CHULA VISTA LIGHT RAIL CORRIDOR IMPROVEMENTS
FINAL SUPPLEMENTAL PROJECT STUDY REPORT

April 2017

Prepared for:

CITY OF
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Abbreviations

The following acronyms, initials, and short forms are used in this report:

ADA	Americans with Disabilities Act
BMP	Best Management Practices
BRT	Bus Rapid Transit
CDFG	California Department of Fish and Game
CIDH	Cast in Drilled Hole
Comm.	Community
CPUC	California Public Utilities Commission
CSP	Corrugated Steel Pipe
FEMA	Federal Emergency Management Agency
HOV	High Occupancy Vehicle
I-5	Interstate 5
kV	Kilovolt
LRT	Light Rail Trolley
MBTA	Migratory Bird Treaty Act
mph	Miles Per Hour
MOU	Memorandum of Understanding
MSE	Mechanically Stabilized Embankment
NPDES	National Pollution Discharge Elimination System
NRCS	National Resources Conservation Service
PA/ED	Project Approval/Environmental Document
Ped.	Pedestrian
PS&E	Plans, Specifications, and Estimate
RCP	Reinforced Concrete Pipe
RTP	Regional Transportation Plan
SANDAG	San Diego Association of Governments
SDG&E	San Diego Gas & Electric
SUSMP	Standard Urban Storm Mitigation Plan
SWPPP	Storm Water Pollution Prevention Plan
TCIF	Trade Corridors Improvement Fund
USACE	U.S. Army Corps of Engineers
VCP	Vitrified Clay Pipe

Figure 1: Vicinity Map

1. INTRODUCTION

In 2012, the City of Chula Vista (City) and San Diego Association of Governments (SANDAG) initiated a Project Study Report (PSR) to analyze alternatives for grade separating the LRT tracks from the roadway crossings at E Street, H Street, and Palomar Streets. Since that time, the City decided the E Street and H Street grade separations be studied as a combined project, hence the development of this report. This report functions as a supplemental report to the 2012 Project Study Report, and whose purpose is to document the analysis of one additional alternative for grade-separating the MTS (Metro Transit System) light rail train (LRT) tracks from the roadway crossings at E and H Streets by combining the two grade separations into one project. Since F Street is between E and H Streets, this combined project would also grade-separate the F Street crossing. The project study location is shown in Figure 1. The grade separated tracks would also be used by the freight trains that travel through this corridor.

2. BACKGROUND

As mentioned, a PSR analyzing alternatives for grade separating the LRT tracks from the roadway crossings at E Street, H Street, and Palomar Street was completed by T.Y. Lin International (TYLI) in August 2012. This Supplemental PSR proposes an additional alternative for grade separating E Street and H Street, and combining these grade separations into one project.

Following the completion of the original PSR in 2012, the City Council has expressed interest in analyzing an alternative not covered and accommodating the following criteria:

- Combines the grade separations at E Street and H Street into one project.
- Places the LRT tracks in a trench extending from a point north of E Street to a point south of H Street.
- Allows freight trains to utilize the LRT tracks, eliminating the need for an at-grade freight bypass track at each of the crossings.

A railroad trench would also provide for a “Quiet Zone” for the E Street, F Street, and H Street locations, which are generally surrounded by residential zoning. The usage of the freight rail horn during the 2:00 to 5:00 a.m. freight service work window causes noise impacts for much of western Chula Vista, beyond the properties adjacent to the rail corridor. Therefore, residents have requested the creation of a "Quiet Zone" along this portion of the corridor.

Also following the 2012 PSR, MTS completed freight improvements between the international border and the E Street station in order to increase the capacity for freight trains per night from two (2) to four (4).

Existing Facilities

2.1.1. E Street and H Street

Descriptions of existing E and H Streets are provided in the original PSR.

2.1.2. F Street

F Street is approximately 0.25 miles south of E Street. It runs east to west in the City and is classified as a four-lane Downtown Promenade in the City's General Plan. This is a special type of urban street similar to a four-lane collector, but with "multi-modal features and amenities that accommodate the surrounding urban context." There is no access to I-5 from F Street. The right-of-way width is 84 feet and the design speed is 35 mph. Properties within the vicinity of the study area include the I-5 corridor to the west, the 5.98-acre vacant City of Chula Vista Corporation Yard at 707 F Street to the northeast and commercial properties to the southeast.

The rail facilities in this location consist of a northbound track and southbound track, or railroad west and railroad east, that are utilized both by LRT and freight operators. Both tracks are electrified with overhead catenary. There is an abandoned freight spur track to the east of the F Street at-grade crossing. Across I-5 and parallel to F Street, there is also an abandoned freight spur and bridge to the west of the F Street at-grade crossing, which the F Street Promenade Study is considering for a multi-purpose pathway. The tracks are at a higher elevation than I-5 in this location, and there is a vegetated slope separating the freeway from the tracks.

3. PURPOSE AND NEED

3.1. Project Need

The need for grade separating the LRT tracks at E and H Streets remains the same as that expressed in the original PSR.

3.2. Project Purpose

The purpose for grade separating the LRT tracks at E and H Streets remains the same as that expressed in the original PSR.

The purpose of this additional alternative is to:

- Address the City Council's desire to grade separate the second and third highest priority crossings, after the Palomar Street crossing, along the Blue Line corridor.
- Place the LRT tracks in a trench in order to preserve the view corridor to the San Diego Bay along E Street and reduce the noise impact produced by overhead tracks.
- Eliminate the need for an at-grade freight bypass track that would degrade the efficiency of freight operations and necessitate keeping a portion of the crossing at-grade, and not separated, reducing the overall improvement to safety at the crossing.
- Reduce ambient noise associated with train horns and railroad warning devices.

4. DEFICIENCIES

The deficiencies at the E Street and H Street crossings are described in the original PSR and remain the same for purposes of analyzing this additional alternative.

5. CORRIDOR AND SYSTEM COORDINATION

Since the original PSR in 2012, SANDAG has completed both LRT and freight improvements along the Blue Line corridor. The LRT improvements extend from the Barrio Logan Station to the San Ysidro Station (including Bayfront/E Street Station and H Street Station), and include either lowering the tracks through the station or raising the station platforms to allow for level boarding of the new, low floor trolleys. Additional improvements to the Blue Line included storm drain upgrades, Americans with Disabilities Act (ADA) accessibility upgrades, replacement of grade crossings, and parking lot improvements.

6. ALTERNATIVES

The scope of this study is to evaluate the feasibility of grade separating both the E and H Street crossings within one project by placing the LRT tracks in a trench.

6.1. Alternative Development

In the 2012 study done by TYLI, several alternatives were analyzed based on the criteria at the time. The track above-grade alternatives have been removed from consideration because the structures would be a visual barrier to the Bayfront view corridor along E Street. The below-grade alternatives that included an at-grade freight bypass track have also been removed from consideration because they included preserving at-grade crossings at each street.

6.1.1. No-Build Alternative

This alternative is discussed in the original PSR.

6.1.2. LRT Tracks Under Both E Street and H Street

A variation of this alternative was proposed, but removed from consideration prior to analysis in the 2012 study because the requirement to construct a second bypass track would likely require the acquisition of a large amount of additional right-of-way. However, given the current constraints and desires of the City, it is now seen as a viable alternative. This would result in the tracks below the existing grade from E Street to H Street in a trench with retaining walls on either side. The overall length of the trench would be approximately 9,410 feet (1.78 miles) with a maximum depth of about 42.5 feet. The alternative proposed in the 2012 PSR assumed freight could remain at-grade rather than grade separated with the LRT, which would have allowed for a shorter trench section and a shallower maximum depth due to the profile grade requirements of the freight railroads.

6.2. Design Standards and Assumptions

The preliminary designs for each alternative were developed using the SANDAG Draft Design Standards and the applicable General Orders of the CPUC. The design standards used are summarized in Table 6.1.

Table 6.1: Summary of Geometric Design Standards

Caltrans Highway Design Manual, 2014	
Chapter 200 Section 204.8 Grade Line of Structures	The minimum vertical falsework clearance over freeways and non-freeways shall be 15 feet.

SANDAG Draft Design Standards, 2014	
Section 2.3.1. Platform Length	Platforms shall be 360 feet in length to accommodate a four-car train.
Section 2.3.3. Platform Width	The minimum standard platform width shall be 15 feet.
Section 3.1.2.2. Minimum Clearances	Where freight trains operate, the distance shall be in accordance with the requirements of CPUC General Order No. 26-D.
Section 31.6.3. Stations	A grade of 0.5 percent is the desired grade in all station areas, if drainage can be accommodated.
Section 3.1.6.3. Stations	Constant grade tangents shall extend 75 ft. beyond the limits of station platforms.
Section 3.1.7.1. Mainline	The desired length of mainline vertical curves above the minimum is determined by the following formulas: Crest $L = \frac{V^2(G_1 - G_2)}{30}$ (English) Sag $L = \frac{V^2(G_1 - G_2)}{60}$ (English) The lengths of vertical curve are generally rounded up to the nearest 50 feet length.
CPUC General Order 26-D	
Section 2.1-Overhead Clearances	The minimum overhead clearance above railroad and street railroad tracks, which are used or proposed to be used for transporting freight cars, shall be 22’-6”.
Section 3.2-General Side Clearances	The minimum side clearance to all structures and obstructions above the top of the rail except those hereinafter specifically mentioned shall be 8'-6".
Section 3.7-Catenary Side Clearances	The minimum side clearance to poles supporting trolley contact conductors supplying motive power to track affected, if of bracket construction, on either single or double main track shall be 8’-3”.
Section 3.16-Side Clearances	All minimum side clearances described above are for tangent track. In general, all structures adjacent to curved track, shall have a minimum side clearance one (1) foot greater than the minimum side clearance otherwise required for tangent track.
Genesee and Wyoming Industrial Track Construction Specifications	
Section 4. Track Design, 4.1 Alignment, 4.1.4	Grade shall not exceed 2%.
Section 5 Clearance Requirements (USA), 5.2 Vertical	27’ from top of rail to overhead wires.

6.3. Trench Cross Section and Clearance Requirements

The proposed railroad trench would consist of two railroad tracks with 18 feet track center spacing, a 13 feet wide access road, and drainage ditches on each side (refer to the E Street and H Street Grade Separations Exhibit for a typical section of the trench). The drainage ditches are shown as grated to allow them to be incorporated into the access road width, thereby reducing the overall trench width. According to CPUC requirements, the minimum horizontal clearance to catenary poles is 8'-3", so to accommodate the center catenaries, the tracks are spaced at 18 feet. The edge of the access road must be located a minimum of 10 feet clear from the nearest track centerline.

Within the station area, the track spacing would remain 18 feet on-center. Platform edges are set at 4'-10" from track centerlines, and the width required by MTS for station platforms is 15 feet (refer to Section B-B from the E Street and H Street Grade Separations Exhibit). Additional width would be added to the trench at specific locations for stairs, ramps, and other improvements.

The minimum vertical clearance required at all overpasses and from permanent overhead struts would be 27 feet from top of rail.

Access into the trench would be provided at either end via an access road along the west side of the tracks, and this access road would be continuous through the station, and behind the platform, to allow maintenance vehicles to exit.

6.4. Track Geometry

The design speed used for both permanent and shoofly track designs are 55 mph for passenger and 40 mph for freight. The track geometry was designed per the latest revision of the MTS LRT Design Criteria.

6.4.1. Vertical Profile

The track profile shown in the E Street and H Street Grade Separations Exhibit represents the top of rail elevation. The trench floor slab would be constructed approximately two feet below top of rail to allow for ties and ballast. Beginning at the railroad west end of the project, the existing double tracks cross Paradise Creek, utilizing a two-track bridge, and this bridge is deemed to be an constraint due to potential environmental impacts associated with any modifications. Avoidance of this constraint then sets this bridge as the western end of the project. A 1.00% slope was used as the maximum grade in order to accommodate the freight operations in the trench and this was used in the development of the profile, with the exception of 1.49% grade necessary to tie into the Paradise Creek Bridge and 1.11% passing under E Street, however these grades meet the minimum requirements of Genesee-Wyoming Railroad.

The proposed track profile was also developed utilizing the required vertical clearance of 27 feet between the top of rail and the soffit of the overpass structures, a structure depth of 2.25 feet, and the assumption the roadway profiles for each E Street, F Street, and H Street could not be modified due to proximity of the I-5 northbound on- and off-ramps.

In order to meet the maximum allowable freight rail grade of 1% on the east end of the project, the track profile results in the track grade being approximately three (3) feet lower than the existing profile at J Street, which would require lowering this at-grade crossing. This will require work within the local street / I-5 northbound ramp intersection and approaches to provide a smooth transition to the ultimate grade crossing. Coordination and approvals with Caltrans are also required since this work area is within the state R/W.

6.4.2. Horizontal Alignment

The horizontal alignment of the tracks is constrained by the narrow right-of-way. Throughout the length of the trench, the tracks and trench structure will be constructed as far east as possible to minimize the footprint of the shoofly track needed on the west side of the existing tracks and to maximize the area needed for construction of the trench.

6.5. Station Design

The proposed grade separation would require two new below-grade stations, one at the Bayfront/E Street Station, and one at the H Street Station. The current MTS standard is to provide a 360 foot long platform on each side. Access across the trench would be available on the E and H Street overpasses, and also via pedestrian overpasses at each station, opposite the roadway overpass. Elevators and stairs would be included on each platform at the access points, four (4) per station. A portion of the existing parking lot would be temporarily removed during construction; however the final design would include a new parking configuration that better utilizes the property.

The vacant Chula Vista Public Works Yard located at 707 F Street could be considered for a new Blue Line station at F Street and thus allow the E Street site to be redeveloped as a gateway entrance to the city. Currently, F Street is being studied for conversion to a promenade from the San Diego Bay area to Third Avenue downtown, likely creating a more pedestrian and bicycle friendly corridor, which could easily be linked with the F Street site. Per the Chula Vista General Plan, the vacant site and adjacent parcels are zoned Mixed Use Transit Focus Area (TFA).This TFA designation is to encompass the area within approximately ¼ mile of existing and planned transit stations, and is intended for the highest intensity mixed use residential environment, allowing for a mix of residential, office, and retail uses in an area that is pedestrian-friendly and has a strong linkage to transit.

6.6. Drainage

Several options for providing drainage of storm water from the trench were discussed during the preparation of this report.

However, we recommend an approach that has been used on other railroad trench projects, to provide storm drain pump stations at low points. Since each end of the trench is at a higher elevation than the middle of the trench, water would be collected at low points into underground sumps, and then pumped out to existing storm drains. The design of the pump systems would maintain the 100-year headwater depths below the railroad ballast. The proposed alternative would require two pump stations. Sub-drains consisting of pervious pipes would be constructed within the track bed allowing for drainage of the sub-grade.

Regarding the current drainage of the project site and how this can be reconfigured to the meet the needs of the project, a concrete drainage channel runs along the east side of the existing tracks. This channel runs almost the full length of the project and seems to function to drain the railroad right of way (and potentially some of the adjacent properties easterly of the railroad right of way). Just south of F Street, this facility begins as an earthen ditch easterly of the railroad. It continues in this same manner until approximately 700 feet south of G Street, where it transitions into a trapezoidal, concrete channel. It continues as a concrete channel until approximately 400 feet northerly of H Street, where it transitions into a reinforced concrete box (RCB) to pass drainage under the H Street Station, remaining in the RCB until just southerly of H Street, where it transitions into a “U” shaped channel. This “U” shaped channel continues southerly for approximately 700 feet, where it transitions into another trapezoidal concrete channel. It continues in this same configuration for approximately another 700 feet, where it then turns westerly at I Street to transition into two (2) reinforced concrete pipes (RCP), approximately 48-60 inches in diameter, to pass under the I-5 freeway. Once on the westerly side of the freeway, it transitions back to a trapezoidal concrete channel and runs southerly until south of J Street where it turns westerly and leads to the bay (this last reach, from the west side of the freeway to J Street and beyond is outside our project limits).

Our project has a direct impact on this facility from I Street southerly to south of J Street to the end of new, depressed profile of the railroad, as the RCP’s crossing under the freeway at I Street and the trapezoidal channel west of the freeway will be severed by the trench. Therefore, the RCP’s under the freeway will need to be abandoned, and the channel west of the freeway replaced with a new facility to convey the drainage from the existing channel east of the railroad southerly to a location where it can drain under the railroad, the freeway, and connect to the channel reach headed to the bay. We speculate a new couplet of 60” RCP’s can be constructed for approximately 2400 feet (*the sizing and the need for these pipes will depend upon a hydrology study within the next phase as the drainage from the railroad right of way will no longer be needed to be conveyed using this system, but rather through a pump system*; however for the purposes of this Supplemental PSR we have assumed the need for these pipes and for the 60” sizing) within I Street by connecting to the channel and turning the path easterly (similar to the existing configuration but the opposite direction) and then turn southerly to be within the Colorado Avenue right of way, where it would remain in the RCP’s until southerly of the J Street, where these pipes would turn westerly, pass under the railroad, the freeway, and connect to a new trapezoidal channel for approximately 200 feet, and terminate with a connection to the existing trapezoidal channel south of J Street heading westerly to the bay.

The reaches northerly of I Street and up to F Street (as well as the entire reach of this channel effected by the project) will need to be examined within a hydrology study during the next phase of the project to determine the required remaining capacity of the channel, in each of its current configurations, and also to recommend how this channel is to be reconfigured for the project requirements.

Due to the expected groundwater level being higher than the trench floor, the use of infiltration BMPs would not be feasible. Water quality within the trench could be maintained through the use of media filters prior to pumping the storm water. Additionally, runoff from low flow storms could be stored then released via a low flow pump at a specified flow rate to minimize increases in runoff. An additional option for enhanced water quality is to pump low flows into the City sewer system, to then be treated. This would require concurrence from the City, and verification that the treatment facility and sewer system have sufficient capacity for added flows. The next phase of the project should explore this further in a Water Quality Technical Report and Preliminary Drainage/Hydrology & Hydraulics Report.

6.7. Utilities

Existing utilities in the project area were mapped based on the provided as-built drawings, aerial topography, aerial photos, site visits, and survey data. The existing utilities were mapped onto the proposed design and all impacts were noted. The corridor for the trench and the new track alignments seems to be relatively free from utilities, with the exception of those within E Street, F Street, H Street, and J Street. It is anticipated all water lines, gas lines, underground electrical, and communication lines crossing the trench can be relocated, either being attached to the proposed overpass bridges, or placed on separate utility structures. Where storm drains cross the trench, the system would be modified to flow parallel the trench to a point where the track profile is high enough for the storm drains to pass under while maintaining the proper slope and clearances. See Appendix A for existing utility locations.

It should be noted that a more detailed analysis would be needed during preliminary design to specifically identify the extent of the utility work (dry and wet) needed to accommodate the railroad trench. The ultimate design will require drainage systems to be relocated and may also require pump stations. Similarly, for the wastewater systems, relocation is required and further analysis is needed to determine the need for pump stations.

6.8. Right-of-Way

SD&AE owns the right-of-way within the majority of the project footprint. The exception is one parcel from D Street to the north, which is owned by MTS. On the north end of the project at Paradise Creek, the right-of-way width is 100 feet. Beginning at D Street and continuing over the course of 250 feet, the right-of-way gradually widens to 137 feet. At Flower Street, the right-of-way immediately narrows to 85 feet. At G Street, the right-of-way immediately widens to 100 feet. At H Street, the right-of-way immediately narrows to 65 feet. On the south end of the project south of J Street, the right-of-way width is 65 feet.

To accommodate the shoofly track, an encroachment permit may be needed from Caltrans for a small portion of land, of approximately 1.15 acres, between D and G Streets.

6.9. Railroad Signaling

Signal improvements would include wayside signals within the trench and associated signal houses located outside the trench, temporary grade crossing warning devices and instrument houses, and temporary control points at each end of the trench. The temporary shoofly track would cross E, F, H, and J Streets at grade, requiring modifications to the existing grade crossing warning devices. This could include relocation of crossing arms and flashing light assemblies, as well as relocation of associated signal houses if they are in conflict with the work area or the shoofly track.

6.10. Geotechnical

A preliminary geotechnical investigation was prepared by Ninyo & Moore in 2010 for the I-5 South Multimodal Corridor Study. Geologic reconnaissance, review of published geologic maps and data reports, aerial photographs, in-house data, and the assessment of the potential geologic hazards in the project area were utilized as sources of information for the geotechnical investigation.

Site soils are not expected to present a rippability issue and can be excavated using conventional earthmoving equipment.

Data from California State Water Resources Board GeoTracker website shows groundwater of depths between 10 and 30 feet below ground surface. The natural grade does not vary significantly with the project limits, and it is anticipated that groundwater will generally be between 10 and 30 feet below natural grade. The final top of rail elevation within the trench will be below the water table. The trench walls and trench slab will need to be designed to seal the trench from groundwater seepage and resist hydrostatic earth pressures.

Groundwater is likely to be encountered during excavation for the trench as well as overpass foundations. Groundwater will need to be controlled during construction of retaining walls, retaining wall footings, overpass foundations, and the trench base slab. Any seepage or groundwater removed from an excavation would need to be tested and disposed of in compliance with all applicable local, state, and federal laws. A comprehensive groundwater monitoring program should be conducted as part of the design of a trench alternative. For sidewall support of the trench and at the bridge abutments, both bottom-up and top-down construction methodologies are geotechnically feasible. The most challenging geotechnical issue will be constructing deep cut retaining walls in the presence of shallow groundwater.

For a conventional bottom-up construction method, it is anticipated that there is insufficient right-of-way to lay back the excavations, so some form of shoring will be required. Soil nail walls are not suited for construction below the groundwater table, but drilled soldier pile walls with lagging are feasible; however, lagging installation below the groundwater will not be water-tight, so the excavation will need to be continually pumped. Additionally, the cut heights are expected to exceed the practical limits for cantilever soldier piles, so either ground anchors (tie-backs), internal struts, or bracing will be required to resist lateral earth loading.

For top-down construction, site soils are expected to be conducive to both secant pile wall and slurry wall construction. Both secant pile wall and slurry walls are effective methods to seal off water, which would eliminate or reduce the expense of pumping and disposal of groundwater from the excavation during construction. Due to the anticipated excavation heights, internal bracing or ground anchors will likely be required. At the bridge overpasses, the abutments would be supported on Cast-in-Drilled Hole (CIDH) piles that would provide lateral support for the trench and also carry the axial superstructure loads. The CIDH piles at these locations would need to extend below the trench slab to develop the necessary axial capacity to support the structural loads.

6.11. Trench Structure

The trench structure will consist of a wall and invert slab system, which will be required to support approximately 42.5 feet maximum of trench cut at the grade separations, two temporary tracks running along the west edge of the trench, and abutment loads for the overpass structures. The system must also withstand high ground water conditions both for temporary construction and for permanent configuration. Some of the challenges and constraints affecting the trench construction include:

- Proximity of existing utilities.
- High groundwater table.
- Requirement for two tracks to remain operational during construction.
- Vertical clearance under the overpass structures.
- Vertical abutment loading of the overpass structures.
- Narrow right-of-way.

6.11.1. Wall Systems

Due to close proximity of right-of-way limits and the need to maintain a dry excavation to avoid dewatering, a top down construction is proposed for the wall. A schematic of a typical top down construction wall system is shown in Figure 6.1.

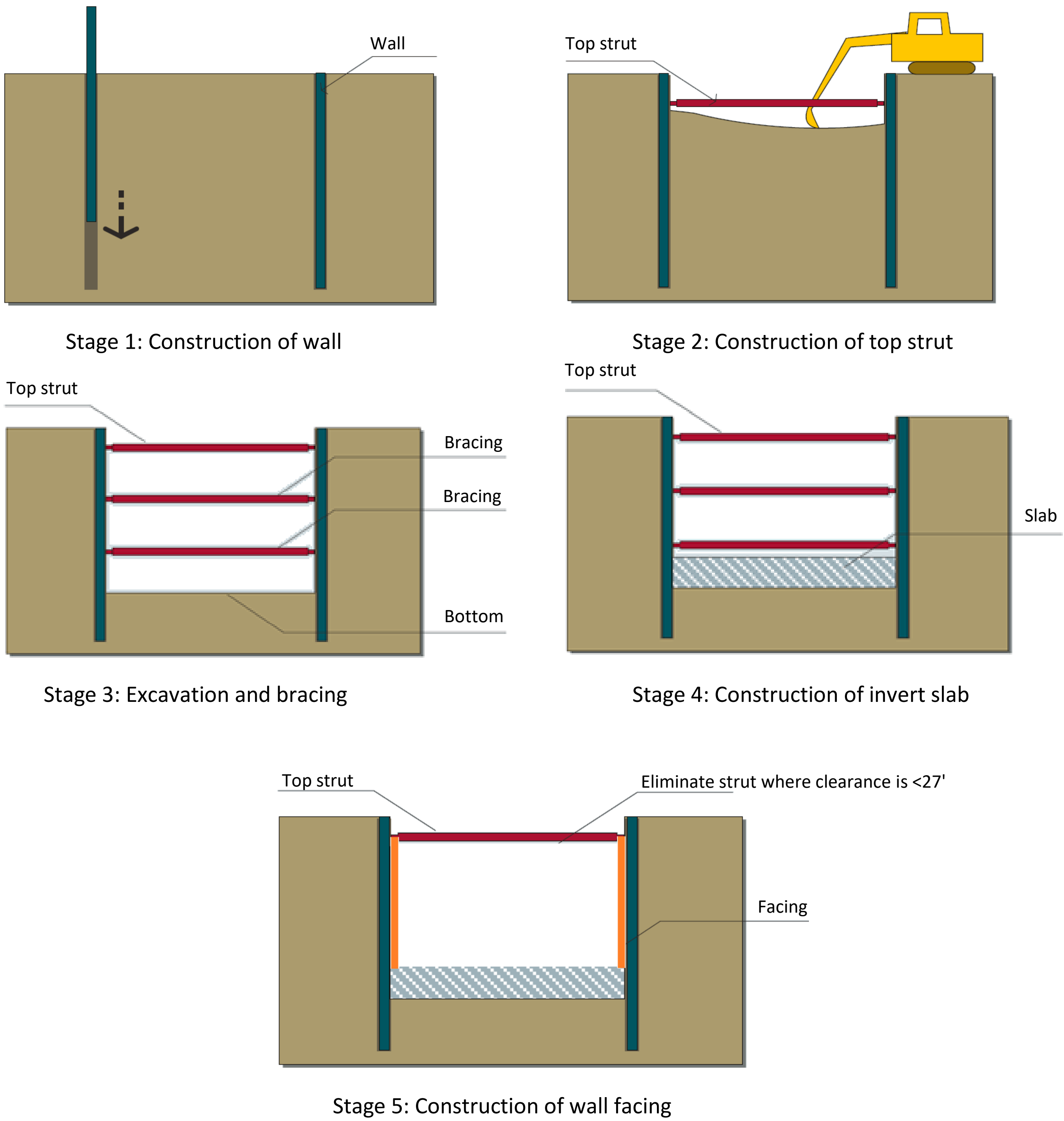


Figure 6.1 Schematic of Construction Staging for Top-down Wall Systems ("Construction of Secant Pile Wall", Land Transport Authority, Singapore, October 2004)

The wall system considered for this feasibility analysis is *Cement Deep Soil Mixing (CDSM) Walls.* CDSM walls are built using top down construction by drilling columns within the ground and mechanically mixing the soil removed by the drilling operation with cementitious binder slurry. The process constructs rows of overlapping columns. H-piles are then inserted for lateral capacity while the column mixture is still workable. A bracing system consisting of lateral struts is to be used for supporting the wall both in the temporary and permanent conditions.

6.11.2. Invert Slab and Seal Course Systems

Due to the trench depth below the groundwater level, a method of keeping the railroad trench dry must be included in the design. There are two ways to dry the trench. One is to provide a drainage system that drains the groundwater into a basin within the trench where it would be pumped out to a storm drain system. The other option is to seal off the trench from the water, similar to what has been done in the Alameda Corridor and Reno Transportation Rail Access Corridor railroad trench projects. Although the pumping option may have cost savings, it is not proposed in this report for the following reasons:

- The groundwater would require testing and treatment prior to discharging to the storm drain.
- The impacts of permanently lowering the groundwater in the area would need evaluation of the environmental effects as well as impacts to any current uses of the groundwater.
- There would be a risk of flooding the railroad tracks in the case that the pump systems failed, resulting in impacts to commuters, freight movement, and possible damage to the track bed. Pump systems could fail due to mechanical failure or clogging of a drain line.

For application on this project, a structural concrete invert slab is proposed between the walls to seal off the base of the trench from groundwater. Of course, removal of existing groundwater present within the trench section after the walls have been constructed will still be needed. Sealing of the trench would create a buoyant force that would act to lift the trench section. The invert slab would therefore be designed as a strut system at the bottom of the wall, which would reduce the embedment length of the piles. Along the majority of the trench, the slurry wall will only need to extend far enough below the trench slab to resist the temporary lateral earth loads until the bottom slab is poured. These temporary lateral loads can be reduced by adding temporary bracing systems over the height of the wall.

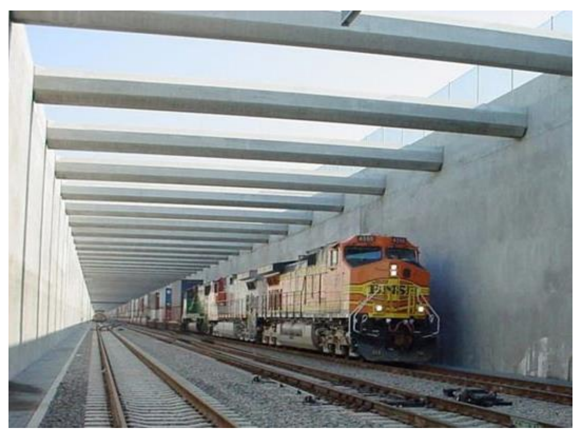
6.11.3. Struts

Since the trench will have two opposing walls, a strut brace can be used between the walls, where available vertical clearance is over 27 feet, to resist the lateral soil pressures. Since wall tiebacks cannot be used due to close proximity of the right-of-way, the wall design can be optimized by designing the strut as a beam-column between the two walls of the trench, with compression loads produced by the lateral soil pressures and moments produced by the strut self-weight. To speed construction, the struts can be precast and connected to the wall over waler beams. The construction staging for the Alameda Corridor, located in Los Angeles, California, which has similar proportions to the proposed trench, is shown in Figure 6.2.

Stage 1: Excavation of the trench after installation of piles and top struts

Stage 2: Construction of invert slab and wall facing

Stage 3: Ballast placement



Stage 4: Completed trench

Figure 6.2: Expected Construction Staging

(Photo courtesy: Eric Brown, Earth Mechanics)

6.12. Bridge Structures

A total of five overpass structures (two pedestrian and three roadway) would be needed for the grade separated trench. The overpass structures to be constructed directly over the trench are proposed to be single span precast/prestressed girder structures supported on abutments, which will be integral with the trench walls.

6.12.1. E Street, F Street, and H Street Overpasses

The Project would construct vehicular bridges on E Street, F Street, and H Street over the proposed trench. These proposed bridges will match the existing configuration of the approach roadways easterly of the proposed trench.

6.12.2. Bayfront/E Street Station and H Street Station Pedestrian Overpasses

Pedestrian overpasses would be constructed at both the Bayfront/E Street Station and the H Street Station to connect the station platforms on either side of the tracks. The overpass structures would be a 10 feet wide by 70 feet long, single span structure. Depending on the timing of the Bayfront Master Plan project with respect to this project, additional pedestrian bridges may be considered at D Street, G Street, and/or I Street, most likely constructed by others.

6.13. Constructability

Due to the high transit passenger volume each of the stations experiences, MTS prefers at least one station remain operational at all times during construction. To accommodate this need, temporary platforms would be required for both stations on the east and west sides of the tracks. Additional temporary pedestrian improvements may be required. J Street would require a full closure and this closure would last from the beginning of the project until the new LRT tracks have been constructed, put into service, and the J Street vertical grade modified to its new, depressed profile. During construction of the grade separations, LRT and freight trains must have two tracks operational, requiring a shoofly track to be built on the west side of the existing tracks throughout the entirety of the construction zone. The length of the shoofly track would be approximately 11,000 feet. LRT and freight trains would use temporary crossovers on either end of the construction zone to access the shoofly track to maintain their existing operations. The visitor center located in the parking lot of the E Street Station may need to be relocated, at least temporarily. Bus routes at H Street will likely remain unaffected, since the bus loading area is along H Street rather than adjacent to the LRT platforms.

In the first stage of construction, the existing easterly track would be removed, while the westerly track would remain in place. A shoofly track would be constructed on the west side of the existing westerly track and the two tracks would function as mainlines for both LRT and freight. Once the rail service has been reestablished on the new shoofly track and the existing track, construction can begin on the trench section. Shoring will be constructed easterly of the two tracks in service and then the eastern half of the trench, including the CDSM walls along the east side of the trench and the easterly abutments of each of the overpass structures, and one trench mainline would be constructed. In addition, the westerly abutments can be constructed while the westerly half of the future trench remains in its existing, at-grade configuration, as this construction can take advantage of local, partial street closures of E, F, and H Street. Close coordination with the City will be required for the development of the staging at each of these locations, regarding which streets can closed and whether streets (half width or full) can be closed in tandem or individually. For this report it is assumed the bridges would be constructed in two stages, half bridge width per stage. In the second stage of construction, the existing westerly track (initially the eastbound track) would be removed, and the new mainline track in the trench would function as the westbound mainline track for both LRT and freight. The shoofly track would continue to function as the eastbound track mainline. Shoring will be constructed easterly of the shoofly track and then the western half of the trench, including the CDSM walls along the west side of the trench, would be constructed.

The construction of temporary at-grade crossings along the shoofly track would require California Public Utilities Commission (CPUC) General Order (GO) 88-B authorization to modify an existing public crossing. A GO 88-B application would be required for the crossings at E, F, H, and J Streets.

The excavation of the trench would require removal of about 576,000 cubic yards of earth. It is anticipated that the removal would be trucked offsite to an approved disposal location by the contractor. The most direct path for trucks removing materials would be along the trench to E or H Streets, then to I-5. The export of materials would take roughly eight to twelve months to complete. Additional truck traffic is expected due to the delivery of materials and equipment. However, the volume would be small compared to during the export of the soil. Depending upon the timing of this project versus that of the Chula Vista Bayfront Master Plan Site, the exported soil could be made available for that project, which will require a large import in order to build the site up to the required elevations to accommodate sea level rise. This would provide an efficient local source of material, reducing haul lengths and keeping this phase of work to a reduced time line.

6.14. Operation and Maintenance

One benefit of the grade separations is that the operations and maintenance costs for the at-grade crossing warning devices and gate arms would be eliminated. The proposed alternative would require maintenance of the retaining walls, overpass structures, elevators at the station, and storm drain pump stations. Estimated annual operation and maintenance costs will be determined during the next phase of the project.

7. COMMUNITY INVOLVEMENT

At this stage of the project development process, there have not been any public hearings or scoping meetings. The purpose of this study is to review the feasibility of a below grade crossing alternative combining E Street and H Street, determine if there are any "deal breaker" issues, and estimate the cost of this combined project. Public hearings will be held during the environmental clearance and design phases of the project.

8. ENVIRONMENTAL COMPLIANCE

The general environmental compliance issues associated with the E Street and H Street crossings are described in the original PSR and remain the same for purposes of analyzing this additional alternative. The only changed condition between the original PSR and this supplement is related to traffic.

8.1. Traffic

The original PSR assumed that an at-grade bypass track would remain at both the E Street and H Street crossings, while the LRT tracks would be grade separated. This means there would still be a potential for collisions between roadway users and trains during the freight operating hours of 1:31 a.m. to 4:04 a.m. in the post-project condition. The alternative proposed in this supplement would eliminate that potential, since freight would also be grade separated. The potential for a collision would also be eliminated at F Street, which is also being grade separated. Therefore, the impact to vehicular traffic at all three crossings would be an overall improvement.

The temporary adverse impacts to traffic circulation within the project vicinity during construction, and particularly at E and H Streets, were discussed in the original PSR. Additionally, there will be adverse traffic impacts at F and J Streets during construction. The impacts at F Street will be similar to E and H Streets, although less significant since this roadway experiences lighter traffic volumes and is not connected to the I-5. Because J Street will be completely closed during the construction of the tracks and lowering of the roadway, traffic impacts will be more significant and will include detours and possible freeway ramp closures. Traffic would be diverted from this major arterial to other local streets.

9. FUNDING, PROGRAMMING, AND ESTIMATE

San Diego Forward: The Regional Plan (2015) allocates $431 million (2014 costs) to Blue Line LRT grade-separation projects in the Constrained Network, see Table 9.1. This includes 28th Street, 32nd Street, E Street, H Street, Palomar Street, Taylor Street, and Ash Street. Further, San Diego Forward ranks the potential grade separation projects throughout the region (See Rail Grade Separation Project Rankings in Attachment B). Three of the top six potential grade separations are within the City. As the top priority project in the plan, the Palomar Street grade separation was identified to go forward initially and is currently in the environmental document stage. H Street and E Street rank fourth and sixth, respectively. As these projects progress to future development phases, specific funding sources will be identified.

The Project Cost Estimate is included as Appendix C. This estimate was developed based on order of magnitude costs and is to be used for long range planning purposes only. Therefore a 35% contingency is included.

Table 9.1

Revenue Constrained Projects

Transit Facilities

TransNet	Service	Route	Description	Capital Cost ($2014); millions	Capital Cost ($YOE); millions
TransNet	COASTER	398	Double tracking (includes grade separations at Leucadia Blvd and two other locations, stations/ platforms at Convention Center/Gaslamp Quarter and Del Mar Fairgrounds, Del Mar Tunnel, and extensions to the Convention Center/Gaslamp Quarter and Camp Pendleton)	$2,710	$5,174
TransNet	SPRINTER	399	SPRINTER efficiency improvements and double tracking (Oceanside to Escondido and six rail grade separations at El Camino Real, Melrose Dr, Vista Village Dr/Main St, North Dr, Civic Center, Auto Parkway and Mission Ave)	$946	$1,339
	SPRINTER	399	Branch Extension to Westfield North County	$176	$437
	SPRINTER	588	SPRINTER Express	$244	$492
TransNet	Trolley	510	Mid-Coast Trolley Extension	$1,753	$1,753
	Trolley	510	Blue Line/Mid-Coast Frequency Enhancements and rail grade separations at 28th St, 32nd St, E St, H St, Palomar St, at Taylor St and Ash St, and Blue/Orange Track Connection at 12th/Imperial	$431	$741
	Trolley	520	Orange Line Frequency Enhancements and four rail grade separations at Euclid Ave, Broadway/ Lemon Grove Ave, Allison Ave/University Ave, Severin Dr	$267	$402
	Trolley	530	Green Line Frequency Enhancements	$0	$0
	Trolley	560	SDSU to Downtown San Diego via El Cajon Blvd/Mid-City (transition of Mid-City *Rapid* to Trolley)	$2,390	$5,005
	Trolley	561	UTC to COASTER Connection (extension of Route 510)	$343	$602
	Trolley	562	San Ysidro to Carmel Valley via National City/ Chula Vista via Highland Ave/ 4th Ave, Southeast San Diego, Mid-City, Mission Valley, and Kearny Mesa	$2,967	$5,471
	Trolley	563	Pacific Beach to El Cajon Transit Center via Balboa and Kearny Mesa	$1,299	$2,938
	Rapid	2	North Park to Downtown San Diego via 30th St, Golden Hill	$39	$52
	Rapid	10	La Mesa to Ocean Beach via Mid-City, Hillcrest, Old Town	$87	$117
	Rapid	11	Spring Valley to SDSU via Southeast San Diego, Downtown, Hillcrest, Mid-City	$113	$173
	Rapid	28	Point Loma to Kearny Mesa via Old Town, Linda Vista	$49	$76
	Rapid	30	Old Town to Sorrento Mesa via Pacific Beach, La Jolla, UTC	$105	$161

10. RISK MANAGEMENT

A Risk Management Plan (RMP) for the project has not yet been implemented, and it is anticipated that a formal RMP will be incorporated in future phases. This document would describe how risk management would be structured and performed on the project. The Risk Management Plan would typically include methodology, roles and responsibilities, budgeting, timing, risk categories, definitions of risk probability and impact, probability and impact matrix, reporting formats, and tracking.

At this point the design incorporated in this study is preliminary, and is based on rough topography, GIS data, and as-built plans. With more detailed design information, other utilities may be found in need of relocation. Geometric designs will be further refined to maximize operations and minimize impacts. A complete drainage study will be required to verify that all modifications to drainage facilities will convey the design storm required by the City. All modifications to at-grade crossings will require approval from the CPUC. The cost estimate included is order of magnitude only and is based on preliminary plans and do not include any station work to increase parking. All costs are given in 2017 dollars. Finally, it appears that, based on the preliminary design, these projects will not require additional right-of-way to be acquired, but likely will require temporary construction easements. However, it is possible that the final design may require some right-of-way acquisitions and/or additional temporary construction easements that have not yet been identified.

11. CONCLUSION

This alternative fulfills the purpose and need by grade separating the tracks from the road. The alternative discussed in this report is recommended for environmental analysis.

12. PROJECT PERSONNEL

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13. REFERENCES

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SANDAG

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T.Y. Lin International

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APPENDIX A

E Street and H Street Grade Separation Exhibit

(Draft Exhibit to be Submitted Under Separate Cover)

APPENDIX B

SANDAG 2050 RTP Grade Separation Priority List

Table M.12

Rail Grade Separation Project Rankings

Name	City	Unconstrained Cost ($2014) (millions)	Average Daily Traffic	Trains Per Day	Total Score	Regional Plan Rank	Rail Designation
Palomar St	Chula Vista	$41	44,364	206	62.63	1	Light Rail
Broadway/ Lemon Grove Ave	Lemon Grove	$82	40,403	144	60.19	2	Light Rail
Ash St	San Diego	$103	30,575	195	59.81	3	Light Rail
H St	Chula Vista	$41	41,861	206	59.63	4	Light Rail
Washington St	San Diego	$41	30,345	195	58.81	5	Light Rail
E St	Chula Vista	$41	39,783	206	58.63	6	Light Rail
Broadway	San Diego	$113	27,845	150	55.81	7	Light Rail
Taylor St	San Diego	$113	42,670	195	55.81	7	Light/Heavy Rail
Euclid Ave	San Diego	$41	37,000	144	50.81	9	Light Rail
28th St	San Diego	$41	33,225	206	49.81	10	Light Rail
32nd St	San Diego	$41	32,470	206	46.81	11	Light Rail
Civic Center Dr	Vista	$41	34,916	68	44.44	12	Light Rail
Auto Parkway and Mission Ave	Escondido	$36	27,623	68	42.13	13	Light Rail
Sorrento Valley Blvd	San Diego	$134	37,990	51	40.81	14	Heavy Rail
Allison Ave/University Ave	La Mesa	$103	24,700	144	40.50	15	Light Rail
North Dr	Vista	$31	8,793	68	39.94	16	Light Rail
Vista Village Dr/Main St	Vista	$62	24,927	68	39.44	17	Light Rail
Severin Dr	La Mesa	$41	8,311	288	37.94	18	Light Rail
El Camino Real	Oceanside	$41	38,000	68	36.06	19	Light Rail
Grand Ave/ Carlsbad Village Dr	Carlsbad	$113	21,113	51	35.00	20	Heavy Rail
Melrose Dr	Vista	$41	25,921	68	31.94	21	Light Rail
Mar Vista Dr	Vista	$31	9,665	68	29.94	22	Light Rail
Los Angeles Dr	Vista	$31	4,291	68	29.94	22	Light Rail
Guajome St	Vista	$31	4,152	68	26.94	24	Light Rail
Leucadia Blvd	Encinitas	$93	34,000	51	18.50	25	Heavy Rail
Tamarack Ave	Carlsbad	$93	10,568	51	18.00	26	Heavy Rail
Cannon Road	Carlsbad	$93	6,416	51	12.00	27	Heavy Rail

* Downtown heavy rail trench in San Diego (Washington, Laurel, Hawthorn, Ash and Broadway Streets) excluded from rankings due to construction feasibility issues.

APPENDIX C

Cost Estimate

E & H Streets Grade Sep (Chula Vista)					
Long Trench Alternative Estimate		Design Level: Preliminary			
3/29/2017		Estimated By: Ballard Metcalfe			
Item	Quantity	Unit	Unit Price	Amount	Subtotals
DESIGN					
Alternative Analysis and Environmental	0.5	%	CCE	$ 1,153,801	
Design-30% Package	1.5	%	CCE	$ 3,461,402	
Design-60% and Permits	1.5	%	CCE	$ 3,461,402	
Design-90%, Final, Bid Support	2	%	CCE	$ 4,615,203	
SANDAG Administration	1	%	CCE	$ 2,307,602	
				Design Subtotal	**$ 14,999,411**
RIGHT OF WAY					
Temporary R/W, Easements	1	LS	$ 1,500,000	$ 1,500,000	
R/W Contingency	35	%	R/W Costs	$ 525,000	
				Right of Way Subtotal	**$ 2,025,000**
CONSTRUCTION COST ESTIMATE					
				Construction Cost Estimate (CCE)	**$ 230,800,000**
ANCILLARY CONSTRUCTION COSTS					
Design Services During Construction	2.5	%	CCE	$ 5,769,004	
Construction Management and Testing	8.3	%	CCE	$ 19,153,094	
SANDAG Const. Admin.	1.725	%	CCE	$ 3,980,613	
Railroad Flagging Services	4000	Hours	$ 70	$ 280,000	
				Ancillary Construction Cost Subtotal	**$ 29,182,711**
TOTAL PROJECT COST ESTIMATE (IN 2016 DOLLARS)					**$ 277,100,000**
Construction Cost Estimate Based on Preliminary Design					
Trackwork					
Track-136lb CWR, Ties, & Ballast	22215	TF	$ 600	$ 13,329,000	
Subballast	11000	CY	$ 75	$ 825,000	
Track Removal	22228	TF	$ 40	$ 889,120	
Temporary No 24 Turnout	4	EA	$ 700,000	$ 2,800,000	
New No 24 Turnout	2	EA	$ 750,000	$ 1,500,000	
Turnout Removal	2	EA	$ 40,000	$ 80,000	
Temporary Shoofly Track	11002	TF	$ 600	$ 6,601,200	
Install Insulated Joints	8	PAIR	$ 10,000	$ 80,000	
				Trackwork Subtotal	**$ 26,104,320**
Site Civil					
Clear and Grub	539306	SF	$0.35	$ 188,757	
Earthwork-Embankment	10000	CY	$ 20	$ 200,000	
Earthwork-Excavation	464304	CY	$ 6	$ 2,785,823	
Temporary Embankment/Removal	10000	CY	$ 55	$ 550,000	
Temporary Shoring	2000	SF	$ 30	$ 60,000	
Dewatering	1	LS	$ 4,800,000	$ 4,800,000	
Temporary Fencing and Controls	1	LS	$ 60,000	$ 60,000	
Temporary Platform	10800	SF	$ 8	$ 86,400	
Platform/Parking/Street Demolition	24606	SF	$ 2	$ 49,212	
Construct New Bayfront/E St Station	1	LS	$ 5,000,000	$ 5,000,000	
Construct New H St Station	1	LS	$ 5,000,000	$ 5,000,000	
Construct AC Pavement	135000	SF	$ 4	$ 542,700	
Aggregate Base	135000	SF	$ 2	$ 248,400	

E & H Streets Grade Sep (Chula Vista)

Long Trench Alternative Estimate — Design Level: Preliminary

3/29/2017 — Estimated By: Ballard Metcalfe

Item	Quantity	Unit	Unit Price	Amount	Subtotals
Construct Sidewalk	4000	SF	$ 6	$ 22,000	
Construct Curb and Gutter	300	LF	$ 23	$ 6,900	
Construct Median Curb and Gutter	220	LF	$ 23	$ 5,060	
Truncated Domes	240	SF	$ 30	$ 7,200	
Signing and Striping	1	LS	$ 150,000	$ 150,000	
Construct Type B Curb Inlet	2	EA	$ 5,500	$ 11,000	
Storm Drain Pump Station	2	EA	$ 1,000,000	$ 2,000,000	
Install 12" PVC Storm Drain	20	LF	$ 72	$ 1,437	
Abandon Pipe	1600	LF	$ 60	$ 96,000	
Install Concrete Channel	200	LF	$ 1,000	$ 200,000	
Install 60" RCP	4800	LF	$ 500	$ 2,400,000	
Traffic Control	1	LS	$ 500,000	$ 500,000	
				Civil Subtotal	**$ 24,970,888**
Bridges					
E St Overpass	5670	SF	$ 225	$ 1,275,750	
Bayfront/E St Station Pedestrain Bridge	700	SF	$ 150	$ 105,000	
F St Overpass	4158	SF	$ 225	$ 935,550	
H St Station Pedestrian Bridge	700	SF	$ 150	$ 105,000	
H St Overpass	5940	SF	$ 225	$ 1,336,500	
				Bridges Subtotal	**$ 3,757,800**
Walls					
Stairway Retaining Walls	560	CY	$ 600	$ 336,000	
Seal Course Concrete	139425	CY	$ 150	$ 20,913,781	
CDSM wall (Design H > 32 ft)	379718	SF	$ 17	$ 6,455,203	
Steel piles (Design H > 32 ft)	30852073	LB	$ 0.50	$ 15,426,036	
CDSM wall (Design H < 32 ft)	437072	SF	$ 17	$ 7,430,221	
Steel piles (Design H < 32 ft)	15334534	LB	$ 0.50	$ 7,667,267	
Wall Concrete	10887	CY	$ 550	$ 5,988,087	
Slab Concrete	54424	CY	$ 400	$ 21,769,409	
Rebar	3293747	LB	$ 0.75	$ 2,470,310	
Waler Beam for struts	253	EA	$ 600	$ 151,800	
Coping Concrete	10456	CY	$ 300	$ 3,136,830	
Erect PC/PS Strut	253	EA	$ 2,000	$ 506,000	
Furnish PC/PS Strut	253	EA	$ 5,000	$ 1,265,000	
Fence	18821	LF	$ 15	$ 282,315	
				Walls Subtotal	**$ 93,798,260**
Utility Relocation					
Relocate / Replace Gas	1	LS	$ 207,000	$ 207,000	
Relocate / Replace Water	1	LS	$ 174,270	$ 174,270	
Relocate / Replace Sewer	1	LS	$ 1,276,768	$ 1,276,768	
Sewer Pump Station	2	EA	$ 1,000,000	$ 2,000,000	
				Utility Relocation Subtotal	**$ 3,658,038**
Environmental					
SWPPP (Temp Erosion Control)	1	LS	$ 200,000	$ 200,000	
Permenant Erosion Control	606250	SF	$ 1	$ 606,250	
Monitors - Environmental/Biological	1500	Hours	$ 150	$ 225,000	
Monitors - Paleo/Archeology	2000	Hours	$ 150	$ 300,000	
				Environmental Mitigation Subtotal	**$ 1,331,250**
Signal					
Northern CP Removal	1	LS	$ 130,000	$ 130,000	
Southern CP Removal	1	LS	$ 130,000	$ 130,000	

E & H Streets Grade Sep (Chula Vista)

Long Trench Alternative Estimate Design Level: Preliminary

3/29/2017 Estimated By: Ballard Metcalfe

Item	Quantity	Unit	Unit Price	Amount	Subtotals
Installation of New Single Crossover Control Point North	1	LS	$ 1,400,000	$ 1,400,000	
Installation of New Single Crossover Control Point South	1	LS	$ 1,400,000	$ 1,400,000	
E St Temporary Gate Relocation	1	LS	$ 500,000	$ 500,000	
E St Crossing Removal	1	LS	$ 52,500	$ 52,500	
F St Temporary Gate Relocation	1	LS	$ 500,000	$ 500,000	
F St Crossing Removal	1	LS	$ 52,500	$ 52,500	
H St Temporary Gate Relocation	1	LS	$ 500,000	$ 500,000	
H St Crossing Removal	1	LS	$ 52,500	$ 52,500	
J St Temporary Gate Relocation (Stage 1)	1	LS	$ 500,000	$ 500,000	
J St Temporary Gate Relocation (Stage 2)	1	LS	$ 500,000	$ 500,000	
TMDS Modifications	1	LS	$ 50,000	$ 50,000	
MTS Flagging Support	250	Days	$ 1,800	$ 450,000	
MTS Signal Support	250	Days	$ 1,800	$ 450,000	
				Signal Subtotal	**$ 6,667,500**
Electrical					
Relocate Traction Power Station - F St	1	LS	$ 1,500,000	$ 1,500,000	
Relocate Traction Power Station - J St	1	LS	$ 1,500,000	$ 1,500,000	
Remove Catenary	22116	TF	$ 50	$ 1,105,800	
Catenary	22110	TF	$ 360	$ 7,959,600	
Temporary Platform Lighting	1	LS	$ 80,000	$ 80,000	
				Electrical Subtotal	**$ 10,645,400**
Base Construction Estimate (BCE)					**$ 170,933,456**
Other Construction Costs					
Contractor Mobilization (once)	0	%	BCE	$ -	
Contractor Demobilization (once)	0	%	BCE	$ -	
Contingency	35	%	BCE	$ 59,826,710	
				Other Construction Cost Subtotal	**$ 59,826,710**
Construction Cost Estimate (CCE)					**$ 230,760,165**
Program Level Cost Estimate					**$ 235,000,000**