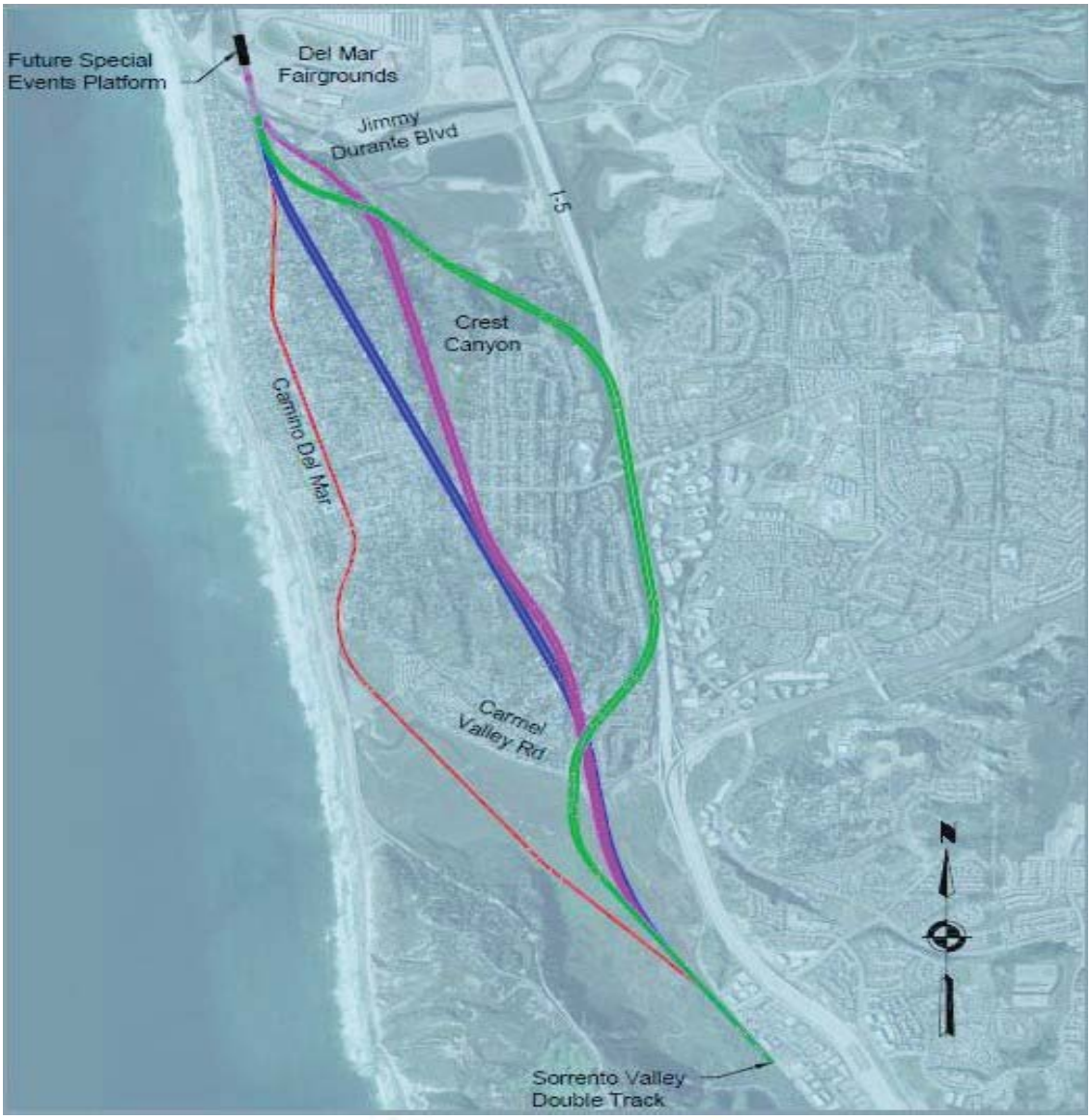
CONCEPTUAL ENGINEERING AND ENVIRONMENTAL CONSTRAINTS FOR DOUBLE TRACK ALIGNMENT ALTERNATIVES BETWEEN DEL MAR FAIRGROUNDS AND SORRENTO VALLEY

SUMMARY REPORT



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1. INTRODUCTION

The San Diego Subdivision of the Los Angeles-San Diego-San Luis Obispo (LOSSAN) rail corridor, the nation's second busiest, is shared between Amtrak's Pacific Surfliner intercity passenger rail, Metrolink and COASTER commuter rail services and Burlington Northern Santa Fe (BNSF) Railway freight services. The Subdivision stretches 60 miles through the coastal communities of Oceanside, Carlsbad, Encinitas, Solana Beach, Del Mar, and San Diego. Currently, 34 percent of the corridor is single track resulting in a rail line that is near capacity in terms of the ability to add new services.

San Diego Forward: The Regional Plan for San Diego identifies an improved LOSSAN rail corridor, and specifically significant increases in passenger and freight Level of Service (LOS), as a major transportation goal. This plan calls for double tracking, bridge replacements and station improvements that will be needed in order to provide additional passenger rail service as an alternative to driving the busy Interstate 5 (I-5) corridor.

2. PURPOSE AND NEED

SANDAG's LOSSAN corridor capital improvement program includes 26 rail projects along the San Diego section of the LOSSAN corridor in various stages of development, including 10 that are open to the public and another eight that are funded through construction. One project funded through preliminary engineering, environmental clearance and permitting is the replacement of the San Dieguito River Bridge, more than two miles of track improvements from Control Point (CP) Valley to CP Del Mar, and constructing a special events platform at the Del Mar Fairgrounds. This project would result in a 2.8 mile stretch of double track, enhanced operational flexibility and reliability of the corridor, and allow for increased LOS.

The Los Angeles San Diego Proposed Rail Corridor Improvements Programmatic Environmental Impact Report/Environmental Impact Statement (PEIR/EIS), certified by the Federal Railroad Administration (FRA) in 2009, calls for a tunnel to replace the current single track alignment between the Del Mar Fairgrounds and Sorrento Valley. Two alignment alternatives were identified, one under Camino Del Mar and one parallel to Interstate 5 (I-5). The completion of double track improvements in this area would require removing the train from the Del Mar Bluffs and constructing a tunnel through the City of Del Mar. While the tunnel segment would not be constructed in the near term and is included in *San Diego Forward* in the 2035-2050 time period, it is necessary to understand the affect the future tunnel alignment would have on the proposed new double track bridge being built as part of the San Dieguito River Bridge Replacement, Double Track and Del Mar Fairgrounds Special Events Platform (SDDT Project). As part of the preliminary design process for the bridge replacement, several preliminary alignments to complete the double track segment to Sorrento Valley together with technical studies were prepared to assess the future impacts before proceeding with the final design. The purpose of this report is to summarize the feasibility of double track alignments previously considered, including tunnel segments, and provide an analysis of the inter-relationship between the future double track alignments and the proposed SDDT Project. This report also provides preliminary

construction costs for each of the alternatives based on current Federal Transit Agency (FTA) data base information and a summary of future steps and considerations to further develop the conceptual alternatives. Neither detailed alternatives analysis, project-specific environmental analysis of proposed tunnel alternatives, nor the selection of a preferred alternative will be completed at this time.

The alignment alternatives analysis between Milepost (MP) 243 to MP 248 provides conceptual engineering for three primary alignments and two modified alignment options between the Del Mar Fairgrounds and Sorrento Valley. Ownership of this section of the LOSSAN Corridor is split between North County Transit District (NCTD) from Milepost (MP) 243 to approximate MP 245.6 and the San Diego Metropolitan Transit System (SDMTS) to MP 248. In addition to the two PEIR/EIS alignments, a potential alignment through Crest Canyon has been added as a third alternative. Each of the alignments is approximately five miles in length. Tunnel segment lengths vary from approximately 10,000 feet to 13,000 feet. Each option includes the connection through Los Peñasquitos Lagoon to the Sorrento Valley Station. The Camino Del Mar tunnel would be constructed using a cut and cover box section. The top of the box structure would be 10 feet to 70 feet below the roadway. The Crest Canyon and I-5 tunnels would 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 varies from 30 feet to 120 feet below the freeway elevation.

3. PREVIOUS STUDIES

In 2009, SANDAG completed detailed technical studies for the San Dieguito River Bridge Replacement and Second Track project followed by studies for a permanent special events platform at the Del Mar Fairgrounds. Alternatives for replacing the existing single track bridge included horizontal and vertical alignments for new concrete double track bridges, and extending the double track section of railway from the existing double track terminus in Solana Beach to an existing passing track in Del Mar (CP Crosby to CP Del Mar). The vertical alignment of the new bridges would be raised to allow freeboard above a 100-year storm event and avoid raising flood levels within the San Dieguito River floodplain.

The special events platform alternatives initially identified a single side loading platform on the east side of the railway. Operational studies completed in 2012 identified a need for platform access from each mainline track. Preliminary horizontal and vertical alignments were updated to reflect the change in platform configuration as part of the *San Dieguito River Bridge Replacement, Double Track and Del Mar Fairgrounds Special Events Platform Alternative Alignment Analysis Report* completed in 2013. A Finding of No Significant Impacts (FONSI) was issued by the Federal Railroad Administration (FRA) in January 2016 based on selection of the easterly alignment as the preferred alternative. Environmental permitting was completed in October 2017 based on a 60 percent level design. The 60percent bridge and double track alignment design defines the northerly tie-in constraints for future tunnel alternatives.

4. ADDITIONAL PROJECTS IN THE STUDY AREA

The Los Peñasquitos Lagoon Bridge Replacement project is near completion. The project will reconstruct four aging timber trestle railway bridges in the lagoon. This project will not construct double tracking in the lagoon or raise the structures or approaches above the 100-year water surface elevation. This double track alignment alternatives analysis assumes that all of the bridges would be replaced as part of the double track and tunnel project.

The Hydraulic Report prepared for the Torrey Pines Road Bridge Replacement Project dated October 2002 reflected a higher ground surface under the bridge due to siltation. The 100-year water surface elevation for this condition was approximately two feet higher than shown on the Federal Emergency Management Agency (FEMA) maps for the Peñasquitos Creek. For purposes of establishing the vertical alignment for bridges and embankments within Los Peñasquitos Lagoon, the higher water surface elevation reflected in the Torrey Pines Road Bridge Report has been used as the basis with a freeboard of two feet added for planning purposes. The impact of sea level rise is currently estimated to be 3.5 feet. With the hydraulic control at the Torrey Pines Road Bridge, the effect of sea level rise is not considered to be significant and has not been included in the criteria used to establish the vertical alignment of the railway.

The Interstate 5/State Route 56 (I-5/SR-56) Interchange Project Final Environmental Impact Report/Environmental Impact Study (FEIR/EIS) was completed and released to the public in June 2017. The Direct Connectors Alternative/Phased Connectors Alternative was selected as the Preferred Alternative. Funding for this project has not been secured, however it is anticipated that the I-5/SR-56 project will be constructed in advance of the Del Mar to Sorrento Valley Double Track. For purposes of this analysis, the complete Direct Connector Alternative has been assumed to be in place prior to construction of the proposed double tracking.

5. DESIGN CRITERIA

The published American Railway Engineering and Maintenance-of-Way Association (AREMA), California Public Utilities Commission (CPUC), Design Criteria Vol III LOSSAN Corridor in San Diego County, Southern California Regional Rail Authority (SCRRA), NCTD, National Fire Protection Agency (NFPA), Federal Emergency Management Agency (FEMA) and FRA standards are the basis for the design criteria.

5.1 Track Design Criteria

The track is designed according to the specific AREMA criteria for Commuter and Class 5 Track. The design criteria include track speeds, clearances, horizontal track geometry, and vertical track geometry. Fire life safety standards are also considered for the trainways egress and emergency access. Preferred design speeds within the corridor are 90 MPH for passenger rail and 60 MPH for freight. Because of the physical constraints within the right-of-way, these speeds may not be achieved. Lower speeds of 60 MPH for passenger rail and 50 MPH for freight may be considered acceptable and would be documented through a design exception process.

5.2 Structure Design Criteria

Structures will be designed according to AREMA standards. The design criteria include clearances, design methods, loads and forces for the structures. For purposes of this study, all bridge types are assumed to be precast double box girders with large diameter pile foundations similar to the preferred bridge type for the SDDT Project.

5.3 Tunnel Configuration Criteria

Tunnel sections will be designed to provide clearances from fixed obstructions in accordance with AREMA and SCRRA guidelines for both passenger and freight cars including clearance necessary for future electrification. A four-foot wide emergency walkway is provided in each tunnel. Minimum clearances dictate a rectangular section with a minimum vertical height of twenty-nine feet and minimum width of twenty-five feet and a bored section with a minimum interior diameter of thirty-three feet.

5.4 Tunnel Access Criteria

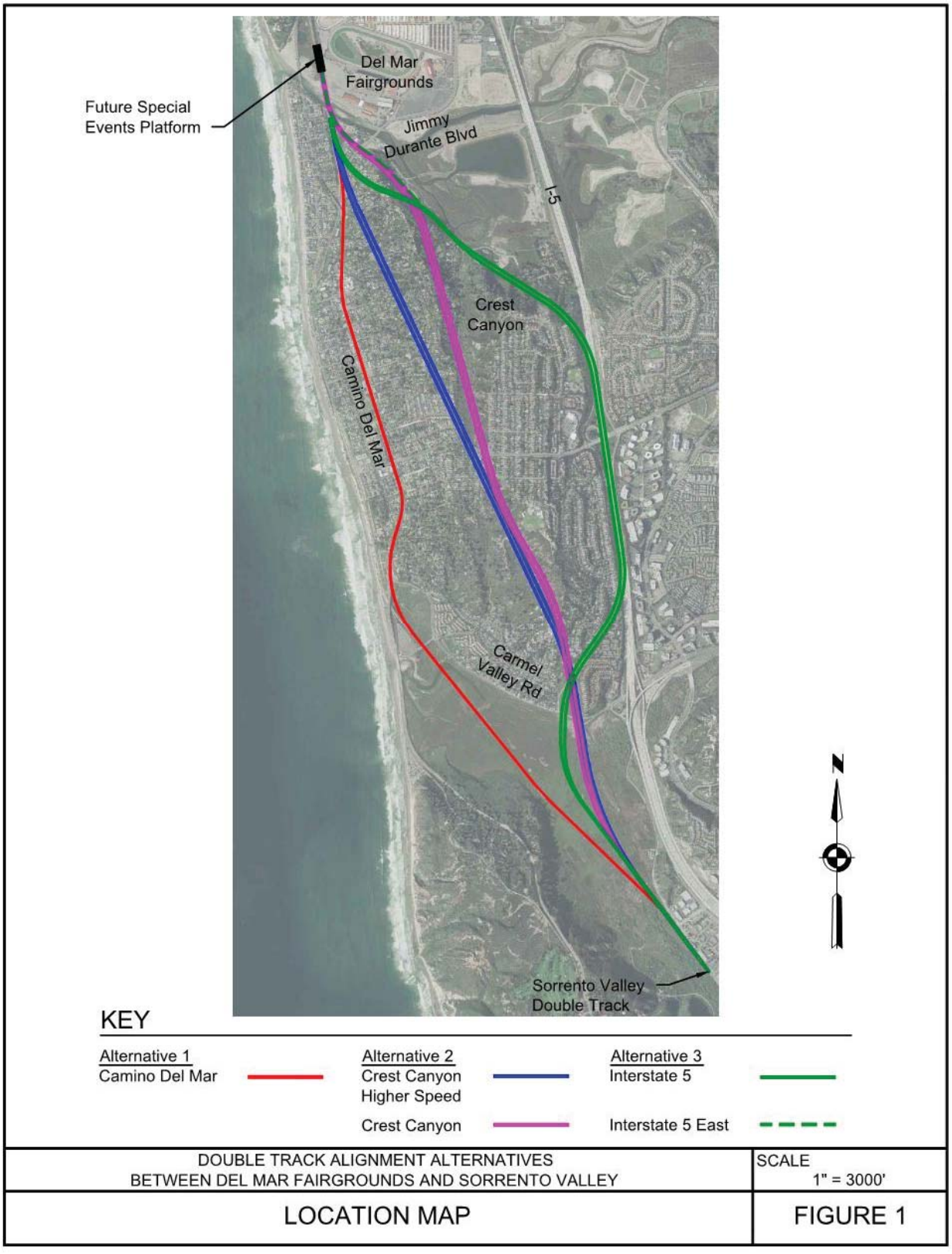
Tunnel access will be designed in accordance with NFPA 130. Emergency access to the surface must be provided at 2,500-foot intervals. Passageways between tunnels must be provided at 800-foot intervals to allow for usage of the adjacent tunnel in case of an incident in the occupied tunnel. The Camino Del Mar Alignment tunnel would be designed with access shafts to the surface in accordance with NFPA 130 in addition to the intermediate passageways between tunnels. Tunnel segments in the Crest Canyon and I-5 Alignments are very deep and access to the surface during emergencies is not considered feasible. Passageways would be provided at minimum intervals of 800 feet to allow crossing to the adjacent tunnel away from the incident. Due to the length of the tunnels, an additional small diameter tunnel was provided to allow for motorized vehicles to assist with evacuation.

5.5 Tunnel Ventilation Criteria

Tunnels in excess of 1,000 feet require ventilation in accordance with NFPA 130. Ventilation systems are designed to remove exhaust fumes during regular operation and to control heat and smoke flow during a fire emergency. The cut and cover Camino Del Mar tunnel would use transverse ventilation with supply and exhaust ducts. This will require separate supply and exhaust ducts along the length of the tunnel plus vent shafts (300 square feet cross sectional area) leading to vent plants of 600 Thousand Cubic Feet per Minute (KCFM) for each tunnel at each portal. Particularly at the north portal, it may be necessary to locate the vent plants some distance away from the actual tunnel alignment, which will further increase the power requirements. The two deep tunnel alternatives are very similar in terms of ventilation approach. Both use vent shafts near the portals and at mid-tunnel. The I-5 alignment option, which includes a short tunnel on the north end, will require jet fans for ventilation in the short tunnel in addition to the vent shafts in the main tunnels. All of the vent locations for either alignment will require a shaft for each tunnel with a cross sectional area of 400 square feet. These may be separate or combined in one large divided shaft, but each will be equipped with multiple, reversible, vane-axial fans with a combined capacity of 800 KCFM for each shaft.

6. DESCRIPTION OF ALTERNATIVES

The SDDT Project will provide a new double track system across the San Dieguito River. In the short term, the rail alignment will continue southerly along the Del Mar Bluffs and across Los Penasquitos Lagoon on a single track. In the longer term, the PEIR/EIS has identified alternatives for relocating the train off the Del Mar Bluffs. Preliminary alternatives for the bridge replacement and special events platform have considered the future realignments as part of the design within the limitations for maintaining the short term alignment to the bluffs. These previous documents identified two general tunnel alignments, one under Camino Del Mar and a second under I-5. A potential alignment through Crest Canyon has been added as a third alternative. Each of the three primary alignments would extend south from the future San Dieguito River Bridge Replacement structure. A secondary option for the northerly segment has been added for Crest Canyon and I-5. The secondary option reconstructs part of the San Dieguito River Bridge on a curve across the river to lessen impacts to private property. A curved configuration for the San Dieguito River Bridge would not be feasible in the short term because of the alignment criteria to connect to the existing railway. Each of the alignment alternatives is described in detail in the following sections and shown in Figure 1.



DOUBLE TRACK ALIGNMENT ALTERNATIVES BETWEEN DEL MAR FAIRGROUNDS AND SORRENTO VALLEY	SCALE 1" = 3000'
LOCATION MAP	FIGURE 1

6.1 ALTERNATIVE 1

CAMINO DEL MAR ALIGNMENT

Alignment Description

The Camino Del Mar Alignment extends a total of 5.0 miles from the northerly abutment of the proposed San Dieguito River Bridge (MP 243) to Sorrento Valley (Figure 2). The alignment follows the existing NCTD right-of-way from the proposed San Dieguito River Bridge south for approximately 1,800 feet. At that point, the alignment leaves the right-of-way and crosses Jimmy Durante Boulevard. From there, the railway would be constructed within a double box structure. Jimmy Durante Boulevard would be raised to pass over the top of the railroad structure. The railway alignment would continue south following the Camino Del Mar right-of-way. The new railway would be constructed in a double concrete box structure 10 feet to 70 feet below the existing street grade. Most construction activities would be completed below a temporary deck structure to minimize construction impacts as further described below. The tunnel segment would be approximately 10,200 feet in length.

The railway alignment would leave the public street right-of-way south of the intersection with Carmel Valley Road. The tunnel segment would end at a portal structure in the hillside east of the North Torrey Pines Road Bridge and transition to a bridge structure. The railway alignment would curve easterly and return to the existing right-of-way through Los Peñasquitos Lagoon to Sorrento Valley. A combination of bridge structure and berm would be constructed in the lagoon. The bridge section would include two single track structures with track centers at 26 feet. Where the existing graded berms would remain, they would be widened to accommodate the double tracking and raised above the 100-year water surface elevation. With the increased portion of track on structure, the total graded footprint for the berms within the lagoon would decrease compared to the existing condition.

Operations

Speeds of 60 miles per hour (MPH) for passenger traffic and 50 MPH for freight traffic are defined as minimums for the corridor with preferred speeds of 90 MPH and 60 MPH for passenger and freight traffic respectively. The Camino Del Mar Alignment as shown in the preliminary plans would be contained within the Camino Del Mar street right-of-way which has relatively short radius horizontal curves. Operating speeds would be reduced to 50 MPH for passenger and 35 MPH for freight because of the existing horizontal curvature and right-of-way limitations. Increasing curve radii to improve speeds in the tunnel section would require significant right-of-way acquisition and impacts to private property. The maximum superelevation would be 3.25 inches. Clearance requirements dictate minimum track centers of 27.5 feet within the tunnel box structure. Reversing curves would be needed at the north end to meet the existing track alignment south of the proposed San Dieguito River Bridge.

Maximum slopes of 2% with desired slopes of 1.2% have been identified for the corridor. A maximum slope of 1.87% (2% compensated) would be used through Camino Del Mar to lessen depth of cover.

Within the tunnel, stairs would be provided to the surface for emergency access at a minimum of 2,500-foot intervals. Walkways would be provided on the outsides of each tunnel for emergency egress to the stairwell locations. Cross connections would be provided between the tunnels at 800-foot intervals.

The existing rail alignment between the San Dieguito River Bridge and Sorrento Valley is a total of 5.0 miles. The Camino Del Mar alignment alternative would be approximately the same length, but would remove the railway from the Del Mar Bluffs.

Local Facilities

The Camino Del Mar Alignment would follow the Camino Del Mar roadway alignment and cross many public street intersections. Extensive roadway realignment would be required in the vicinity of the north portal, and utility relocation would be required along the entire alignment. Jimmy Durante Boulevard would be realigned vertically to cross over the top of the concrete box structure. Commercial and residential properties adjacent to Jimmy Durante Boulevard would be impacted by the higher roadway alignment. Existing sewer, water, gas and storm drain facilities would be relocated to avoid conflicts with the railway structures. Grading and construction of access roads would be required at each of the portals. Existing utilities within and crossing Camino Del Mar would be impacted on a temporary basis during the relocation construction.

A transverse ventilation system with supply and exhaust ducts along the length of the tunnel would be used to limit the number of vent shafts at the surface. With the ducted system, two vent shafts with a cross sectional area of 300 square feet each would be constructed near each end of the tunnel for a total of four vent shafts. A total of three access structures would be constructed to the surface for emergency egress.

Table 1 outlines the overall advantages and disadvantages of the Camino Del Mar alignment alternative in terms of land use, local transportation, train operations, environmental concerns, and other factors.

Table 1

CAMINO DEL MAR ALIGNMENT EVALUATION

ADVANTAGES	DISADVANTAGES
No existing homes would be eliminated as a result of this alignment	Significant amount of utility conflicts along Camino Del Mar
The alignment would not be located underneath any existing residential or commercial buildings	Requires 50/35 MPH speed due to existing tight curves along Camino Del Mar
Shortest tunnel segment length	No ideal locations for large above ground ventilation power and fan rooms
Would reduce the overall berm footprint through Los Peñasquitos Lagoon by approximately one-half	Jimmy Durante Northbound would be raised from Camino del Mar to north of David Way
Least impact on archaeological resources	Jimmy Durante Southbound would be reconstructed to go over both the rail line and the existing Camino Del Mar bridge
No Impact to SDDT bridge	A portion of the Camino del Mar bridge would be reconstructed
	Access to Luzon Road would be eliminated
	Access to Grand Ave from Jimmy Durante would be eliminated
	Significant disruption of traffic operations during construction
	The southern half of the alignment follows the existing alignment through Los Peñasquitos Lagoon. FEMA flood elevation requires raising existing structures through Los Peñasquitos Lagoon
	Visual impacts
	High impact to biological resources
	Disruption of local businesses during construction
	Higher noise and vibration impacts during construction

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			CAMINO DEL MAR ALIGNMENT	FIGURE 2

6.2 ALTERNATIVE 2

CREST CANYON HIGHER SPEED ALIGNMENT

Alignment Description

The Crest Canyon Higher Speed Alignment extends a total of 4.8 miles from the northerly abutment of the proposed San Dieguito River Bridge to Sorrento Valley (Figure 3). The alignment follows the existing NCTD right-of-way from the bridge south for approximately 1,300 feet. At that point the alignment leaves the right-of-way and crosses Jimmy Durante Boulevard on a graded section approximately 10 feet above the existing roadway. Jimmy Durante Boulevard would be raised to pass over the top of the railroad alignment. A 500 foot-long segment of cut and cover box would be constructed as a transition to a three tunnel section. Two 33.6-foot diameter tunnels would be constructed to accommodate the railway. An 18.5-foot diameter center tunnel would be constructed to accommodate emergency access. The tunnel segment would be approximately 13,200 feet in length at depths up to 270 feet below existing ground. The alignment would pass under existing private property, and continue under Portofino Drive to the southerly portal located approximately 400 feet east of Portofino Drive. A 300-foot long cut and cover box section and open trench would transition from the tunnel section to a bridge section. The railway alignment would continue southerly on two single track bridge structures for approximately 6,300 feet and include replacement of Bridge 247.7. The remainder of the alignment would be constructed on a berm to meet the double track alignment constructed as part of the Sorrento Valley Double Track Project. The new berm would be widened and raised to provide clearance above the 100-year water surface elevation.

Operations

The majority of the Crest Canyon Higher Speed Alignment would be on tangent with curves limited to each end connecting to the proposed San Dieguito River Bridge to the north and Sorrento Valley to the south. Maximum speeds of 90 MPH for passenger traffic and 60 MPH for freight traffic would be maintained for the entire alignment with the exception of the northerly tie into the San Dieguito River Bridge where freight speeds would be reduced to 55 MPH. The minimum horizontal curve radius would be 7,200 feet with 1-inch maximum superelevation.

The maximum slope would be 0.51% to allow for adequate drainage of the tunnel. The vertical alignment would be controlled by the proposed San Dieguito River Bridge to the north and minimum clearance over Carmel Valley Road and under Portofino Drive to the south. The tunnel depth would prohibit the use of vertical shafts for emergency access or regular maintenance. A third tunnel would be provided between the railway tunnels with passageways every 800 feet to provide refuge and egress.

The existing rail alignment between the Del Mar Fairgrounds and Sorrento Valley along the Del Mar Bluffs is a total of 5.0 miles. The Crest Canyon Higher Speed Alignment would be a total of 4.8 miles for a reduction of 0.2 miles in total length.

Local Facilities

The Crest Canyon Higher Speed Alignment would cross existing public streets and require realignment of existing roads and utilities. Jimmy Durante Boulevard would be realigned vertically to cross over the top of the railway alignment. Existing sewer, water, gas and storm drain facilities would be relocated to avoid conflicts with the railway structures and to accommodate the revised roadway profile. Grading and construction of access roads would be required at each of the portals.

The tunnel ventilation system would require construction of six intake/exhaust shafts along the alignment. Each shaft would be approximately 400 square feet in cross sectional area and extend to heights 25 feet above grade. Two shafts would be located near the middle of the tunnel segment and two shafts would be located near each end of the tunnel segment.

Property and right-of-way acquisition would be required for the Crest Canyon Higher Speed Alignment. Above ground right-of-way would be required for new double track north and south of the tunnel to connect back to the existing right-of-way. Underground easements would be required for the tunnel segment through Crest Canyon Open Space. The commercial and residential properties adjacent to Jimmy Durante Boulevard would be impacted and residential properties in the vicinity of the portals and graded open trench would be impacted. Acquisition of some of these properties would be required for grading and construction staging.

Table 2 outlines the overall advantages and disadvantages of the Crest Canyon Higher Speed alignment alternative in terms of land use, local transportation, train operations, environmental concerns, and other factors.

Table 2

CREST CANYON HIGHER SPEED ALIGNMENT EVALUATION

ADVANTAGES	DISADVANTAGES
Speeds through entire alignment would be 90 MPH for passenger and 60 MPH for freight, matching speeds of the Sorrento Valley Double Track Project	A significant amount of office and residential buildings would have to be acquired in the north portal area.
There would be only one horizontal curve in the tunnel, resulting in easier construction	Portions of alignment would go underneath homes
Tunnel grades would be relatively flat, allowing just enough incline for adequate drainage	Jimmy Durante Northbound would be reconstructed to go over the rail line
Shortest overall alignment	Jimmy Durante Southbound would be reconstructed to go over both the rail line and the existing Camino Del Mar bridge
Shortest travel time	David Way at Jimmy Durante would be raised, or possibly abandoned as the elevation difference of the proposed Jimmy Durante is close to 11 feet
Would allow for removal of the existing berms in Los Peñasquitos Lagoon	Westerly Luzon Ave. would be abandoned and homes along it would be acquired as part of the project
Less impact to biological resources than Camino Del Mar alignment	Access to Grand Ave from Jimmy Durante would be eliminated or significant reconstruction required
No Impact to SDDT bridge	Significant disruption of traffic operations during construction
	Track on structure through most of Los Peñasquitos Lagoon
	Loss of open space link (wildlife corridor) between Los Peñasquitos Lagoon and Crest Canyon Open Space

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			CREST CANYON HIGHER SPEED ALIGNMENT	FIGURE 3

CREST CANYON ALIGNMENT

Alignment Description

The Crest Canyon Alignment would extend a total of 4.9 miles from the northerly abutment of proposed San Dieguito River Bridge to Sorrento Valley (Figure 4). Approximately 600 feet of the proposed San Dieguito River Bridge would be removed and reconstructed. The alignment would shift easterly across the City of Del Mar Public Works facility, through the Del Mar Wye, then through a commercial parcel and across Jimmy Durante Boulevard. This first segment would be constructed on two single track bridge structures which would provide necessary clearance over Jimmy Durante Boulevard. The railway alignment would continue for approximately 1,900 feet in a graded open trench section generally parallel to and above Racetrack View Drive. The railway alignment would enter a three tunnel section that generally follows the Crest Canyon Open Space avoiding private property. Two 33.6-foot diameter tunnels would be constructed to accommodate the railway. An 18.5-foot diameter center tunnel would be constructed to provide emergency access. The tunnel segment would be approximately 12,700 feet in length and at depths of up to 250 feet below existing ground. The alignment would pass under Portofino Drive with the southerly portal located in the open space hillside to the east. An open trench section would transition to two single track bridge structures crossing Carmel Valley Road. The alignment would continue southerly on bridge structures for approximately 6,200 feet and include the replacement of Bridge 247.7. The remainder of the alignment would be constructed on a berm to meet the double track alignment constructed as part of the Sorrento Valley Double Track Project. The new berm would be widened and raised to provide clearance above the 100-year water surface elevation.

Operations

Speeds of 60 MPH for passenger traffic and 50 MPH for freight traffic are defined as minimums for the corridor with preferred speeds of 90 MPH and 60 MPH for passenger and freight traffic respectively. The majority of the Crest Canyon Alignment would achieve speeds of 90 MPH and 60 MPH for passenger and freight travel. The first curve south of the San Dieguito River Bridge Alignment would be a tighter radius with speeds reduced to 55 MPH and 40 MPH respectively with a superelevation of 3.25 inches. The tighter curve would be necessary to minimize impacts to the residential properties east of Jimmy Durante Boulevard.

Maximum slopes of 2% with desired slopes of 1.2% have been identified for the corridor. Slopes of 1.16% and -0.50% would provide minimum clearances over existing roadways and minimum cover for the tunnel portals.

The tunnel depth would prohibit the use of vertical shafts for emergency access or regular maintenance. A third tunnel would be provided between the railway tunnels with passageways every 800 feet to provide refuge and egress.

The existing railway alignment between the Del Mar Fairgrounds and Sorrento Valley along the Del Mar Bluffs is a total of 5.0 miles. The Crest Canyon Alignment would be approximately 4.9 miles for a decrease in length of 0.1 miles.

Local Facilities

The Crest Canyon Alignment would cross existing public streets including Jimmy Durante Boulevard and Carmel Valley Road on two single track bridge structures and cross under Portofino Drive in a tunnel section. Reconstruction of existing public streets and disruption of existing utilities would not be required as part of this alignment alternative. Grading and construction of access roads would be required at each of the portals.

The tunnel ventilation system would require construction of six intake/exhaust shafts along the alignment. Each shaft would be approximately 400 square feet in cross sectional area and extend 25 feet above grade. Two shafts would be located near the middle of the tunnel segment and two shafts would be located near each end of the tunnel segment.

Property and right-of-way acquisition would be required for the Crest Canyon Alignment. Above ground right-of-way would be required for the northerly segment and the southerly segment outside of the existing right-of-way. Underground easements would be required for the tunnel segment through the Crest Canyon Open Space. In addition, some of the private homes in the vicinity of the graded open trench segment at the northerly portal would be need to be acquired for grading and construction staging.

Table 3 shows the overall advantages and disadvantages of the Crest Canyon Alignment alternative in terms of land use, local transportation, train operations, environmental concerns, and other factors.

Table 3

CREST CANYON ALIGNMENT EVALUATION

ADVANTAGES	DISADVANTAGES
Speeds through the majority of the tunnel will be 90 MPH for passenger and 60 MPH for freight	Portion of San Dieguito Bridge required to be reconstructed
Minimizes the number of homes and residential buildings to be acquired at the northern end of the alignment	55/40 MPH speed required across San Dieguito Bridge due to a tight horizontal curve
Roadway improvements are minimal because the track crosses over intersecting roads at beginning of alignment	Track would be on structure through most of Los Peñasquitos Lagoon
Tunnel grades are relatively flat, allowing just enough incline for adequate drainage	Some homes likely need to be acquired
Would allow for removal of the existing berms in Los Peñasquitos Lagoon	Loss of open space link (wildlife corridor) between Los Peñasquitos Lagoon and Crest Canyon Open Space
Shorter overall track length than existing condition	Tunneling under homes is required
Less impact to biological resources than Camino Del Mar alignment	

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			CREST CANYON ALIGNMENT	FIGURE 4

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6.3 ALTERNATIVE 3

INTERSTATE 5 ALIGNMENT

Alignment Description

The Interstate 5 Alignment extends a total of 5.3 miles from the northerly abutment of the proposed San Dieguito River Bridge to Sorrento Valley (Figure 5). The alignment would follow the existing NCTD right-of-way from the proposed San Dieguito River bridge south for approximately 1,400 feet on a raised berm. At that point the alignment would leave the right-of-way and cross Jimmy Durante Boulevard at an elevation approximately 10 feet above the existing roadway. The railway alignment would continue southeasterly in a twin bored tunnel section for approximately 1,400 feet, then through a graded open trench for 1,050 feet and cross Racetrack View Drive on two single track bridge structures with 18 feet minimum clearance above the roadway. The alignment would continue southeasterly in a graded open trench for 950 feet until there is adequate cover for a tunnel section. Two 33.6-foot diameter bored tunnels for railway and one 18.5-foot diameter tunnel for emergency access would be constructed under Interstate 5 and Portofino Drive for a length of nearly 12,000 feet. The cover under Interstate 5 varies from 50 feet to 120 feet and under Portofino Drive varies from 50 feet to 80 feet. The southerly tunnel portal would be located in the hillside east of Portofino Drive. The alignment would continue on two single bridge structures for approximately 6,600 feet and would replace Bridge 247.7. The remainder of the alignment would be constructed on a berm to meet the double track alignment constructed as part of the Sorrento Valley Double Track Project. The new berm would be widened and raised to provide clearance above the 100-year water surface elevation.

Operations

Speeds of 60 MPH for passenger traffic and 50 MPH for freight traffic are defined as minimums for the corridor with preferred speeds of 90 MPH and 60 MPH for passenger and freight traffic respectively. The majority of the Interstate 5 Alignment would achieve speeds 60 MPH and 40 MPH with the first curve south of the proposed San Dieguito River Bridge reduced to 55 MPH for and 40 MPH for passenger and freight traffic respectively. The maximum superelevation for the alignment would be 2.75 inches. The existing physical constraints dictate the use of sharper curves and reduced speeds. These constraints include the location of the proposed San Dieguito River Bridge and avoidance of existing homes along Racetrack View Drive and Portofino Drive.

Maximum slopes of 2% with desired slopes of 1.2% have been identified for the corridor. Slopes of 1.33% and -0.43% would provide minimum clearances from existing roadways and minimum cover for the tunnel portals.

The tunnel depth would prohibit the use of vertical shafts for emergency access or regular maintenance. A third tunnel would be provided between the railway tunnels with passageways every 800 feet to provide refuge and egress.

The existing railway alignment between the Del Mar Fairgrounds and Sorrento Valley along the Del Mar Bluffs is a total of 5.0 miles. The Interstate 5 Alignment would be approximately 5.3 miles for an increase in length of 0.3 miles.

Local Facilities

The Interstate 5 Alignment would cross existing public streets and require realignment of existing roads and utilities. Jimmy Durante Boulevard would be realigned vertically to cross over the top of the railway alignment. Commercial and residential properties adjacent to Jimmy Durante Boulevard would be impacted by the higher roadway alignment. Existing sewer, water, gas and storm drain facilities would be relocated to avoid conflicts with the railway structures and to accommodate the revised roadway profile. Grading and construction of access roads would be required at each of the portals.

The tunnel ventilation system would require construction of six intake/exhaust shafts along the tunnel alignment. Each shaft would be approximately 400 square feet in cross sectional area and extend to a height of 25 feet above grade.

Property and right-of-way acquisition would be required for the Interstate 5 Alignment. Above ground right-of-way would be required for the northerly and southerly railway segments and bridge structures outside of the existing right-of-way. Underground easements would be required for both tunnel segments. The commercial properties west of Jimmy Durante Boulevard would be impacted by the railway alignment. In addition, some of the private homes in the vicinity of the alignment would be acquired to allow for grading and construction staging. Underground easements for the remaining portion of the tunnel to the southerly portal would be required. The main tunnel section under Portofino Drive would extend beyond the public street right-of-way. Underground easements would be needed from adjacent private properties. New right-of-way would be required from the south portal for approximately 6,500 feet until the alignment returns to the SDMTS right-of-way.

Table 4

INTERSTATE 5 ALIGNMENT EVALUATION

ADVANTAGES	DISADVANTAGES
A significant portion of the tunnel alignment will be constructed under I-5 limiting the length under existing homes	A significant amount of office and residential buildings will have to be acquired at the north portal area
Would allow for removal of the existing berms in Los Peñasquitos Lagoon	Portions of alignment would go underneath homes
Less impact to biological resources than Camino Del Mar alignment	Requires 60/40 MPH speed due to tight horizontal curves along the alignment
No impact to SDDT bridge	The existing Jimmy Durante Blvd bridge over the San Dieguito River would have to be replaced and raised
	Jimmy Durante Northbound would be reconstructed to go over the rail line
	Jimmy Durante Southbound would be reconstructed to go over both the rail line and the existing Camino Del Mar bridge
	Access to David Way from Jimmy Durante would be eliminated
	Access to Grand Ave from Jimmy Durante would be eliminated or significant reconstruction required
	Significant disruption of traffic operations during construction.
	Track on structure through most of Los Peñasquitos Lagoon
	Overall track length is greater than existing condition

HNTB 401 B Street Suite 510 San Diego, CA 92101	SANDAG San Diego's Regional Planning Agency	NORTH COUNTY TRANSIT DISTRICT	DOUBLE TRACK ALIGNMENT ALTERNATIVES BETWEEN DEL MAR FAIRGROUNDS AND SORRENTO VALLEY	SCALE 1" = 2000'
			INTERSTATE 5 ALIGNMENT	FIGURE 5

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INTERSTATE 5 EAST ALIGNMENT

Alignment Description

The Interstate 5 East Alignment (Figure 6) would provide an option to improve speed and lessen impacts compared to the Interstate 5 Alignment. This variation would remove approximately 650 feet of the San Dieguito River Bridge and shift the first 7,000 feet of the alignment to the east of the Interstate 5 Alignment. The majority of the railway alignment from the San Dieguito River Bridge to the northerly tunnel portal would be constructed on two single track bridge structures. Three shorter segments of graded open trench would be constructed as dictated by the existing elevations just east of Jimmy Durante Boulevard, and north of the tunnel portal. From the tunnel portal, the Interstate 5 East Alignment would follow the Interstate 5 Alignment to meet the Sorrento Valley Double Track Project. The entire length of the Interstate 5 East Alignment would be 5.2 miles.

Several other alignment options were considered for the southerly portion of the alignment to improve speed and lessen environmental impacts to the lagoon. One option would construct a tunnel under Interstate 5 to the Carmel Valley Road off ramps then curve back to the west, continue underneath four rows of existing homes and daylight in the hillside west of Point Del Mar Way. In order to achieve 17.5 feet of vertical clearance from Carmel Valley Road, the railway profile would be raised resulting in insufficient vertical clearance (less than 25 feet) from the top of the tunnel to the existing homes. Lowering the profile to go under Carmel Valley Road would not be feasible due to the water table elevation through Los Peñasquitos Lagoon. Another option would split the tunnels into single bore tunnels at the south portal. The Main Track 2 portal would be located in the hillside west of Point Del Mar Way and the Main Track 1 portal would be located to the west of the I-5 off ramp at Carmel Valley Road. This would create the same vertical clearance issues under the existing homes as well as requiring acquisition of the commercial properties to the east of Point Del Mar Way. If acquisition of these homes would be considered feasible, the railway alignment could be straightened, speeds improved and impacts to Los Peñasquitos Lagoon reduced.

Operations

Speeds of 60 MPH for passenger traffic and 50 MPH for freight traffic are defined as minimums for the corridor with preferred speeds of 90 MPH and 60 MPH for passenger and freight traffic respectively. The Interstate 5 East Alignment would remove a portion of the San Dieguito River Bridge which would allow the alignment to shift east and north reducing grading impacts and roadway conflicts. The curve lengths and speed would not be improved, therefore the majority of the alignment would achieve speeds 60 MPH and 40 MPH for passenger and freight traffic respectively, similar to the Interstate 5 Alignment.

Maximum slopes of 2% with desired slopes of 1.2% have been identified for the corridor. Slopes of 1.18% and -0.51% would provide minimum clearances from existing roadways and minimum cover for the tunnel portals.

The tunnel depth would prohibit the use of vertical shafts for emergency access or regular maintenance. A third tunnel would be provided between the railway tunnels with passageways every 800 feet to provide refuge and egress.

The existing railway alignment between the Del Mar Fairgrounds and Sorrento Valley along the Del Mar Bluffs is a total of 5.0 miles. The Interstate 5 East Alignment would be approximately 5.2 miles for an increase in length of 0.2 miles.

Local Facilities

The Interstate 5 East Alignment would cross existing public streets including Jimmy Durante Boulevard and Racetrack View Drive on two single track bridge structures. Reconstruction of existing public streets and disruption of existing utilities would not be required as part of this alignment alternative. Grading and construction of access roads would be required at each of the portals.

The tunnel ventilation system would require construction of six intake/exhaust shafts along the alignment. Each shaft would be approximately 400 square feet in cross sectional area and extend to heights 25 feet above grade. Two shafts would be located near the middle of the tunnel segment and two shafts would be located near each end of the tunnel segment.

Property and right-of-way acquisition would be required for the Interstate 5 Alignment East Alignment. Above ground right-of-way would be required for the northerly segment and the southerly segment outside of the existing right-of-way. Underground easements would be required for the tunnel segment under I-5 and Portofino Drive. The main tunnel section under Portofino Drive would extend beyond the public street. The commercial properties west of Jimmy Durante Boulevard would be impacted by the railway alignment. In addition, some of the private homes and commercial properties in the vicinity of the portals and graded open trenches would need to be acquired for grading and construction staging.

Table 5

INTERSTATE 5 EAST ALIGNMENT EVALUATION

ADVANTAGES	DISADVANTAGES
Roadway improvements at the north end are minimal because the track crosses over all intersecting roads.	Would require a portion of the future San Dieguito Double Track Bridge to be reconstructed
Minimizes the amount of homes and residential buildings to be acquired at the northern end of the alignment.	Requires 60/40 MPH speed due to tight horizontal curves along the alignment
A significant portion of the tunnel alignment will be constructed under I-5 limiting the length under existing homes	Portions of alignment would go underneath homes
Would allow for removal of the existing berms in Los Peñasquitos Lagoon	Track on structure through most of Los Peñasquitos Lagoon
Less impact to biological resources than Camino Del Mar alignment	Longer overall track length than existing condition

HNTB 401 B Street Suite 510 San Diego, CA 92101	SANDAG San Diego's Regional Planning Agency	NORTH COUNTY TRANSIT DISTRICT	DOUBLE TRACK ALIGNMENT ALTERNATIVES BETWEEN DEL MAR FAIRGROUNDS AND SORRENTO VALLEY	SCALE 1" = 2000'
			INTERSTATE 5 EAST ALIGNMENT	FIGURE 6

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7. SUMMARY OF ENVIRONMENTAL CONSTRAINTS

An environmental constraints analysis has been completed for the five alignment alternatives and is documented in the report titled *Environmental Constraints for Conceptual Double Track Alignment Alternatives Between Del Mar Fairgrounds and Sorrento Valley* (Appendix II). Two tunnel alignments were previously studied as part of the California Department of Transportation and Federal Railroad Administration (FRA) Program EIR/EIS that evaluated improvements to the 125-mile-long Los Angeles to San Diego portion of the LOSSAN corridor in 2009. The two alignments generally follow the Camino Del Mar Alignment and the I-5 Alignment options. The two alignments that generally follow Crest Canyon and are roughly halfway between Camino Del Mar and Interstate 5 were developed following the completion of the Program EIR/EIS and were therefore not evaluated in that document. Nothing in the PEIR/EIS precludes the future, project-specific analysis of new alternatives. Readers should also note that while the environmental constraints report is a step toward the ultimate analysis of alternative double track alignments between the Del Mar Fairgrounds and Sorrento Valley pursuant to the National Environmental Policy Act (NEPA) and, if required, California Environmental Quality Act (CEQA), it is not the project-specific analysis of those alternatives that would be required prior to adopting and constructing a new rail alignment through/under the City of Del Mar and/or the City of San Diego's Torrey Pines Community.

In addition to NEPA and potentially CEQA compliance, a wide range of other environmental approvals and permits could be required for any of the alignment alternatives, including a Coastal Consistency Certification/Determination, Clean Water Act Section 404 Individual Permit, Clean Water Act Section 401 Water Quality Certification, federal Endangered Species Act Section 7 Consultation and Incidental Take Permit, and, potentially, California Fish and Game Code Section 1602 Streambed Alteration Agreement, among others.

The environmental constraints report evaluates biological resources, noise and vibration, air quality and greenhouse gases, land use, cultural resources, geology and soils, water quality/hydrology, and paleontological (fossil) resources. Visual quality will be evaluated in the future pending additional development of preliminary alignment alternative designs.

For the topics of biological resources, water quality/hydrology, and paleontological resources, the focus of the constraints analysis is on the potential for a given alignment alternative to affect the respective resource. The assessment of land use constraints addresses the extent to which an alignment alternative would require the removal of existing land uses and/or be inconsistent with adjacent planned uses. The analyses of noise/vibration and air quality/greenhouse gases focus on the potential for project-related emissions to affect the surrounding community, and the focus of the geology/soils analysis is on whether there are existing geology/soils constraints that would make an alternative infeasible from a geotechnical standpoint.

For each resource or issue area, existing (baseline) conditions are described and environmental constraints are discussed in narrative format and assessed as high, medium or low. Given the size of the project, the engineering and construction issues associated with a tunnel large enough

to accommodate double train tracks, and related project features such as vents and safety access shafts, a case could be made that for virtually every issue area and every alignment, the constraint level is high. Ranking every topic and alignment as having a high constraint would provide a conservative estimate of the environmental issues to be faced by future double track construction and operation, but would not be useful in helping decision-makers and members of the public in comparing the relative environmental merits and drawbacks of each alignment. Accordingly, a comparative approach is used. For example, each of the alternatives would generate some construction noise—probably round-the-clock—near noise sensitive land uses such as residences, and this typically warrants assessment of a high noise and vibration constraint. However, in light of the greater number of noise-sensitive land uses that would be affected by construction of the Camino Del Mar Alignment when compared to the Crest Canyon or Interstate 5 alignments, construction of the Camino Del Mar Alignment is assessed as having a high noise and vibration constraint, whereas construction of the Crest Canyon or Interstate 5 alignments is assessed as having a medium noise and vibration constraint (see Section 3.2 for the Noise and Vibration constraints analysis.) For some issue areas such as paleontological resources, however, the constraints facing each alignment are too similar to warrant the assessment of different constraint levels for different alignments.

Based on the preliminary nature of the alignment design and the anticipated timeframe before a preferred alignment is selected and project-specific environmental impact analysis is started, no quantification of impacts or ranking of alignment alternatives is provided in the environmental constraints report. The analysis does not address the removal of the existing railroad tracks from the Del Mar Bluffs because this removal would occur under each of the alternatives, therefore, the constraints facing track removal from the bluff would not affect the future selection of a double track alignment from the range of potential alternatives. The impacts and benefits of track removal from the Del Mar Bluffs would, however, be addressed in the future project-specific environmental analysis of the alignment alternatives between the Del Mar Fairgrounds and Sorrento Valley.

The following table provides a summary of the environmental constraint levels assessed for each of the alternatives evaluated in this report.

Table 6. Summary of Assessed Environmental Constraint Level

Issue Area	Constraints Ranking by Alternative*				
	Camino Del Mar	**Crest Canyon Higher Speed**	**Crest Canyon**	**Interstate 5**	**Interstate 5 East**
Biological Resources	H	M	M	M	M
Noise*	H/L	M/M	M/H	M/H	M/H
Vibration**	L	L	L	L	L
Air Quality and Greenhouse Gas	L/H	L/H	L/H	L/M	L/M
Land Use	M	H	H	H	H
Cultural Resources	L	H	H	H	H
Geology and Soils	M	M	M	M	M
Water Quality/ Hydrology†	H	H	H	H	H
Paleontological Resources	M	M	M	M	M

* Where two levels of environmental constraints are provided for one category (e.g., “high/low”), the first assessment reflects construction and the second reflects operations.

** The “Low” constraint for vibration is contingent on the success of planned vibration dampening in the tunnel segments under and adjacent to residences and businesses.

† Because the Water Quality/Hydrology discussion provides separate constraints for a number of specific resource areas (e.g., watershed and drainage characteristics, floodplain/hazard, and water quality), the highest level of constraint for any of these topics is listed for each alignment.

L = Low; M=Medium; H=High

8. SUMMARY OF GEOTECHNICAL CONSIDERATIONS

A preliminary geotechnical evaluation has been completed for each of the alternatives and is attached as Appendix IV. Based on the results of a background review, geotechnical reconnaissance, and preliminary engineering analysis, the proposed Del Mar Fairgrounds to Sorrento Valley Alternatives are feasible from a geotechnical perspective. General conclusions regarding geotechnical conditions are presented below.

The project site extends from San Dieguito Lagoon in the north, through the Del Mar Mesa south to Los Peñasquitos Lagoon. The proposed tunnel alignments would generally traverse the Del Mar Mesa which generally consists of a pair of north-south trending ridges partially separated by Crest Canyon. The western ridge descends generally uniformly to the west and to the coast. The eastern ridge is bounded to the west by Crest Canyon and to the east by I-5. The ridges are cut by numerous steep-sided valleys and ravines. Elevations range from roughly 10 feet above mean sea level (MSL) along the coast and in the lagoons north and south of the mesa to roughly 420 feet above MSL along the eastern ridge north of Del Mar Heights Road.

The Del Mar Mesa is underlain by gently dipping marine sedimentary rocks of the Eocene-age La Jolla Group. This series of sedimentary rocks underlies much of the coastal plain of western San Diego County and consists of several formations. Two of these formations, the Del Mar Formation and the Torrey Sandstone, are likely to be encountered along the proposed tunnel alignments. In addition to formational units of the La Jolla Group, very old paralic deposits, old paralic deposits, alluvium, landslide deposits, colluvium, and fill soils were observed or inferred to underlie portions of the project area. The very old paralic deposits, Torrey Sandstone, and Delmar Formation are generally expected to be stable unless weak beds are encountered. These materials are considered soft rock for tunneling purposes. Expansive clays within the Delmar Formation may cause invert heave and may have stability issues at the portals, especially if groundwater seepage is present. Torrey Sandstone and very old paralic deposits may be subject to raveling over time if left exposed to wet conditions. Portions of the old paralic deposits are relatively cohesionless and may be unstable in excavation sidewalls, especially under saturated conditions.

The project area, like most of southern California, is considered seismically active. In general, hazards associated with seismic activity include ground surface rupture, strong ground motion, liquefaction, seismically induced settlement, and tsunamis. Other geologic hazards include landsliding. The Del Mar Mesa area is not underlain by known active or potentially active faults (i.e., faults that exhibit evidence of ground displacement in the last 11,000 years and 2,000,000 years, respectively). However, the site is located in a seismically active area, as is the majority of Southern California, and the potential for strong ground motion is considered significant during the design life of the proposed structure. The most significant seismic event likely to affect the proposed project would be a moment magnitude 7.2 earthquake within the Rose Canyon fault zone located approximately 2.0 miles west of the project site.

The tunnel alternatives are proposed to be constructed predominantly within very dense formational materials of the Delmar Formation and the Torrey Sandstone. Due to the density of these materials, the potential for liquefaction and dynamic settlement to affect these areas of tunnels is considered low. Based on the relatively loose nature of the granular alluvial materials underlying the alignments where they cross the alluvial areas of the San Dieguito and Los Peñasquitos Lagoons, these portions of the alignment will be subject to liquefaction and dynamic settlement.

Two small landslides have been mapped on the northern portion of the site adjacent to Racetrack View Drive. These landslides are apparently large blocks of formational materials that have moved north along relatively low-angle failure surfaces. The mapped landslides overlie a portion of the I-5 Alignment options.

Tunnel excavation anticipated for the Crest Canyon and I-5 Alignment options should be technically feasible using shielded open face digger machines with breasting capabilities, or possibly a shielded full-face tunnel boring machine (TBM). In general, sequential excavation and support methods, e.g., New Austrian Tunneling Method (NATM) could be used. Various excavation and support types could be used, depending on the prevailing ground conditions. NATM relies primarily on the inherent strength of the ground mass to provide the primary tunnel support. A thin layer of shotcrete along with a combination of rock bolts, wire mesh and steel ribs would typically be used as the primary lining. Drill-and-blast methods would probably not be required. Construction of the Camino Del Mar tunnel segment using cut and cover methods with depths up to 70 feet should be feasible. Concerns along the cut and cover segment and for portal excavation would include stability of excavation side walls, groundwater seepage and expansive claystones.

9. PROJECT COST ESTIMATES

High level construction cost estimates have been completed for each of the alternatives based on FTA construction data base costs and recent construction experience. Construction cost estimate details are presented in Appendix VI. Preliminary right of way requirements have been estimated for each of the alternatives based on general area requirements for underground and above ground facilities. The location of parcels to be acquired has not been identified at this time. The value of right of way to be acquired has been estimated based on property values identified using local real estate data bases including Zillo https://www.zillow.com/ and Redfin https://www.redfin.com/. Additional detail supporting right of way costs is presented in Appendix VII. Additional costs including design costs and ancillary construction costs have been estimated at 31% and 27% of construction cost consistent respectively. A summary of the estimated construction and right of way costs is presented in Table 7.

Table 7:Preliminary Alignment Alternative Costs (2017 $ millions)					
	Alignment Alternative				
	Camino Del Mar	Crest Canyon Higher Speed	Crest Canyon	Interstate 5	Interstate 5 East
Construction Cost	$1,040	$1,335	$1,380	$1,450	$1,455
Right of Way Cost	$ 250	$ 210	$ 170	$ 380	$ 240
Design Cost (31%)	$ 322	$ 414	$ 428	$ 450	$ 451
Ancillary Construction Cost (27%)	$ 281	$ 360	$ 373	$ 392	$ 393
Contingency (30%)	$ 568	$ 696	$ 705	$ 801	$ 762
Total	$2,461	$3,015	$3,056	$3,472	$3,301

10. COMPARISON OF ALTERNATIVES

The Camino Del Mar Alignment provides the shortest tunnel segment, but also results in the lowest train speeds. The Crest Canyon Higher Speed Alignment provides the highest speeds and shortest travel times with one of the longest tunnel segments. This alignment provides the shortest travel distance compared to the other alternatives with a reduction of 0.2 miles compared to the existing condition. The I-5 Alignment and I-5 East Alignment option provide the longest overall travel distances, with an increase of 0.3 miles and 0.2 miles respectively compared to the existing condition. While the total distance to travel is greatest, the increased speed would result in a shorter travel time compared to the existing condition or to the Camino Del Mar Alignment.

The Camino Del Mar tunnel segment would be considerably shallower, would be constructed using a modified cut and cover method and would be closer to the surface for access and vents. The corridor is fully developed with multifamily and commercial uses. The short-term impacts to land use, noise and vibration, businesses and traffic during construction would likely be the greatest. The Crest Canyon and I-5 tunnel segments would be constructed using a tunnel boring machine. The tunnels would reach depths in excess of 200 feet below grade making access to surface impossible and adding cost for the ventilation system. Impacts to land use would be concentrated at the north and south ends of the project. The Crest Canyon tunnel segment options would pass below more residential homes than the I-5 tunnel options. The Crest Canyon Alignment options and the I-5 Alignment options would have a greater permanent impact on land use than the Camino Del Mar Alignment.

All of the alternatives would allow for restoration of the Del Mar Bluffs. The Camino Del Mar Alignment would join the existing right-of-way at the north end of Los Peñasquitos Lagoon.

Additional bridge structure would be used in the lagoon to avoid increasing the foot print in the lagoon. The Crest Canyon and I-5 Alignment options would enter Los Peñasquitos Lagoon to the east. These segments would be on bridge structure with lesser permanent impacts to the lagoon. Table 8 provides a summary of project features for each of the alignments.

Table 8

SUMMARY COMPARISON OF ALIGNMENT ALTERNATIVES AND OPTIONS

Criteria	Alternative 1: Camino Del Mar	Alternative 2: Crest Canyon Higher Speed	Alternative 2: Crest Canyon	Alternative 3: I-5	Alternative 3: I-5 East
Total Project Costs	$2.5 B	$3.0 B	$3.1 B	$3.5 B	$3.3 B
Total Length (miles)	5.0	4.8	4.9	5.3	5.2
Tunnel Length (feet)	10,200	13,200	12,700	13,400	11,600
Bridge Length (feet)	7,700	6,300	8,200	7,700	12,100
Type	Cut/Cover	Twin bored	Twin bored	Twin bored	Twin bored
Depth (feet)	10-70	Up to 270	Up to 250	Up to 120	Up to 120
Speeds (MPH) (passenger/freight)	50/35	90/60	90/60*	Most 60/40	Most 60/40
Emergency Access	Stairs every 2,500 feet	3rd Tunnel	3rd Tunnel	3rd Tunnel	3rd Tunnel
Right-Of-Way Needed	Yes	Yes	Yes	Yes	Yes
Reconstruction of San Dieguito Railway Bridge	No	No	South 600 feet removed	No	South 650 feet removed
Impacts					
Residential	No	Yes	Yes	Yes	Yes

Table 8

SUMMARY COMPARISON OF ALIGNMENT ALTERNATIVES AND OPTIONS

Criteria	Alternative 1: Camino Del Mar	Alternative 2: Crest Canyon Higher Speed	Alternative 2: Crest Canyon	Alternative 3: I-5	Alternative 3: I-5 East
Local Roads	Yes	Yes	Yes	Yes	Yes
Construction	Yes	Yes	Yes	Yes	Yes
Utility	Yes	Yes	Yes	Yes	Yes
Visual	Yes	Yes	Yes	Yes	Yes
Los Peñasquitos Lagoon	Neutral	Positive	Positive	Positive	Positive
Jimmy Durante Blvd	Raise above rail	Raise above rail	Railway over	Raise above rail	Railway over
Geotechnical	Yes	Yes	Yes	Yes	Yes
Travel Time (Minutes)	6/8.6	3.2/4.8	3.7/5.4	5.4/8	5.3/7.8

with shallow cover for the underground segment. The Crest Canyon Alignment and Interstate 5 Alignment utilize bored tunnels for the underground segments with a third tunnel for emergency access and ventilation. A second option is provided for the Crest Canyon Alignment and the Interstate 5 Alignment to show potential improvements to the above ground segment of double track if a portion of the new San Dieguito River Bridge were to be removed and replaced. The tunnel alignments and the tunnel concepts are essentially the same basic alignments. Overall the tunnel alignment and type are feasible for this conceptual design level. Special design considerations will be needed to address varying geotechnical conditions through the corridor, protect existing structures within close proximity to the tunnel alignments, protect/relocate existing utilities and local roadways, limit right of way requisitions and minimize permanent and construction impacts to the environment.

The Camino Del Mar Alignment is the shortest alignment and reflects that lowest cost based on the preliminary design concept. This alignment is the most constrained by adjacent uses and has a high risk of unknown conditions. The cut and cover box type is generally feasible for shallow cover conditions, however further analysis of the geotechnical conditions and impacts to adjacent structure foundations, utilities, traffic and private property during construction is needed to confirm both cost and feasibility. Structure type and construction methods that limit impacts to traffic and private property should be considered such as, installing a second row of piles to facilitate deck beam construction and limit full lane closures. Methods for removing and transporting muck should be considered in more detail early in the design to confirm cost and feasibility.

The Crest Canyon and Interstate 5 tunnel configurations include a third smaller tunnel for emergency access and ventilation. While access to the surface is challenging due to depth for Crest Canyon and conflicts with the existing freeway of Interstate 5, use of a third tunnel is an unusual solution and adds significant cost for construction of the tunnel, wider portals and additional right of way. Further consideration should be given to using cross passages between the running tunnels and a walkway within the running tunnels for egress. This would allow evacuation into the non-event tunnel in case of an emergency and eliminate the need for the third tunnel.

Additional technical studies and analysis are needed to further assess feasibility of the double track and tunnel alternatives. In addition to the concerns identified above for each of the alternative tunnel types, the next phase of the feasibility analysis should include the following areas:

1. Geotechnical analysis with preliminary design of permanent and temporary structures to address loose foundation materials, potential landslides, high cut slopes at portals, expansive clays, localized faults.
2. Analysis of preferred boring technologies suitable to the geotechnical conditions. Consideration should be given to a NATM/SEM tunnel at the south end of Camino Del Mar where cover is deeper in order to reduce community and utility impacts.

3. Tunnel Ventilation concepts including alternative concepts using fan material types appropriate to the length and type, size and location of ventilation shafts and fan rooms.
4. Conceptual design elements to limit noise and vibration impacts for the permanent condition and during construction.
5. Construction access and staging areas including muck haul routes, laydown areas, settlement basins, etc.
6. Analysis of existing utilities in the cut-and-cover locations.
7. Review of existing adjacent structures within the zone of influence.

13. APPENDICES

I. Conceptual Double Track Alignment Alternatives between Del Mar Fairgrounds and Sorrento Valley
II. Environmental Constraints Report
III. Cultural Resources Report
IV. Geotechnical Evaluation
V. Conceptual Tunnel Ventilation Report
VI. Construction Cost Estimate
VII. Right of Way Cost Estimate
VIII. High Level Technical Review Memorandum