Draft Environmental Document | Q3/2025 | - | | | | | | | | |
| Record of Decision | Q4/2026 | - | | | | | | | | |
| Final Design | Q1/2027 | Q4/2028 | | | | | | | | |
| Right of Way Support Acquisition | Q1/2027 | Q4/2029 | | | | | | | | |
| Construction | Q1/2029 | Q4/2035 | | | | | | | | |

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# 17 Project Funding

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

On September 9, 2022, the SANDAG Board of Directors amended the budget to accept $300 million in State of California General Fund monies in the Transit and Intercity Rail Capital Program for the advancement of the SDSVDT project. This award fully funds the preliminary engineering and environmental phases as well as partially funds the final design and ROW phases over five years.

Project funding sources for full funding of the final design, ROW, and construction 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. Some example programs are:

## 17.1 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.

## 17.2 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.

## 17.3 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 measures for future transportation improvements such as those identified in the SD-LOSSAN Study.

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# 18 Construction Costs and Operations and Maintenance Costs

## 18.1 Construction Costs

The construction costs included in Appendix G 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 using a bottom-up approach. All unit costs from recent projects have been escalated to 2022 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. 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 CDM is approximately $1.56 billion in 2022 dollars.

The total estimated construction cost for CCHS is approximately $1.48 billion in 2022 dollars.

## 18.2 Operations and Maintenance Costs

The operations and maintenance costs included in Appendix H was established based on the following parameters:

- Team of three inspectors/maintenance crew operating 260 shifts per year
- Shifts are 8 hours/day
- Equipment per shifts consists of pick-up truck, vent fans, utility terrain vehicles, and miscellaneous power (refer to Section 14)

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 is approximately $2 million 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.

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# 19 Next Steps and Future Considerations

The conceptual engineering effort completed as part of this report was built upon the PDT's recommendations and rankings of the conceptual alternatives. These efforts have resulted in conceptual engineering plans for two alignment alternatives that address the current and future needs of the corridor and two other portal locations beyond those identified in the 10 percent plans.

Further evaluation of the portal locations and refinement of the assumptions the conceptual alternatives is warranted prior to the selection of alternatives to be carried forward into the preliminary engineering and environmental phase.

Throughout the development of the conceptual plans and associated reports, the team identified various items that should be considered or evaluated further. Although this list is not exhaustive, it highlights some of the key project features recommended for further development in support of the preliminary engineering and environmental phase:

- Further refine the single and twin bore configurations
- Further refine tunnel portal footprints and identify additional opportunities to reduce impacts
- Evaluate alternative delivery methods and determine preferred contracting approach
- Further analyze the preferred grade separation at Jimmy Durante Boulevard and associated impacts to refine and improve the intersection
- Evaluate a potential universal crossover between CP Valley and CP Rose to provide additional operational flexibility
- Develop draft construction phasing plans and schedule
- 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 identify major utility conflicts that could impact environmental process
- Determine the geologic subsurface conditions along the proposed tunnel alignments at depth
- Collect additional groundwater data and provide quantitative data using piezometers along the proposed 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 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
- Update existing floodplain models to reflect current topography, hydrology, and future sea level rise projections

- Further analyze potential impacts on private property owners and open space areas and associated mitigation measures
- Federalize the project to begin the NEPA process; work with federal lead agency to scope NEPA review and develop schedule
- Conduct cultural resource records search and pedestrian survey
- Conduct hazardous materials records search
- Conduct biological resource 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
- Prepare maps of geologic formations and identify those with the highest probability to support sensitive paleontological resources
- Develop a bridge type selection report
- Develop Los Peñasquitos optimization study to maximize tidal flows and balance berm removal
- Conduct additional hydraulic modeling in San Dieguito Lagoon that assumes replacement of both Bridge 243 and the CDM bridge with assumed sea level rise projections
- Develop a robust risk analysis
- Amend the shared use agreement between BNSF, NCTD, and MTS to allow for smaller clearance criteria
- Determine what, if any, additional portal alternatives should be considered
- Further evaluate potential flood mitigation measures at the north portal
- Work with stakeholders to identify alternative disposal/reuse options for the tunneling and other soils associated with construction of the project
- Work with stakeholders to identify future uses of the MTS and NCTD ROWs that will no longer accommodate rail improvements.

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