Los Angeles County
Metropolitan Transportation Authority

West Santa Ana Branch Transit Corridor

Cut-and-Cover Analysis Memo

Task No. 83.02a

Metro

WEST SANTA ANA BRANCH TRANSIT CORRIDOR PROJECT
Contract No. AE5999300

Cut-and-Cover Analysis Memo

Task No. 83.02a

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Metro

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ACRONYMS AND ABBREVIATIONS

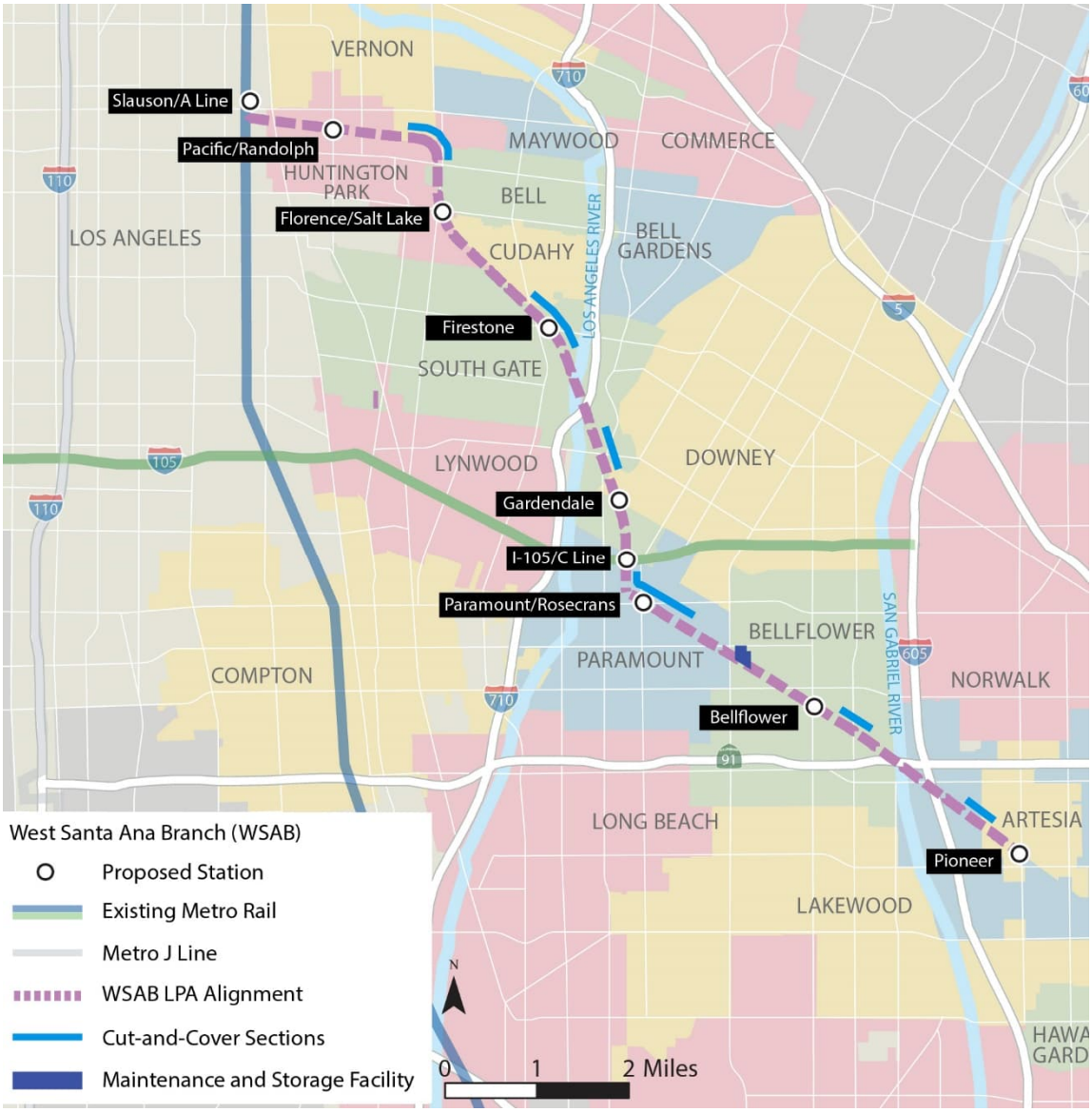
Acronym	Definition
CPUC	California Public Utilities Commission
EIR	environmental impact report
EIS	environmental impact statement
FTA	Federal Transit Administration
LPA	Locally Preferred Alternative
LRT	light rail transit
Metro	Los Angeles County Metropolitan Transportation Authority
mph	miles per hour
ROW	right-of-way
SOE	support of excavation
TBM	tunnel boring machine
WSAB	West Santa Ana Branch

1 INTRODUCTION

The Los Angeles County Metropolitan Transportation Authority (Metro) Board of Directors approved a Locally Preferred Alternative (LPA) for the West Santa Ana Branch (WSAB) Transit Corridor during the Metro Board meeting on January 27, 2022. The LPA extends from a northern terminus at the Slauson/A Line Station located in the Florence-Firestone unincorporated area of Los Angeles County to a southern terminus at the Pioneer Station located in Artesia for a total of 14.8 miles. A Draft Environmental Impact Statement/ Environmental Impact Report (EIS/EIR) was released in July 2021, which included a two-month public comment and review period. During that comment period, as well as through ongoing coordination with stakeholders affected by the project, communities along the alignment requested that Metro study an alternate configuration for aerial segments of the alignment. In response to these requests, in January 2022, the Metro Board directed staff to undertake an assessment of the sections of the LPA that were in an aerial configuration to determine if a cut-and-cover alignment could be constructed at a lower cost. Cut-and-cover was specified as it is the more appropriate construction method where short segments of an alignment are underground (in comparison to construction with a tunnel boring machine (TBM)). Each section evaluated in this study has a length of less than 2 miles. Cut-and-cover construction would have a lower cost than a tunnel bored alignment.

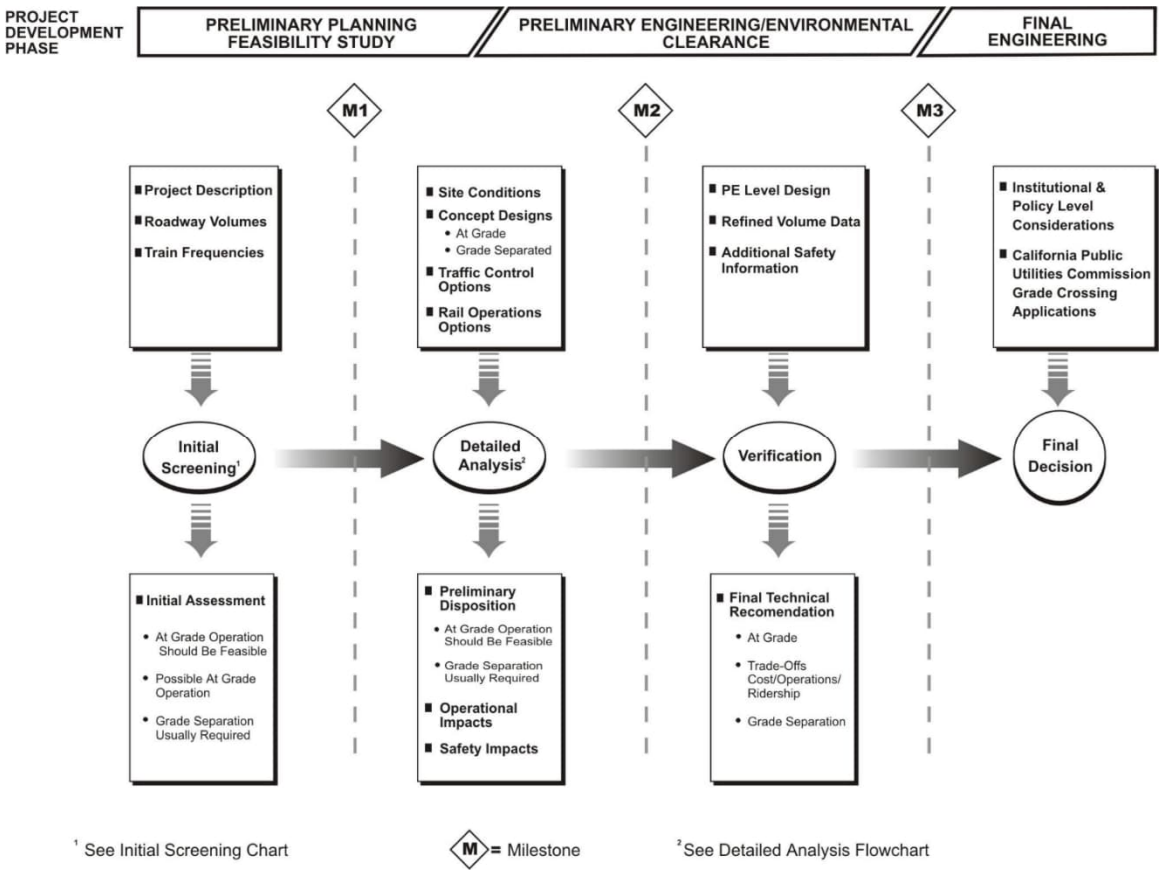
This study includes an assessment of six sections along the LPA alignment, illustrated in Figure 1-1. In the Draft EIS/EIR, each of these six sections were grade-separated aerial guideways. Metro used the Metro Grade Crossing Safety Policy for Light Rail Transit (Policy), approved in December 2003 and revised in October 2010, to determine where grade separations were warranted. This policy provides a system-wide standard methodology in Los Angeles County for determining whether grade crossings along light rail transit (LRT) lines should be considered for grade separation or at-grade. The policy provides a three-step process for considering rail grade separations and considers horizon year traffic volumes, train frequency, and safety considerations. Coordination also occurred with the California Public Utilities Commission (CPUC). The three steps are shown in Figure -1-2.

Figure 1-1. Cut-and-Cover Sections Included in Study



Source: WSP 2022

Figure -1-2. LA Metro Grade Separation Three-Step Grade Separation Determination



Source: LA Metro Grade Crossing Safety Policy for Light Rail Transit, 2011

Table 1-1 identifies each of the sections studied and the length of the section. For each of the sections studied, a conceptual-level plan and profile were created. As the cut-and-cover alignment would not drastically differ from the horizontal alignment proposed in the Draft EIS/EIR, much of the same information previously gathered was used to develop these plan and profiles. Information such as utility locations, ground surface, and nearby conditions were available to determine the most feasible design for a cut-and-cover alignment. Major utilities that cross the alignment, including large gravity storm drains, generally dictated the length and depth of the cut-and-cover sections. Relocation of these major utilities would involve significant cost and impacts during construction. Parallel utilities may affect the construction and constructability of the cut-and-cover alignment and may require relocation when in conflict with the potential cut-and-cover design. Once a plan and profile were developed for each section, a high-level cost summary was created specific to that section. Unit costs used are consistent with the Draft EIS/EIR cost estimate for comparison purposes.

Table 1-1. Cut-and-Cover Sections

Section #	Name	Right-of-Way	Cut-and-Cover and Trench Section Length	Jurisdiction(s)
1	Randolph Street Curve	La Habra Branch/San Pedro Subdivision	2,190 feet / 0.41 mile	Huntington Park/Vernon
2	Firestone Station	San Pedro Subdivision	4,100 feet / 0.78 mile	South Gate/Cudahy
3	Imperial Highway and Garfield Avenue	San Pedro Subdivision	3,262 feet / 0.62 mile	South Gate
4	Paramount	San Pedro Subdivision/Pacific Electric Right-of-Way	7,388 feet / 1.40 miles	Paramount
5	Flower Street/ Woodruff Avenue	Pacific Electric Right-of-Way	2,971 feet / 0.56 mile	Bellflower
6	183rd Street/Gridley Avenue	Pacific Electric Right-of-Way	3,300 feet / 0.63 mile	Cerritos/Artesia

Source: WSP 2022

2 CONSTRUCTION METHODS

The method of excavation for stations, tunnels, utilities, and other underground LRT components is largely governed by existing geologic conditions, including the presence of groundwater, and availability of construction access and staging areas. Typically, cut-and-cover construction is a common method to construct underground stations and short tunnels whereas a TBM with a precast concrete segmental lining system is more appropriate for longer tunnels because of cost and schedule considerations. TBM construction has higher advance rates but requires higher procurement and mobilization costs. Therefore, cost effectiveness would be achieved for longer tunnel segments by taking advantage of the higher advance rates for TBM construction, which compensates for the fixed mobilization costs over longer tunnel lengths. A cut-and-cover construction method would be the more appropriate because of the relatively short lengths of each tunnel sections and the limited space available for staging and launching TBMs. There is a potential that the TBM tunneling method could be used for the Paramount section due to the length (1.40 miles), but this method would likely be more expensive than cut-and-cover construction. All other sections are less than 1 mile in length and, therefore, TBM tunneling would not be considered cost-effective.

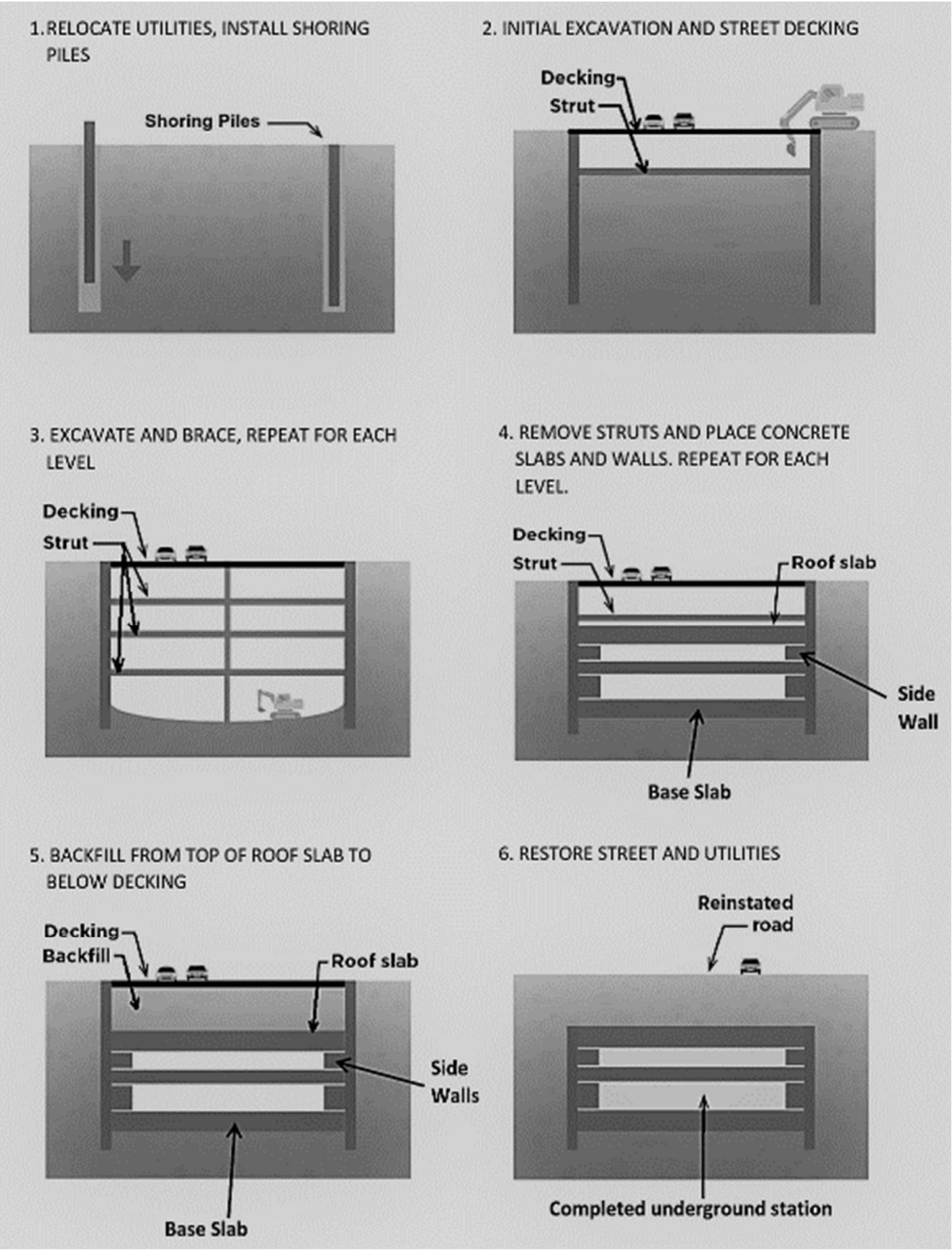
Cut-and-cover construction has been assumed for each of the sections studied in this memorandum. Dewatering may be required at cut-and-cover excavation locations to temporarily lower the groundwater level below the excavation depth or to an impermeable layer. Dewatering facilitates installation of shoring systems, improves soil stability, and allows excavation in dry conditions. To dewater an area, groundwater would be pumped from wells installed around the perimeter of the excavation, which limits impacts to surrounding structures, ground, and utilities adjacent to the excavation. Any contaminated groundwater would be properly treated prior to being discharged. Uncontaminated groundwater may be

treated and pumped back into the groundwater table, pumped to the sewer or storm drain system, or used on-site for dust-control purposes.

Figure 2-1 presents the typical sequence for cut-and-cover construction at an underground station, and Figure 2-2 presents the typical cross section at a trench section. Excavation would occur after installation of the shoring system. Conflicting utilities would be supported and protected in place, or, if feasible, temporarily relocated outside of the excavation area. Excavation would then proceed underneath the utilities until a full excavation depth is reached. The guideway structures and associated elements would be built within the excavation; the excavation would then be backfilled above the structure to the ground surface; and the surface would be restored. At each end of the cut-and-cover section, trench sections with retaining walls (U-structure) would need to be constructed for the descent and ascent transitions from/to the cut-and-cover tunnel to the at-grade configuration. Top of the typical cut-and-cover box tunnel would be approximately 17 feet above top of rail for the light rail vehicle envelope and catenary and 2 feet of reinforced concrete roof. The tunnels would be backfilled until the tunnel reaches a daylight or portal location. Trench configurations would be at depths of less than 17 feet on each end of the tunnel. Where an underground station is proposed within the cut-and-cover tunnel section, the excavation would be wider than the guideway sections to accommodate station platforms. A station box would be fully excavated, and the final station structure would be built. Once built, the excavation would be backfilled above the station roof, and the surface would be restored.

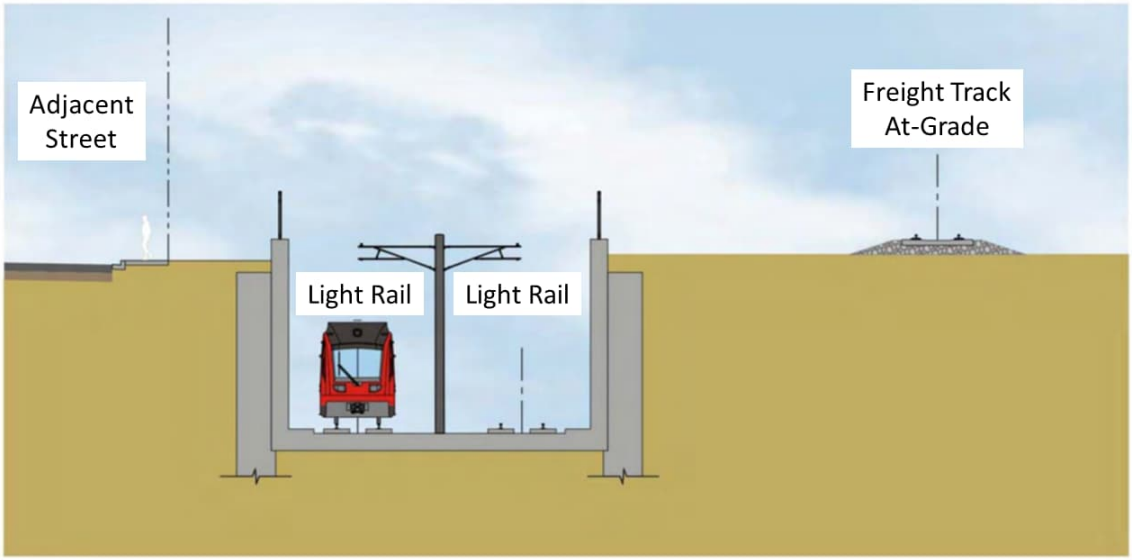
Temporary support of excavation (SOE) would be provided to stabilize the ground, and excavation would be carried out inside the supported area. Where necessary, temporary concrete decking can be placed during weekends over the cut immediately following the first lift of excavation (at about 8 feet below ground surface) to allow traffic to pass above. Once the deck is in place, excavation and internal bracing would continue to the required depth. Temporary SOE walls would be typically installed before excavation commences. Depending on the depth of excavation and ground and groundwater conditions, the excavation support could consist of reinforced concrete drilled-in-place piles (tangent pile wall or secant pile wall), soldier piles and lagging, slurry walls, or deep soil mix wall. These wall systems are braced with internal struts or supported by tiebacks as the excavation progresses. Tiebacks consist of inclined wire strands or steel rods installed in drilled holes in the ground behind the wall. One end of the tieback would be secured to the wall and the other end would be anchored to stable ground to provide sufficient resistance and to control ground movement. After installation of the temporary SOE system and initial excavation, deck beams would be installed, followed by multiple sequences of excavation and installation of cross-bracing. Decking would be placed on the deck beams to allow traffic and pedestrian circulation to resume after the initial excavation. Decking installation could require temporary street closures and would be installed in progressive stages. With the decking installed and the utilities supported, the major excavation work can proceed. Spoils from excavation sites would be moved to an off-street work site or closed parking/traffic lane and loaded into haul trucks.

Figure 2-1. Typical Cut-and-Cover Construction Sequence



Source: WSP 2020
Note: Station walls would be constructed inside the shoring piles.

Figure 2-2. Typical Trench Cross Section



Source: WSP 2022

Upon completion of excavation to the final depth, the construction sequence for the final structures would commence with the construction of the foundation base slab, followed by installation of exterior walls and any interior column elements. Slabs are typically poured as the pours for columns and the intermediate floor and roof wall progress. For station construction, entrance locations are generally used as access points during station construction. Exterior entrances would be constructed after completion of the structure. Final concrete and architectural finish works would occur after tunnel construction is completed. The final structures would be constructed with cast-in-place concrete. The time of construction would vary depending on the length and the design configuration for each structure. The typical duration for completing the concrete and architectural works for a single station may take approximately 25 months. Once the installation of the desired final structure is completed inside the excavated area, the rest of excavation would be backfilled. This backfilling is typically done with imported soils delivered by truck. Typically, backfilling would be carried out in the last three to six months of construction.

3 SECTION DESCRIPTIONS

This section describes the cut-and-cover design for the six sections studied. Information includes design depth, design speed, major utility, and constructability considerations. Refer to Appendix A, Plan and Profiles, for conceptual engineering drawings for each section.

3.1 Randolph Street Curve

This section comprises the LRT alignment at the Randolph Avenue grade crossing and the freight crossings along both the La Habra Branch and the San Pedro Subdivision right-of-way (ROW). Traveling southeast, this section would include approximately 760 feet of open trench along the La Habra Branch ROW before crossing beneath the freight tracks in a cut-and-cover tunnel of approximately 630 feet. Once the alignment crosses beneath both freight tracks, it would ascend via an open trench about 680 feet long to cross Gage Avenue at-grade.

The cut-and-cover configuration would have a similar length as the aerial guideway originally considered in the Draft EIS/EIR design.

Active freight tracks are located within this section; therefore, the LRT tracks would be grade separated to avoid conflicts with the freight tracks as the LRT alignment turns from the La Habra Branch ROW along Randolph Street toward southeast to the San Pedro Subdivision ROW along Salt Lake Avenue. For the cut-and-cover configuration, about 6.5 feet of cover would be needed on top of the cut-and-cover tunnel structure for the LRT alignment to cross under the existing freight tracks, resulting in a maximum top of rail profile depth below surface of approximately 23.5 feet. This design would maintain the LRT design speeds included in the Draft EIS/EIR (i.e., 40 miles per hour (mph)). Retaining walls would be required on each side of the descent into the cut-and-cover tunnel

In addition to the clearance under the freight tracks, there are major underground utilities that would be parallel to or cross the alignment. The below-grade utilities located in this section are shown in Table 3-1. The major utility that affected design in this section is the Double 8'0" x 4'9" Reinforced Concrete Box that would cross the alignment near Newell Street. Maintaining this utility in place is preferable to relocation because of the size and nature of the utility, particularly from a construction cost standpoint. As a result, the alignment would either need to transition to a cut-and-cover configuration prior to the utility in order for the cut-and-cover tunnel to pass under it (resulting in a longer length of cut-and-cover alignment) or transition to cut-and-cover configuration after crossing the utility in an aerial configuration. The study assumed that the LRT alignment would descend to cut-and-cover configuration after this utility is cleared, which would reduce the overall cost of this section. However, descending to cut-and-cover configuration after clearing the utility would result in conflicts with the water and telecom lines, potentially requiring hanging these utilities in place across the excavation during construction. Backfill over the LRT cut-and-cover structure would be deep enough to avoid these utilities. The abandoned gas utility would also be impacted, but it would be removed as it is no longer in use.

A 15-inch sanitary sewer line would be located parallel to the retaining walls on the western end of this alignment and may result in constructability challenges. The LRT alignment would not directly impact this utility, but the utility would run parallel and be less than 20 feet from construction of the cut-and-cover excavation.

Table 3-1. Major Underground Utilities at the Randolph Street Curve Section

Item #	Utility	Description	Parallel to Excavation or Crossing Alignment	Conflict (Impact/ No Impact)	Treatment
1	Sewer	8" Vitrified Clay Pipe	Parallel	No Impact	Protect-in-place during construction
2	Sewer	15" Vitrified Clay Pipe	Parallel	No Impact	Protect-in-place during construction
3	Sewer	24" Vitrified Clay Pipe	Crossing	No Impact	Protect-in-place during construction
4	Sewer	24" Reinforced Concrete Pipe in 45" Casing	Crossing	No Impact	Protect-in-place during construction

Item #	Utility	Description	Parallel to Excavation or Crossing Alignment	Conflict (Impact/ No Impact)	Treatment
5	Storm Drain	Double 8'0" x 4'9" Reinforced Concrete Box	Crossing	No Impact	Protect-in-place during construction
6	Storm Drain	30" Reinforced Concrete Pipe	Parallel	No Impact	Protect-in-place during construction
7	Gas	Abandoned 26" Gas Line	Parallel	Impact	Remove
8	Water	12" Water Line	Crossing	Impact	Utility hanging across excavation
9	Water	18" Ductile Iron Reclaimed Water Line	Crossing	Impact	Utility hanging across excavation
10	Telecom	Buried Underground Telecom Line with 2.5' Cover	Crossing	Impact	Utility hanging across excavation

Source: WSP 2022

Construction of the aerial alignment evaluated in the Draft EIS/EIR could require intermittent full roadway closures, typically at night, where the alignment crosses over Randolph Street. In comparison, construction of a cut-and-cover alignment would require excavation where the alignment passes under Randolph Street, resulting in full and/or partial closure of the roadway while initial excavation is performed and temporary decking is installed in several weekends. The cut-and-cover tunnel near Gage Avenue would be near an active freight line along the San Pedro Subdivision. A temporary shoo-fly track would be required during construction to maintain freight service. Additional permanent ROW along the east side of the subdivision would also be required for the retaining walls within the trench.

From an environmental impact standpoint:

- Construction-related traffic would likely increase due to increased excavation quantities, resulting in increased construction-related impacts to air quality and traffic compared to the Draft EIS/EIR.
- No operational noise impacts after mitigation were identified in this section in the Draft EIS/EIR. Therefore, a cut-and-cover configuration would not be expected to reduce operational noise impacts.
- No visual impacts were identified in this section in the Draft EIS/EIR because there are no scenic resources. The section is characterized as an “Industrial and Residential Landscape Unit” with small-scale residential, commercial, small-scale industrial, and large-scale industrial uses. The freight track within the La Habra Branch ROW is at a similar grade as the industrial development north of the railroad ROW and at a higher elevation from Randolph Street and the adjacent residential properties. Despite the elevation difference, views into and out of the La Habra Branch ROW are

not obstructed. The area lacks visual elements that unify the industrial, commercial, and residential uses, and the visual quality is characterized as generally inharmonious, disorderly, and incoherent. Therefore, the permanent visual character of the area would not be altered with an underground or trenched configuration.

A cut-and-cover configuration would increase costs by approximately $30 million ($2022) or $47 million ($2035) compared to the Draft EIS/EIR design. This cost does not include the cost of additional ROW that could be potentially required if a shoo-fly track is needed to minimize freight impacts during construction. Refer to Section 4 for more information on cost.

3.2 Firestone Station

This section comprises the LRT alignment from just south of Ardine Street to Rayo Avenue and includes the Atlantic Avenue, Firestone Station, and the Firestone Boulevard grade crossing. The cut-and-cover alignment evaluated in this study would, traveling from northwest to southeast descend into a trench configuration north of Atlantic Avenue and continue in a cut-and-cover configuration for a similar length as the aerial guideway proposed in the Draft EIS/EIR. The concept would include approximately 280 feet of open trench along the San Pedro Subdivision ROW before crossing beneath existing freight tracks along the Patata Line and Atlantic Avenue in a cut-and-cover tunnel. The alignment would remain in a cut-and-cover tunnel as it approaches a below-grade Firestone Station and continue below grade to cross under Firestone Boulevard for a total length of 3,125 feet. The alignment would then ascend via an open trench 495 feet long to cross Rayo Avenue at-grade. The horizontal alignment would be nearly identical as that proposed in the Draft EIS/EIR. Compared to the Draft EIS/EIR design, changes to the vertical alignment would decrease the LRT design speed at the first vertical curve from 55 mph to 50 mph and from 60 mph to 50 mph at the second vertical curve. Retaining walls would be required on each side of the cut-and-cover tunnel.

The below-grade utilities located in this section are listed in Table 3-2. The depth of the cut-and-cover alignment design was dictated by major underground utilities that would cross the alignment. The study assumes that these utilities would be protected in place by hanging across the excavation during construction. A minimum of 2 feet of clearance is needed between the top of the cut-and-cover tunnel and the bottom of the utilities, resulting in a maximum depth to top of rail of 42 feet.

An 11’6” x 7’6” reinforced concrete box houses three storm drain lines that run parallel to the LRT alignment. This utility may affect constructability, but it is assumed that the utility could be supported in place during construction with the designed depth of the LRT alignment.

Table 3-2. Major Underground Utilities at the Firestone Station Section

Item #	Utility	Description	Parallel to Excavation or Crossing Alignment	Conflict (Impact/ No Impact)	Treatment
1	Storm Drain	48" Reinforced Concrete Pipe	Crossing	No Impact	Protect-in-place during construction
2	Sewer	36" Reinforced Concrete Pipe	Crossing	No Impact	Protect-in-place during construction
3	Sewer	27" Reinforced Concrete Pipe	Crossing	No Impact	Protect-in-place during construction
4	Water	18" Steel Reclaimed Water in 45" Casing	Crossing	No Impact	Protect-in-place during construction
5	Gas	26" Gas in 36" Casing	Crossing	No Impact	Protect-in-place during construction
6	Storm Drain	11'6" x 7'6" Reinforced Concrete Box	Parallel	No Impact	Protect-in-place during construction
7	Storm Drain	18" Reinforced Concrete Pipe	Crossing	No Impact	Protect-in-place during construction
8	Sewer	21" Vitrified Clay Pipe in 42" Casing	Crossing	No Impact	Protect-in-place during construction
9	Electrical	16" Kilovolt in 20" Casing	Crossing	No Impact	Protect-in-place during construction

Source: Jacobs 2022

Prior to descending southward into the underground cut-and-cover configuration, the alignment would conflict with existing freight tracks running parallel to the alignment and spurs that cross the alignment. This concept would increase ROW requirements compared to the Draft EIS/EIR because a temporary shoo-fly track would be required during construction to maintain freight service, and additional permanent ROW would be required for the retaining walls within the trench. Additionally, construction of the Firestone Station as an underground side platform configuration would necessitate the temporary relocation of the existing freight track and siding that run parallel to the station, requiring additional temporary ROW acquisitions. The Draft EIS/EIR design assumed a center platform for the aerial Firestone Station, as that is the preferred Metro configuration and requires fewer vertical circulation elements than a side platform configuration. For the cut-and-cover design, side platforms were assumed because track centers would remain at the minimum distance throughout the section, which would reduce the overall footprint along the alignment compared to a center platform design. Under this design assumption, the station box would be larger than that with a center platform configuration and additional vertical circulation elements would be needed, but overall construction and ROW impacts would be reduced. It is particularly important in this section to reduce impacts to nearby structures on private property adjacent to the San Pedro Subdivision.

Construction of the aerial alignment evaluated in the Draft EIS/EIR would require intermittent full roadway closures, typically at night, where the alignment crosses over Atlantic Avenue and Firestone Boulevard (Table 3.51 in the Draft EIS/EIR). Outside the intermittent closures, lane widths would be reduced to accommodate construction of a modified median and column for the aerial alignment, with these impacts occurring for 12 to 24 months. In comparison, construction of a cut-and-cover alignment would require excavation where the alignment passes under this intersection, resulting in full and/or partial closure of the roadway while initial excavation is performed and temporary decking is installed presumably during weekends.

From an environmental impact standpoint:

- Construction-related traffic would likely increase due to increased excavation quantities, resulting in increased construction-related impacts to air quality and traffic compared to the Draft EIS/EIR.
- The Draft EIS/EIR identified one operational noise impact along this section. Mitigation was not recommended at Cluster N169 (a motel along Firestone Boulevard) because the noise threshold was only exceeded by 0.2 dBA and there were no other sensitive receivers within 1,000 feet, thus making a soundwall unreasonable. It is likely that the moderate impact identified at Cluster N169 would be eliminated with a cut-and-cover alignment; however, a complete noise analysis would be needed to verify.
- No visual impacts were identified in this section in the Draft EIS/EIR because there are no scenic resources. The section is characterized as an "Industrial Landscape Unit" with commercial, small-scale industrial, mid-scale industrial, and large-scale industrial uses. Existing views to and from the railroad ROW are generally available through chain-link fences. However, views to and from the railroad ROW are limited or obscured where industrial properties have fences with slats and where the rear of industrial buildings or walls are at the property line adjacent to the railroad ROW. The area lacks visual elements that unify the industrial and commercial uses, and the visual quality is characterized as generally inharmonious, disorderly, and incoherent. Therefore, the permanent visual character of the area would not be altered with an underground or trenched configuration.

A cut-and-cover configuration would increase costs by approximately $813 million ($2022) or $1.272 billion ($2035) compared to the Draft EIS/EIR design. This cost does not include the cost of additional ROW that could be potentially required for freight impacts to spurs. Refer to Section 4 for more information on cost.

3.3 Imperial Highway and Garfield Avenue

This section comprises the LRT alignment at the Imperial Highway grade crossing and the Garfield Avenue grade crossing. For the cut-and-cover configuration, traveling toward southeast, the LRT vertical alignment would diverge from the Draft EIS/EIR proposed vertical alignment and descend into a trench configuration west of the crossings. The freight track would remain at-grade. The LRT alignment would continue into a cut-and-cover configuration beneath the crossings and ascend to at-grade east of the crossings where it would rejoin the Draft EIS/EIR proposed vertical alignment. The LRT design speeds for the vertical curves remain the same as those in the Draft EIS/EIR, at 60 and 65 mph,

respectively. The cut-and-cover configuration would have a similar length as the aerial guideway evaluated in the Draft EIS/EIR. The potential cut-and-cover configuration would include approximately 680 feet of open trench for the northern descent, 2,004 feet of cut-and-cover tunnel beneath the crossings, and 448 feet of open trench for the southern ascent. Retaining walls would be required on each side of the cut-and-cover tunnel.

A summary of major below-grade utilities is included in Table 3-3.The design would avoid impacts to the major utilities. There are no known major utilities running parallel to the section. The cut-and-cover structure would have a maximum depth to top of rail of 38 feet, which is dictated by major underground crossing utilities that would be protected in place by hanging across the excavation during construction. Specifically, a 12-inch sewer in 30-inch steel pipe gravity-fed utility and a 67-inch steel pipe water utility drive the depth of the cut-and-cover portion, with an assumed minimum 5 foot clearance between the top of the cut-and-cover structure and the bottom of utility. The cut-and-cover configuration would be approximately 30 percent longer than the aerial guideway evaluated in the Draft EIS/EIR because of the depth needed to avoid major utilities and the distance required for the guideway to descend and then ascend after reaching that depth.

Table 3-3. Major Underground Utilities at the Imperial Highway and Garfield Avenue Section

Item #	Utility	Description	Parallel to Excavation or Crossing Alignment	Conflict (Impact/ No Impact)	Treatment
1	Water	8" Cast Iron Pipe	Crossing	No Impact	Support structure in place
2	Sewer	12" Polyvinyl Chloride Pipe in 30" Casing	Crossing	No Impact	Support structure in place
3	Water	12" Cast Iron Pipe in 20" Casing	Crossing	No Impact	Support structure in place
4	Water	67" Pipe in Steel Casing	Crossing	No Impact	Support structure in place
5	Sewer	42" Reinforced Concrete Pipe	Crossing	No Impact	Support structure in place
6	Sewer	Abandoned 10" Vitrified Clay Pipe in 24" Casing	Crossing	No Impact	Protect-in-place during construction

Source: WSP 2022

Construction of the aerial alignment evaluated in the Draft EIS/EIR would require intermittent full roadway closures, typically at night, where the alignment crosses over Imperial Highway and Garfield Avenue (Table 3.51 in the Draft EIS/EIR). Outside the intermittent closures, lane widths would be reduced to accommodate construction of a modified median and column for the aerial alignment, with these impacts occurring for 12 to 24 months. In comparison, construction of a cut-and-cover alignment would require excavation where the alignment passes under this intersection, resulting in full and/or partial closure of the roadway while initial excavation is performed and temporary decking is installed in several weekends.

Right-of-way acquisitions would increase compared to the Draft EIS/EIR because a temporary shoo-fly track would be required during construction and additional permanent ROW would be required for the retaining walls and SOE along trench sections.

From an environmental impact standpoint:

- Construction-related traffic would likely increase due to increased excavation quantities, resulting in increased construction-related impacts to air quality and traffic compared to the Draft EIS/EIR.
- No operational noise impacts after mitigation were identified in this section in the Draft EIS/EIR. Therefore, a cut-and-cover configuration would not be expected to reduce operational noise impacts.
- No visual impacts were identified in this section in the Draft EIS/EIR because there are no scenic resources. The section is characterized as an "Industrial Landscape Unit" with small-scale industrial, mid-scale industrial, and large-scale industrial uses. The area lacks visual elements that unify the industrial and commercial uses, and the visual quality is characterized as generally inharmonious, disorderly, and incoherent. Therefore, the permanent visual character of the area would not be altered with an underground or trenched configuration.

A cut-and-cover configuration would increase costs by approximately $102 million ($2022) or $159 million ($2035) compared to the Draft EIS/EIR design. This cost does not include the cost of additional ROW that could be potentially required if a shoo-fly track is required to minimize freight impacts during construction. Refer to Section 4 for more information on cost.

3.4 Paramount

This section comprises the LRT alignment at the freight crossing along the Pacific Electric ROW, the Paramount Boulevard/Rosecrans Avenue grade crossing, and the Downey Avenue grade crossing. The LRT alignment would be grade separated as the alignment turns from the San Pedro Subdivision (toward south) to the Pacific Electric ROW (toward southeast) to avoid conflicts with the freight tracks. The cut-and-cover configuration assumes the alignment would diverge from the Draft EIS/EIR vertical alignment and descend into a trench configuration northwest of the freight track crossing. The cut-and-cover configuration would include approximately 668 feet of open trench before descending beneath the freight tracks in a cut-and-cover tunnel. The cut-and-cover tunnel would cross under the freight tracks before approaching the proposed Paramount/Rosecrans Station, which would be below grade with side platforms. The alignment would remain in a cut-and-cover tunnel as it passes under the Paramount Boulevard and Rosecrans Boulevard intersection and continues under Downey Avenue, for a total length of 6,020 feet. At Downey Avenue, the alignment would begin to ascend via an open trench about 552 feet long to come back to grade and match the Draft EIS/EIR proposed alignment near the World Energy facility.

The horizontal alignment would remain identical to the Draft EIS/EIR alignment, north of the turn, within the San Pedro Subdivision. Changes to the vertical alignment would include an increase in LRT design speed compared to the Draft EIS/EIR for one curve from 55 to 65 mph. LRT design speeds would be maintained at 65 mph at the other curve, and 20 mph at the San Pedro Subdivision and Pacific Electric ROW. Retaining walls would be required before and after the cut-and-cover tunnel. The cross section of the cut-and-cover configuration would be slightly wider than that of the aerial guideway.

The depth of the cut-and-cover configuration was dictated by the depth needed to pass under the existing freight tracks and major underground crossing utilities that would be protected in place by hanging across the excavation during construction. The below-grade utilities located in this section are identified in Table 3-4. A major utility that influenced the design is the 78-inch storm drain line under Downey Avenue. A minimum of 5 feet vertical clearance is provided between the bottom of the storm drain and the top of the cut-and-cover structure, resulting in a maximum depth to top of rail of 29.9 feet for the cut-and-cover alignment.

Existing parallel running water and oil lines may impact construction of the cut-and-cover alignment and may need relocation. Other existing utilities may cause potential constructability impacts.

Table 3-4. Major Underground Utilities at the Paramount Section

Item #	Utility	Description	Parallel to Excavation or Crossing Alignment	Conflict (Impact/ No Impact)	Treatment
1	Storm Drain	48" Reinforced Concrete Pipe	Crossing	No Impact	Protect-in-place during construction
2	Storm Drain	8'0" x 6'0" Reinforced Concrete Box	Crossing	No Impact	Protect-in-place during construction
3	Water	24" Reclaimed Water	Parallel	Impact	Relocate structure
4	Storm Drain	90" Reinforced Concrete Pipe	Crossing	No Impact	Protect-in-place during construction
5	Water	6" Water Line	Crossing	No Impact	Protect-in-place during construction
6	Water	24" Steel Pipe Reclaimed Water	Crossing	No Impact	Protect-in-place during construction
7	Water	24" Water Line	Parallel	Impact	Relocate structure
8	Oil	Idle 6" Natural Gas Oil Line	Parallel	Impact	Relocate structure
9	Storm Drain	78" Reinforced Concrete Pipe	Crossing	No Impact	Protect-in-place during construction
10	Oil	Idle 6" Natural Gas Oil Line	Parallel	Impact	Relocate structure
11	Oil	10" Oil Line	Parallel	Impact	Relocate structure

Source: Jacobs 2022

Prior to descending toward southeast into the underground cut-and-cover configuration and within the open trench, the alignment would conflict with existing freight tracks and spurs that run parallel to and cross the project alignment. Compared to the Draft EIS/EIR, additional ROW acquisitions would be required. A temporary shoo-fly track would be required during construction to maintain freight service that crosses the alignment. Additional permanent ROW would be required for the retaining walls along the trench segment. Additionally, construction of the Paramount/Rosecrans Station in an underground side platform configuration could necessitate temporarily relocating existing freight track and

siding, creating additional temporary ROW impacts near the station. The Draft EIS/EIR design assumed a center platform for the aerial Paramount/Rosecrans Station, as that is the preferred Metro configuration and requires fewer vertical circulation elements compared to a side platform configuration. For the cut-and-cover design, side platforms were assumed because track centers would remain at the minimum distance throughout the section, which would reduce the overall footprint along the alignment compared to a center platform design. Under this design assumption, the station box would be larger than that with a center platform configuration and additional vertical circulation elements would be needed, but overall construction and ROW impacts would be reduced. The LRT below Downey Avenue may preclude a future Downey Avenue underpass.

Construction of the aerial alignment evaluated in the Draft EIS/EIR would require intermittent full roadway closures, typically at night, where the alignment crosses over Paramount Boulevard, Somerset Boulevard, and Downey Avenue (Table 3.51 in the Draft EIS/EIR). Outside the intermittent closures, lane widths on Paramount Boulevard and Downey Avenue would be reduced to accommodate construction of a modified median and column for the aerial alignment, with these impacts occurring for 12 to 24 months. Impacts on Somerset Boulevard would be limited to temporary lane closures and relocations during grade crossing and median construction, with impacts lasting one to three months. In comparison, construction of a cut-and-cover alignment would require excavation where the alignment passes under these streets, resulting in full and/or partial closure of the roadways while initial excavation is performed and temporary decking is installed in several weekends.

From an environmental impact standpoint:

- Construction-related traffic would likely increase due to increased excavation quantities, resulting in increased construction-related impacts to air quality and traffic compared to the Draft EIS/EIR.
- The Draft EIS/EIR identified nine operational noise impacts after mitigation along this section. Severe impacts would occur at two clusters, and moderate impacts would occur at seven clusters. While freight noise would not be reduced under this design, LRT noise would be reduced or eliminated when the alignment is in a cut-and-cover configuration. A complete noise analysis would be needed to determine noise impacts with a cut-and-cover configuration.
- No visual impacts were identified in this section in the Draft EIS/EIR because there would be no visual changes to the existing visual elements in the area. The section is characterized as a “Suburban Residential Landscape Unit” north of the Paramount Boulevard and Rosecrans Avenue intersection and an “Industrial Landscape Unit” south of the intersection with low-rise residential, small-scale commercial, and large-scale commercial uses. “Defiance” by Harold L. Pastorius Jr., a public art sculpture, is part of this landscape unit and is visible at the Paramount Boulevard/Rosecrans Avenue intersection and the surrounding commercial uses. Paramount Park and Paramount High School also adjoin the Pacific Electric ROW in this portion of the landscape unit, in addition to transmission towers that generally parallel the Pacific Electric ROW. The area lacks visual elements that unify the industrial and commercial uses, and the visual quality is characterized as generally inharmonious, disorderly, and incoherent. Therefore, the permanent visual character of the area would not be altered with an underground or trenched configuration.

A cut-and-cover configuration would increase costs by approximately $949 million ($2022) or $1.484 billion ($2035) compared to the Draft EIS/EIR. This cost does not include the cost of additional ROW that could be potentially required for freight impacts to adjacent properties along the San Pedro Subdivision. Refer to Section 4 for more information on cost.

3.5 Flower Street/Woodruff Avenue

This section comprises the LRT alignment at the Flower Street grade crossing and the Woodruff Avenue grade crossing. The potential cut-and-cover configuration would diverge from the Draft EIS/EIR vertical alignment and descend into a trench configuration of approximately 940 feet to the west of the Flower Street and Woodruff Avenue intersection. The alignment would continue into a cut-and-cover tunnel to cross under the Bellflower Bike Trail, Flower Street, and Woodruff Avenue for a total length of 1,026 feet and ascend via an open trench of 814 feet to at-grade east of the crossing south of Woodruff Avenue, where it would match the Draft EIS/EIR design. The horizontal alignment of the below grade configuration would be similar to that of the aerial guideway. Changes to the vertical alignment would increase the LRT design speed from 60 mph to 65 mph compared to the Draft EIS/EIR. The cross section of the cut-and-cover configuration would be slightly wider than that of the aerial guideway, but no new ROW impacts are anticipated. The cut-and-cover configuration would have a similar length as the aerial guideway considered in the Draft EIS/EIR. Retaining walls would be required on each side of the cut-and-cover tunnel.

Unlike other sections considered in the study, there are no freight tracks in the vicinity of this section. The depth of the cut-and-cover is controlled by existing underground crossing utilities, and the design was developed to avoid impacting these major utilities. A summary of the major underground utilities is included in Table 3-5. The cut-and-cover section would be approximately 1,026 feet in length with a maximum depth to top of rail of approximately 23 feet.

Table 3-5. Major Underground Utilities at Flower Street and Woodruff Avenue Section

Item #	Utility	Description	Parallel to Excavation or Crossing Alignment	Conflict (Impact/ No Impact)	Treatment
1	Water	48" Prestressed Concrete Pressure Pipe with 15.2 feet of cover	Crossing	Relocate	Relocate utility
2	Oil	8" Pipe with 4 feet of cover	Crossing	No Impact	Protect-in-place during construction
3	Reclaimed Water	24" Pipe with 12.24 feet of cover	Crossing	No Impact	Protect-in-place during construction.
4	Sewer	60" Reinforced Concrete Pipe with 10 feet of cover	Crossing	No Impact	Protect-in-place during construction.

Source: WSP 2022

Construction of the aerial alignment evaluated in the Draft EIS/EIR would require intermittent full roadway closures, typically at night, where the alignment crosses over Woodruff Avenue and Flower Street (Table 3.51 in the Draft EIS/EIR). Outside the intermittent closures, temporary lane closures and relocations would be required during grade crossing and median construction, with these impacts occurring for 12 to 24 months. In comparison, construction of a cut-and-cover alignment would require excavation where the alignment passes under this intersection, resulting in full and/or partial closure of the roadways while excavation is performed and temporary decking is installed in several weekends.

From an environmental impact standpoint:

- Construction-related traffic would likely increase due to increased excavation quantities, resulting in increased construction-related impacts to air quality and traffic compared to the Draft EIS/EIR.
- The Draft EIS/EIR identified four operational noise impacts after mitigation along this section. Severe impacts would occur at two clusters, and two moderate impacts would occur at two other clusters. LRT noise would be reduced when the alignment is in a cut-and-cover configuration; however, the relatively short cut-and-cover section would limit the area of noise reduction. A complete noise analysis would be needed to verify the noise impacts associated with a cut-and-cover concept.
- A visual impact was identified in this section for the visual analysis under the Draft EIS/EIR design, but Mitigation Measure VA-2 “Relocation of Belle” would reduce the impact to less than significant after mitigation. The “Belle” public art cow statue is located near the intersection of the Bellflower Bike Trail and Woodruff Avenue where the potential cut-and-cover activities are proposed. Similar to construction activities and impacts discussed in the Draft EIS/EIR, cut-and-cover construction activities would still require the removal of “Belle.” Mitigation Measure VA-2 (“Relocation of Belle”) would be implemented, and the City of Bellflower would be able preserve the public art at a city-approved location. The section is characterized as a “Suburban Residential Landscape Unit.” Low-rise residential, small-scale commercial, and large-scale commercial uses are located in this landscape unit. The permanent visual character of the area would not be altered or obstructed, and no aerial structure would be visible along the Bellflower Bike Trail with an underground or trenched section. Therefore, the permanent visual character of the area would not be altered with an underground or trenched section.

A cut-and-cover configuration would increase costs by approximately $28 million ($2022) or $45 million ($2035) compared to the Draft EIS/EIR design. Refer to Section 4 for more information on cost.

3.6 183rd Street/Gridley Road

This section comprises the LRT alignment at the 183rd Avenue/Gridley Road grade crossing. For the cut-and-cover configuration evaluated in this study, the alignment would diverge from the Draft EIS/EIR vertical alignment and descend into a trench configuration approximately 844 feet long in the City of Cerritos to the west of the grade crossing. The alignment would continue into a cut-and-cover tunnel beneath the crossing for 1,983 feet and ascend via an open trench 473 feet long to at-grade east of the crossing in the City of Artesia

where it would rejoin the Draft EIS/EIR proposed alignment. The horizontal alignment would be similar to the Draft EIS/EIR alignment. Changes to the vertical alignment would include an increase in LRT design speeds compared to the Draft EIS/EIR for two curves from 60 to 65 mph. Retaining walls would be required on each side of the cut-and-cover tunnel, with a maximum depth of 17 feet to top of rail.

There are no active freight tracks in this location. The depth of the cut-and-cover alignment is dictated by major underground utilities that would be protected in place by hanging across excavation during construction. A summary of major below-grade utilities is included in Table 3-6. The cut-and-cover configuration would be approximately 20 percent longer than the aerial guideway evaluated in the Draft EIS/EIR in order to reach the depth necessary to avoid impacts to major utilities. Specifically, a 93-inch storm drain and a 10-inch sewer in 36-inch steel pipe are the two gravity-fed utilities driving the depth of the alignment, with a minimum 5 feet of clearance between the top of the cut-and-cover structure and bottom of utility. The cut-and-cover alignment would have a maximum depth to top of rail of 39.5 feet. There are no known major underground utilities running parallel to this alignment.

Table 3-6. Underground Utilities at 183rd Street and Gridley Road

Item #	Utility	Description	Parallel to Excavation or Crossing Alignment	Conflict (Impact/ No Impact)	Treatment
1	Storm Drain	93" Reinforced Concrete Pipe	Crossing	No Impact	Protect-in-place during construction
2	Gas	4" Gas Line with 4.84' of Cover	Crossing	No Impact	Protect-in-place during construction
3	Sewer	10" Vitrified Clay Pipe in 36" Steel	Crossing	No Impact	Protect-in-place during construction
4	Water	12" Ductile Iron Pipe with 6.16' of Cover	Crossing	No Impact	Protect-in-place during construction
5	Water	6" Cast Iron Pipe with 7.33' of Cover	Crossing	No Impact	Protect-in-place during construction

Source: Jacobs 2022

Construction of the aerial alignment evaluated in the Draft EIS/EIR would require intermittent full roadway closures, typically at night, where the alignment crosses over 183rd Street and Gridley Road (Table 3.51 in the Draft EIS/EIR). Outside the intermittent closures, temporary lane closures and relocations would be required during grade crossing and median construction, with these impacts occurring for 12 to 24 months. In comparison, construction of a cut-and-cover alignment would require excavation where the alignment passes under this intersection, resulting in full and/or partial closure of the roadways while initial excavation is performed and temporary decking is installed in several weekends.

The alignment through the cut-and-cover section would be configured to allow for a potential future station at 183rd Street and Gridley Road with side platforms centered beneath the crossing. Side platforms were chosen to reduce the footprint of the cut-and-cover section,

which would be wider if a center platform configuration was selected. Because this location would be designed to allow for the addition of a potential future station, multiple construction activities, such as advance station utility relocation, soil stabilization, and additional excavation for a future station, are assumed to occur during construction of the cut-and-cover section in order to minimize service disruption if the station is added in the future after the start of revenue service. Adding these elements would increase the duration of construction at this location as well as cost, but service disruption and future costs would be reduced. The cross section of the cut-and-cover alignment would be slightly wider than that of the aerial guideway, but no new ROW impacts are anticipated.

From an environmental impact standpoint:

- Construction-related traffic would likely increase due to increased excavation quantities, resulting in increased construction-related impacts to air quality and traffic compared to the Draft EIS/EIR.
- The Draft EIS/EIR identified 13 operational noise impacts after mitigation along this section of the alignment. Severe impacts were identified at eight clusters, and moderate impacts were identified at five clusters. A cut-and-cover configuration would reduce LRT operational noise; however, a complete noise analysis would be needed to determine the noise impacts associated with this concept.
- No visual impacts were identified in this section in the Draft EIS/EIR because there are no scenic resources. The section is characterized as an "Suburban Residential Landscape Unit" with low-rise residential, small-scale commercial, and large-scale commercial uses. The area lacks visual elements that unify the industrial and commercial uses, and the visual quality is characterized as generally inharmonious, disorderly, and incoherent. Therefore, the permanent visual character of the area would not be altered with an underground or trenched configuration.

A cut-and-cover configuration with a station would increase costs by approximately $747 million ($2022) or $1.169 billion ($2035) compared to the Draft EIS/EIR. A cut-and-cover configuration without a station would increase costs by approximately $296 million ($2022) or $462 million ($2035). Refer to Section 4 for more information on cost.

4 COST SUMMARY

4.1 Cost Estimate Overview

The methodology used for preparing the high-level cost summary is generally consistent with the estimates developed for the Draft EIS/EIR, as summarized in the WSAB Transit Corridor Project Final Advanced Conceptual Engineering Capital Cost Report (Metro 2021), included as Appendix P of the Draft EIS/EIR. The preparation of estimates follows Federal Transit Administration (FTA) guidelines, which are appropriate for transit projects when FTA is the federal lead agency. Unlike the Draft EIS/EIR, the level of design for this cut-and-cover study was not completed to a 15 percent level, so certain design information that would include additional detail to inform cost estimates was not developed. ROW costs were also not included in the cost estimate development and would need to be included if cut-and-cover design moves forward. Freight and utility protection costs were included in the cut-and-cover estimates because additional protection would be needed when excavation occurs. Because of the lower level of design, contingency was increased compared to the Draft EIS/EIR. The

amount of allocated contingency depends on the stage of engineering completion and typically decreases as design advances. For this study, allocated contingency was assumed at 30 percent for Standard Cost Category Codes 10-50, as shown in Table 4-1. Allocated contingency was assumed at 40 percent for Site Utilities and Utility Relocation due to the low level of utility studies. Table 4-1 also identifies the allocated contingency from the Draft EIS/EIR. Unallocated contingency was increased from the Draft EIS/EIR for this study to 15 percent because of the lower level of design, and therefore, greater unknowns.

Table 4-1. Contingency Percentages

FTA SCC No.	Description	Draft EIS/EIR Contingency Percentage	Cut-and-Cover Study Contingency Percentage
10	Guideway and Track Elements		
	Guideway Elements (Except Underground)	25	30
	Guideway Elements (Underground)	25	30
	Track Elements	25	30
20	Stations, Stops, Terminals, and Intermodal	25	30
40	Sitework and Special Conditions		
	Demolition, Clearing, and Earthwork	25	30
	Site Utilities and Utility Relocation	25	40
	Hazardous Materials, Contaminated Soil Removal/Mitigation, and Groundwater Treatments	25	30
	Environmental Mitigation (e.g., Wetlands, Historic/Archaeological, and Parks)	25	30
	Site Structures, including Retaining Walls and Sound Walls	25	30
	Pedestrian/Bike Access and Accommodation, including Landscaping	25	30
	Automobile, Bus, and Van Access, including Roads and Parking Lots	25	30
50	Systems	25	30
80	Professional Services (applies to Categories 10-50)	0	0
90	Unallocated Contingency	10	15

Source: Metro 2021, Lenax 2022
Notes: EIS/EIR = Environmental Impact Statement/Environmental Impact Report; FTA = Federal Transit Administration; ROW = right-of-way; SCC = Standard Cost Category

4.2 Estimate Results

As described in Section 3, each of the cut-and-cover sections studied would increase costs compared to the aerial configuration in the Draft EIS/EIR. Cost increases vary depending on

the section, as each section with a potential underground station would result in substantially more cost than sections without an underground station. Draft EIS/EIR cost estimates were produced using 2020 dollars, but each section studied was extracted from the Draft EIS/EIR cost estimate and escalated to 2022 dollars to provide an equal comparison. 2022 dollars were used in order to analyze the cost differences in current dollars. Estimates were also escalated to 2035 dollars to understand the year of expenditure cost differences. Table 4-2 identifies each of the costs that would be added if a cut-and-cover configuration is chosen.

Table 4-2. Cut-and-Cover Cost for Each Section ($2022)

Section	Name	Length	Underground Station	Cost Increase ($2022) (rounded to nearest million)	Year of Expenditure Cost Increase ($2035) (rounded to nearest million)
1	Randolph Street Curve	2,190 feet/ 0.41 mile	No	$30 million	$47 million
2	Firestone Station	4,100 feet/ 0.78 mile	Yes	$813 million	$1,272 million
3	Imperial Highway and Garfield Avenue	3,262 feet/ 0.62 mile	No	$102 million	$159 million
4	Paramount	7,388 feet/ 1.40 miles	Yes	$949 million	$1,484 million
5	Flower Street/Woodruff Avenue	2,971 feet/ 0.56 mile	No	$28 million	$45 million
6a	183rd Street/Gridley Avenue	3,300 feet/ 0.63 mile	Not to Preclude	$296 million	$462 million
6b	183rd Street/Gridley Avenue[1]	3,300 feet/ 0.63 mile	Yes	$747 million	$1,169 million
All sections, without station at 183rd Street/Gridley Avenue[2]		23,211 feet/ 4.40 miles	2 stations	$2,218 million	$3,469 million
All sections, with station at 183rd Street/Gridley Avenue[3]		23,211 feet/ 4.40 miles	3 stations	$2,670[2] million	$4,176 million

Source: Lenax 2022

Notes:

[1:] The Draft EIS/EIR alignment at 183rd/Gridley was designed not to preclude a future aerial station. For the 183rd Street/Gridley Avenue with station option, this study assumes an aerial station for comparison with the cut-and-cover underground station, with station elements and cost consistent to other proposed aerial stations.

[2:] When applying an expected accuracy range appropriate for this study, which is between -30% to +50%, the resulting cost increase would be between $1.553 billion and $3.327 billion, respectively.

[2:] When applying an expected accuracy range appropriate for this study, which is between -30% to +50%, the resulting cost increase would be between $1.869 billion and $4.005 billion, respectively.

While each of the cut-and-cover sections would increase costs, sections with a proposed underground station would all require cost increases above $700 million ($2022), and sections without a proposed or future underground station would all require cost increases near or below $100 million ($2022). Year of Expenditure costs are also included for reference,

as the construction end date would be the conservative estimate for the true cost to Metro. The Association for the Advancement of Cost Engineering expected accuracy range for a Class 4 Study, which is between 1 percent and 15 percent level of design, ranges from -30 percent to +50 percent. When applying this range to the cost estimates, the total cost increase in 2022 dollars for implementation of all cut-and-cover sections without a station at 183rd and Gridley Avenue would range from $1.553 billion to $3.327 billion. The cost increase for all sections with a station at 183rd and Gridley Avenue would range from $1.869 billion to $4.005 billion. Refer to Appendix B, Cost Estimates, for detailed cost estimates beyond the overall summary shown in Table 4-2.

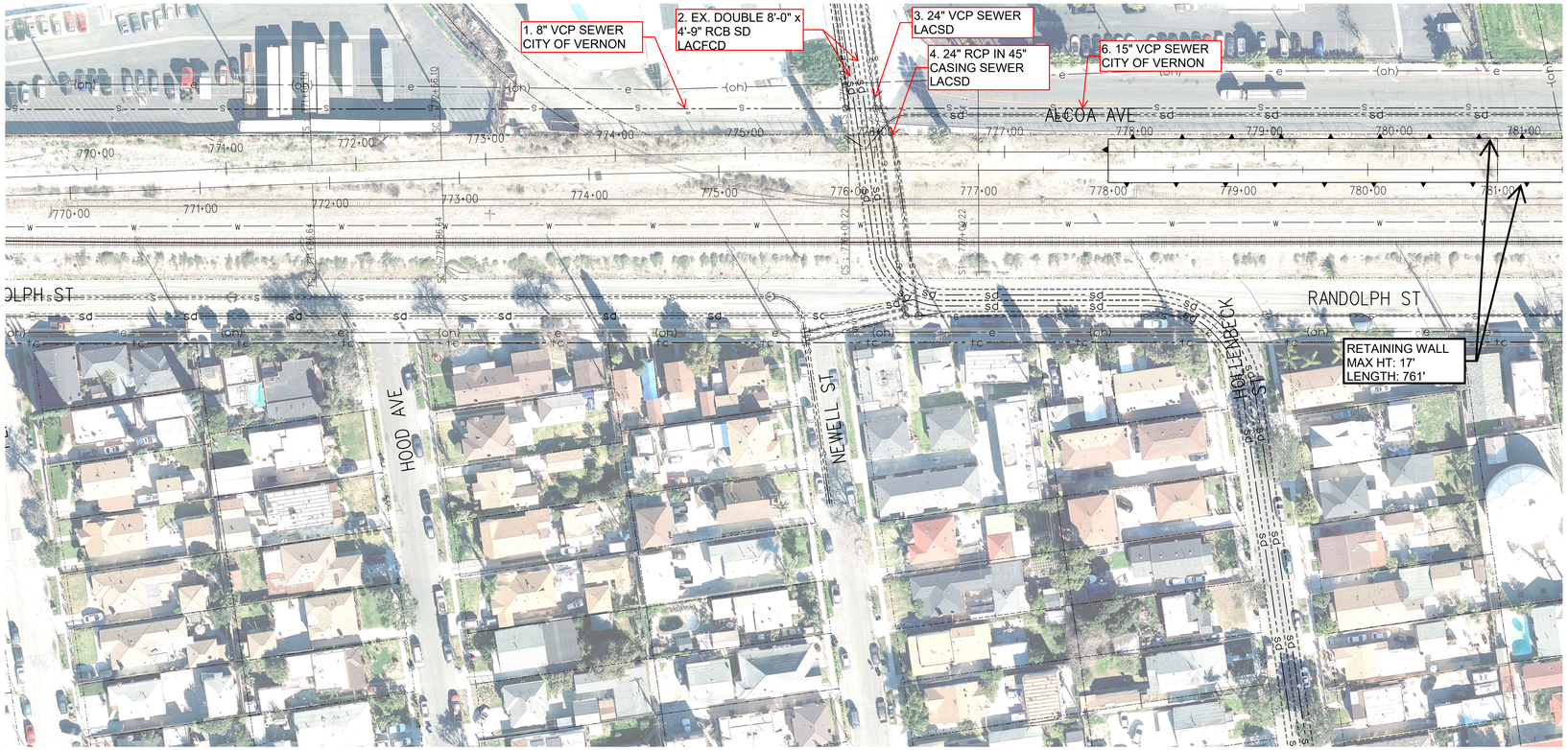
5 CONCLUSIONS

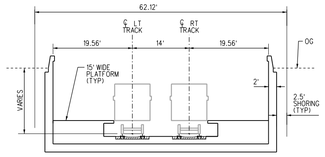
The design for each of the sections analyzed as part of this study was largely dictated by utility considerations. Protecting utilities in place is preferable to relocation from a cost and construction impact standpoint, particularly for larger utilities. Additionally, four of the six sections also have active freight lines directly adjacent to the alignment, which increases the complexity of construction and could increase ROW needs.

Operationally, some unmitigated noise impacts identified in the Draft EIS/EIR would likely be reduced with a cut-and-cover scenario; however, detailed noise assessments would be required. Construction-related traffic would likely increase due to increased excavation quantities, resulting in increased construction-related impacts to air quality and traffic compared to the Draft EIS/EIR.

As shown in Table 4-2, each cut-and-cover section evaluated in this study would increase costs compared to the Draft EIS/EIR design. The approximate total cost difference when escalated to Year of Expenditure dollars would range from approximately $3.469 billion to $4.176 billion depending on whether the future station at 183rd Street and Gridley Road is included in the cost.

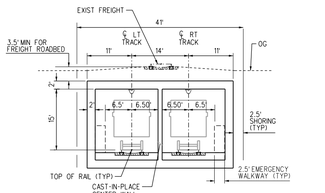
APPENDIX A – PLAN AND PROFILES





TYPICAL STATION - OPEN TRENCH

SCALE: NTS



TYPICAL CUT AND COVER WITH FREIGHT ABOVE

SCALE: NTS

NOTES:

1. UTILITY INFORMATION IS IN PRELIMINARY STAGES, LOCATIONS AND ELEVATIONS TO BE CONFIRMED.
2. STRUCTURAL TYPE AND SIZING IN PRELIMINARY STAGES, TO BE REFINED.

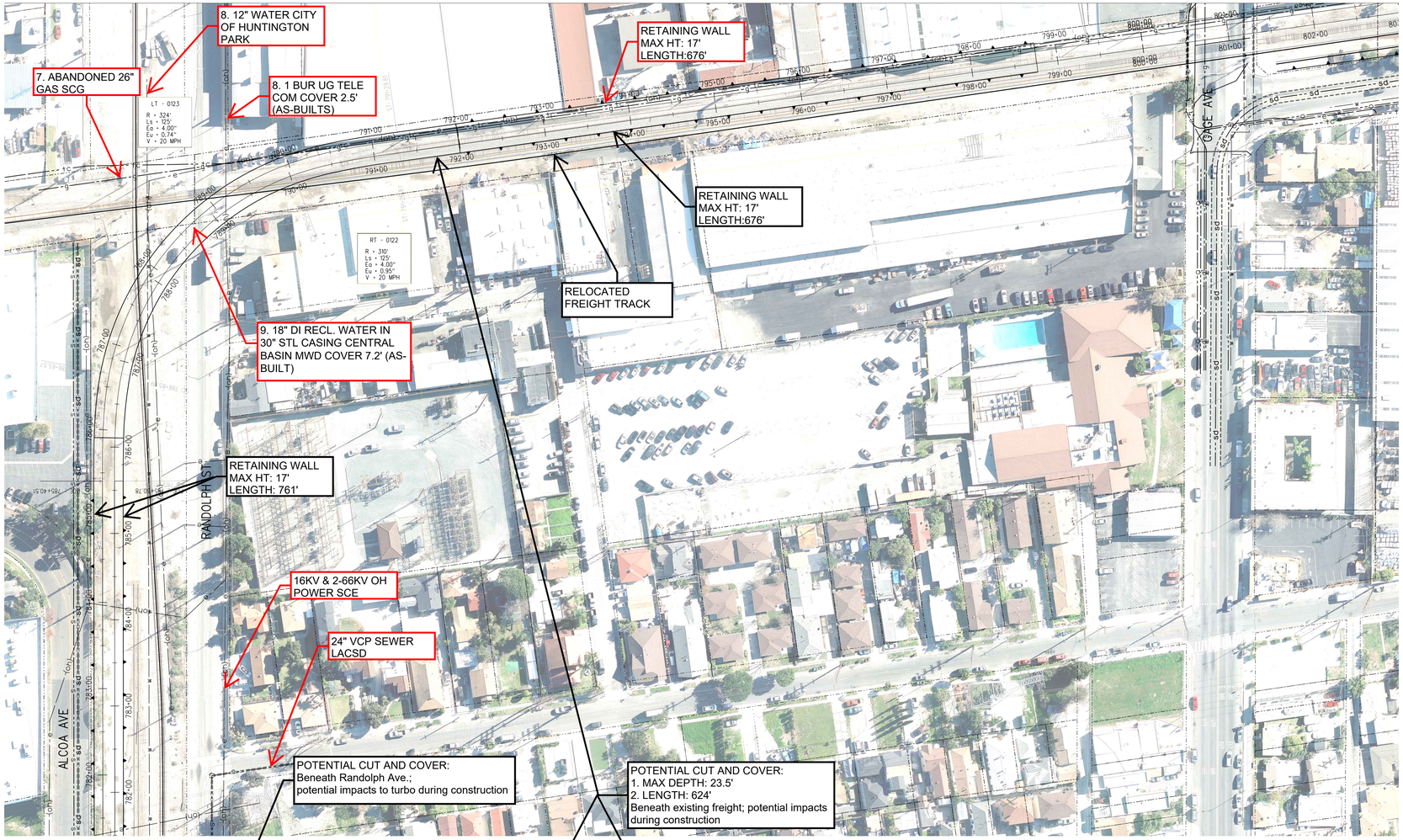
40' 20' 0 40' 80'

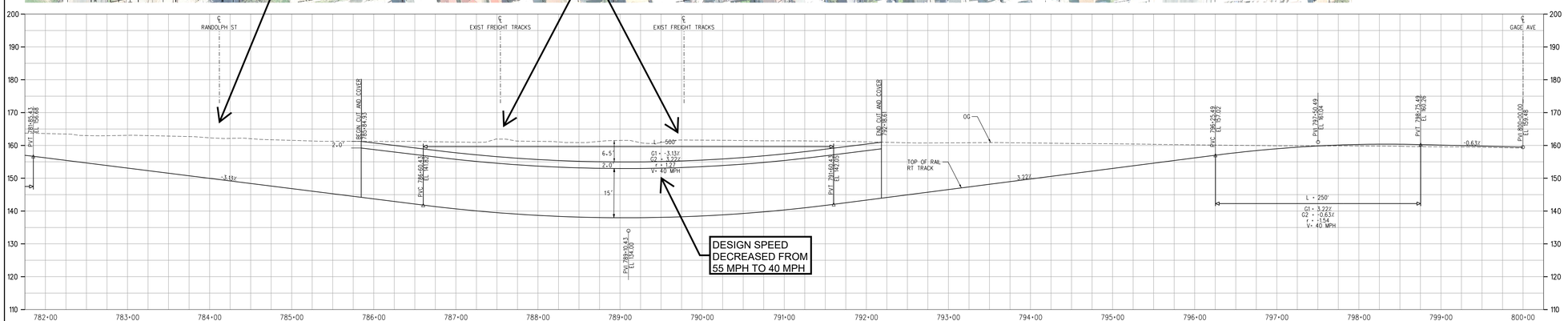
HORIZ: 1"=80'

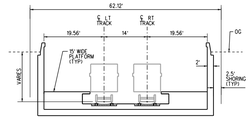
RANDOLPH STREET

CUT AND COVER STUDY
WEST SANTA ANA BRANCH TRANSIT CORRIDOR

DRAFT 07.07.22

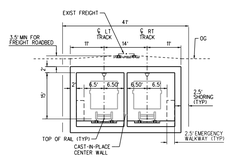






TYPICAL STATION - OPEN TRENCH

SCALE: NTS



TYPICAL CUT AND COVER WITH FREIGHT ABOVE

SCALE: NTS

NOTES:

1. UTILITY INFORMATION IS IN PRELIMINARY STAGES, LOCATIONS AND ELEVATIONS TO BE CONFIRMED.
2. STRUCTURAL TYPE AND SIZING IN PRELIMINARY STAGES, TO BE REFINED.

40' 20' 0 40' 80'

HORIZ: 1"=80'

RANDOLPH STREET

CUT AND COVER STUDY

WEST SANTA ANA BRANCH TRANSIT CORRIDOR

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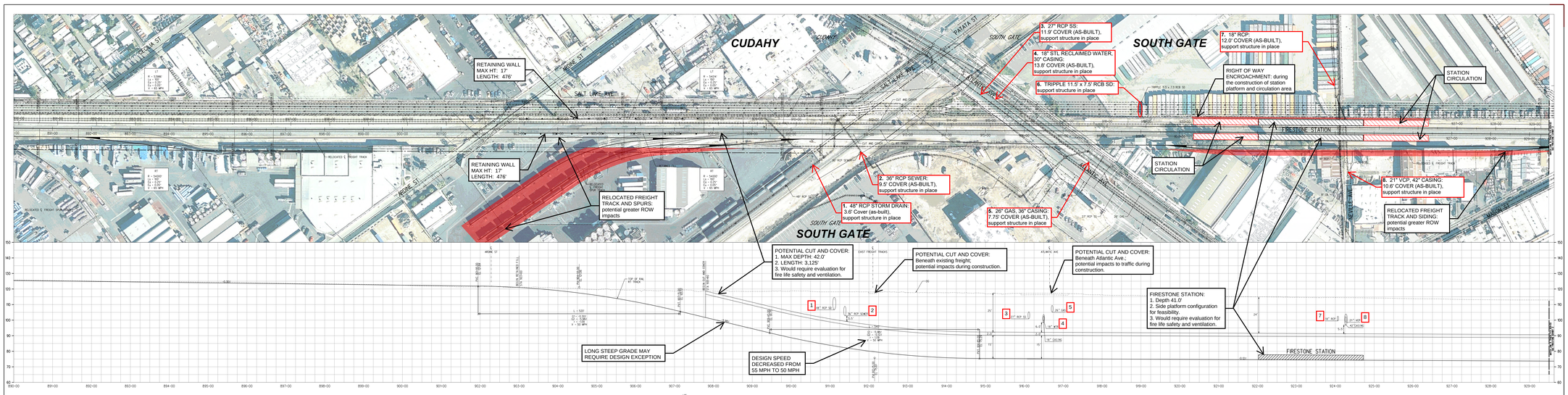
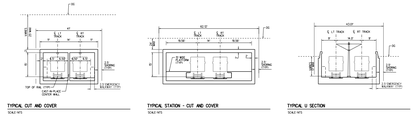




NOTES:

1. UTILITY INFORMATION IS IN PRELIMINARY STAGES, LOCATIONS AND ELEVATIONS TO BE CONFIRMED.
2. STRUCTURAL TYPE AND SIZING IN PRELIMINARY STAGES, TO BE REFINED.

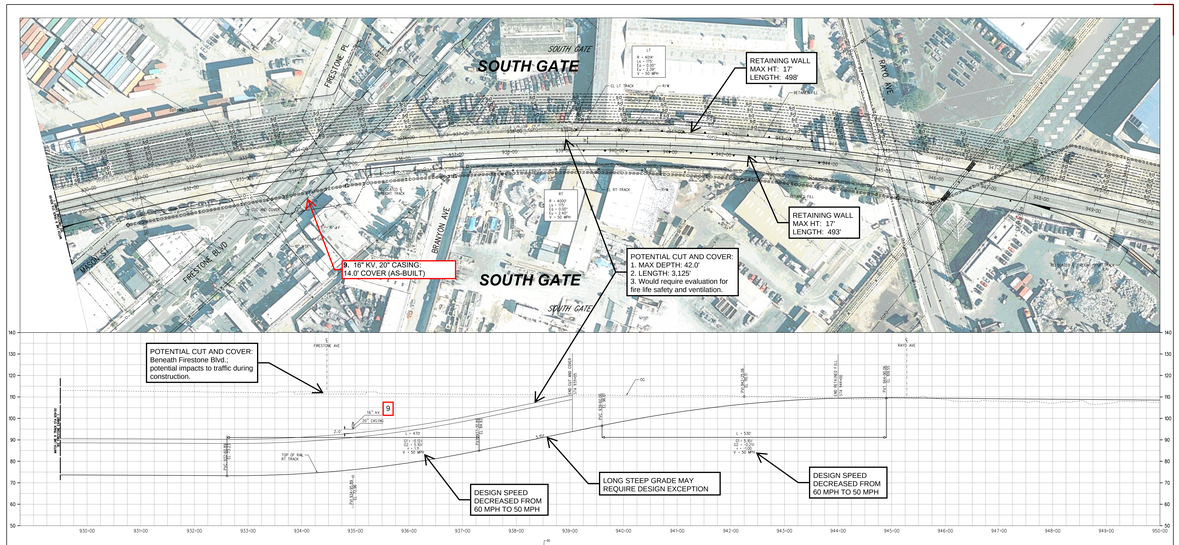
HORIZ: 1"=80'

FIRESTONE BOULEVARD

CUT AND COVER STUDY – EXHIBIT 1 OF 2

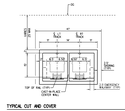
WEST SANTA ANA BRANCH TRANSIT CORRIDOR

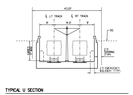
DRAFT 5.31.22



FIRESTONE BOULEVARD

CUT AND COVER STUDY – EXHIBIT 2 OF 2
WEST SANTA ANA BRANCH TRANSIT CORRIDOR

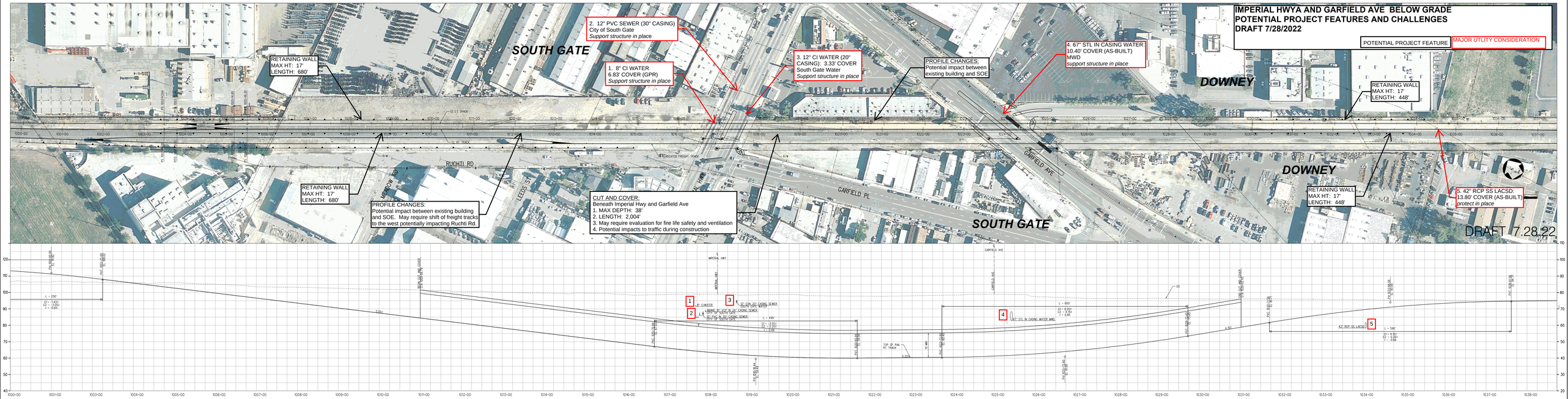




NOTES:

1. UTILITY INFORMATION IS IN PRELIMINARY STAGES, LOCATIONS AND ELEVATIONS TO BE CONFIRMED.
2. STRUCTURAL TYPE AND SIZING IN PRELIMINARY STAGES, TO BE REFINED.

DRAFT 5.31.22



IMPERIAL HWY AND GARFIELD AVE

CUT AND COVER STUDY

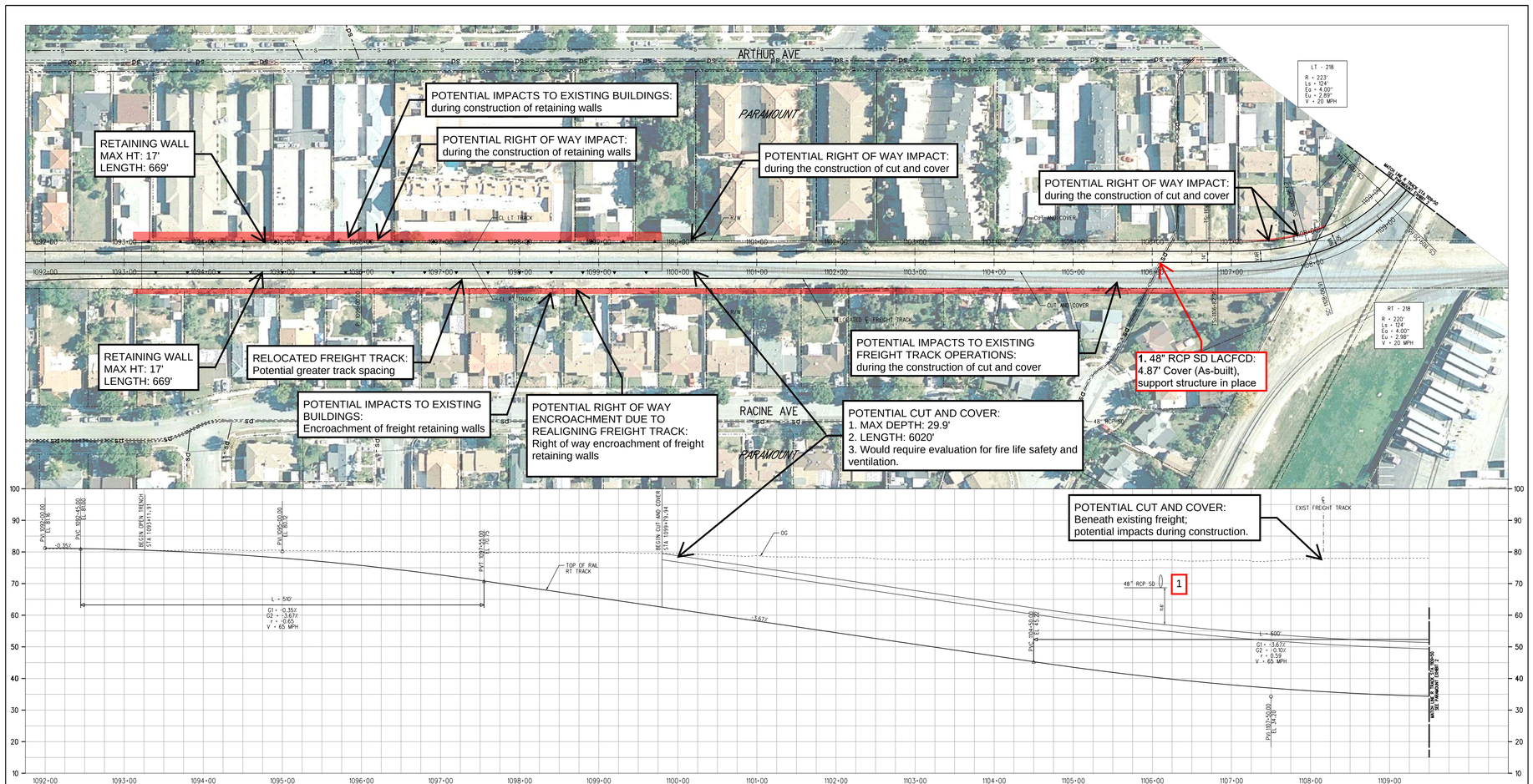
WEST SANTA ANA BRANCH TRANSIT CORRIDOR

NOTES:

1. UTILITY INFORMATION IS IN PRELIMINARY STAGES, LOCATIONS AND ELEVATIONS TO BE CONFIRMED.
2. STRUCTURAL TYPE AND SIZING IN PRELIMINARY STAGES, TO BE REFINED.

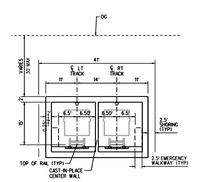
HORIZ 1"=80'

DRAFT 7.28.22

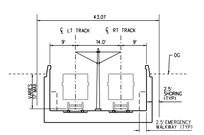


NOTES:

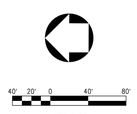
1. UTILITY INFORMATION IS IN PRELIMINARY STAGES, LOCATIONS AND ELEVATIONS TO BE CONFIRMED.
2. STRUCTURAL TYPE AND SIZING IN PRELIMINARY STAGES, TO BE REFINED.



TYPICAL CUT AND COVER
SCALE: NTS



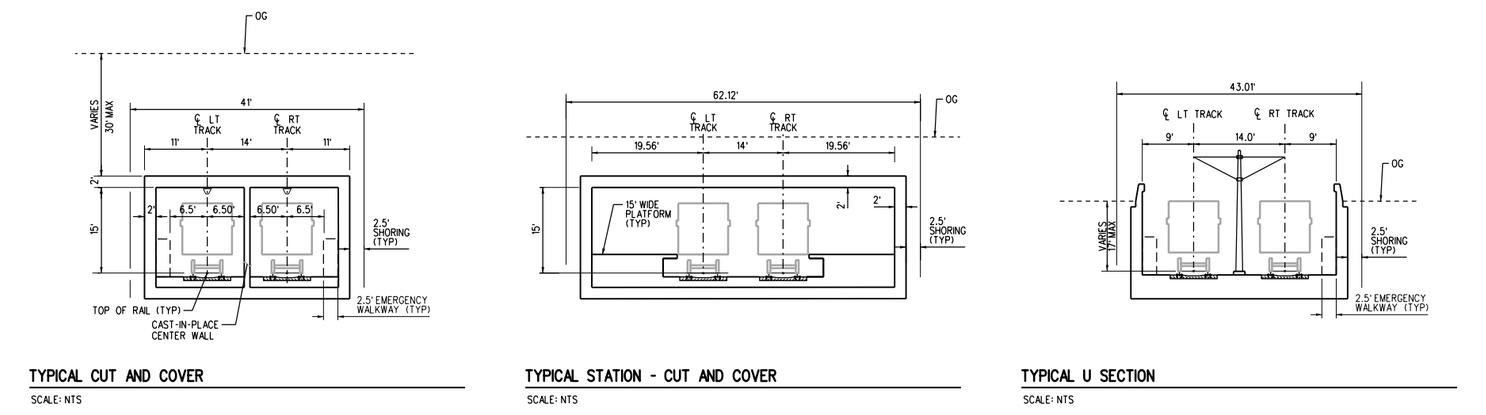
TYPICAL U SECTION
SCALE: NTS



PARAMOUNT

CUT AND COVER STUDY – EXHIBIT 1 OF 2
WEST SANTA ANA BRANCH TRANSIT CORRIDOR

DRAFT 7.14.22



PARAMOUNT

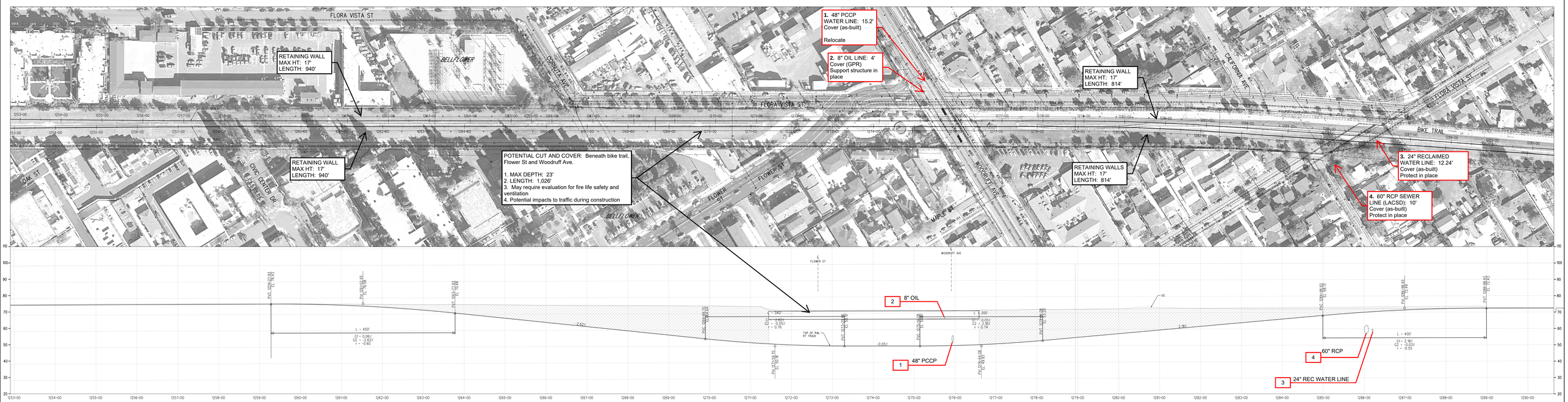
CUT AND COVER STUDY – EXHIBIT 2 OF 2

WEST SANTA ANA BRANCH TRANSIT CORRIDOR

NOTES:

1. UTILITY INFORMATION IS IN PRELIMINARY STAGES, LOCATIONS AND ELEVATIONS TO BE CONFIRMED.
2. STRUCTURAL TYPE AND SIZING IN PRELIMINARY STAGES, TO BE REFINED.

DRAFT 7.14.22



FLOWER ST AND WOODRUFF AVE

CUT AND COVER STUDY

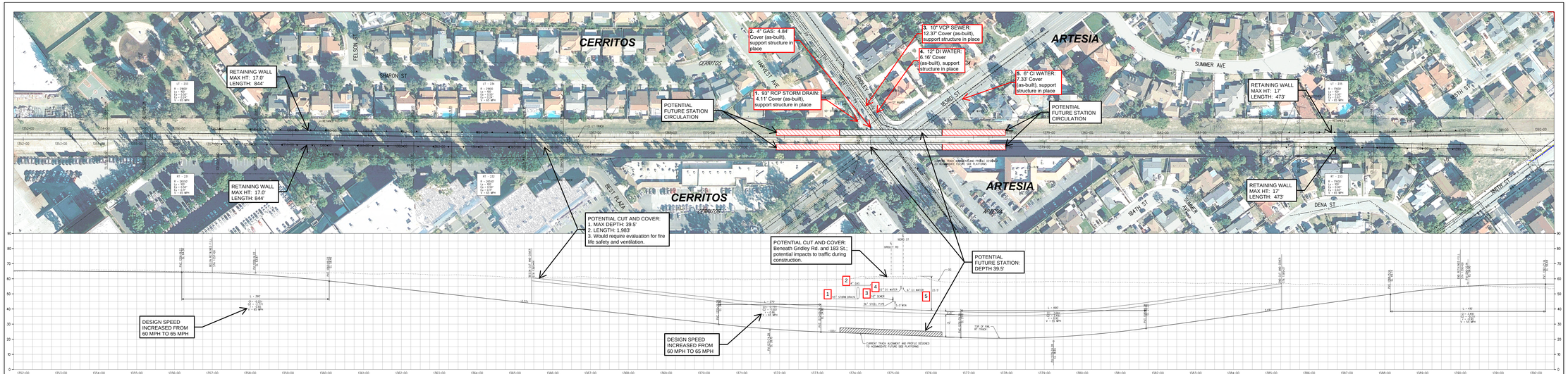
WEST SANTA ANA BRANCH TRANSIT CORRIDOR

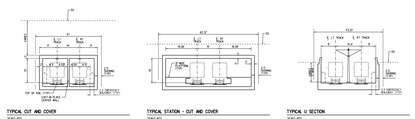
NOTES:

1. UTILITY INFORMATION IS IN PRELIMINARY STAGES, LOCATIONS AND ELEVATIONS TO BE CONFIRMED.
2. STRUCTURAL TYPE AND SIZING IN PRELIMINARY STAGES, TO BE REFINED.

HORZ: 1"=80'

DRAFT 5.17.22





183RD STREET AND GRIDLEY AVENUE

CUT AND COVER STUDY
WEST SANTA ANA BRANCH TRANSIT CORRIDOR

NOTES:

1. UTILITY INFORMATION IS IN PRELIMINARY STAGES, LOCATIONS AND ELEVATIONS TO BE CONFIRMED.
2. STRUCTURAL TYPE AND SIZING IN PRELIMINARY STAGES, TO BE REFINED.

HORIZ: 1"=80'

DRAFT 6.30.22

APPENDIX B – COST ESTIMATES

Revised Cost Estimates 12/8/22 - 30% Allocated Contingency and 15% Unallocated Contingency								
COMPARISON TABLE ACE v. CUT-AND-COVER STUDY ($2020)				2022 Escalation				Escalation to 2035
	Alignment Length (RF)	ACE Grade Separation Option	Cut-and-Cover Study	ACE Grade Separation Option	Cut-and-Cover Study	Delta		From 2022 @
								3.50%
183rd & Gridley Ave. With Station	3300	$185,092,875	$805,370,760	$223,038,256	$970,477,605	$747,439,348		$1,168,962,299
183rd & Gridley Ave. Without Station	3300	$134,619,375	$380,017,960	$162,217,323	$457,924,397	$295,707,074		$462,472,871
Firestone Blvd.	4100	$223,288,175	$898,041,325	$269,063,870	$1,082,146,307	$813,082,438		$1,271,625,206
Flower St. & Woodruff Ave.	2971	$98,902,375	$122,546,760	$119,178,079	$147,669,734	$28,491,655		$44,559,697
Imperial Hwy & Garfield Ave	3262	$113,081,375	$197,515,720	$136,263,877	$238,007,875	$101,743,998		$159,123,142
Paramount Blvd. & Rosecrans Blvd.	7388	$348,910,375	$1,136,491,985	$420,439,531	$1,369,481,081	$949,041,550		$1,484,259,284
Randolph St.	2190	$78,755,050	$103,682,620	$94,900,406	$124,938,309	$30,037,903		$46,977,960

Total (with not to preclude 183rd/Gridley Station):	$2,218,104,618		$3,469,018,159
Total (with 183rd/Gridley Station:	$2,669,836,892		$4,175,507,587

Escalation	
1/2020 to 1/2021	7.00%
1/2021 to 1/2022	7.00%
1/2022 to 9/2022	5.25%

MAIN WORKSHEET-BUILD ALTERNATIVE

West Santa Ana Branch Transit Corridor
Environmental Study
Randolph St. Grade Separation Option
(From 776+85.43 To 798+75.49)

Today's Date 11/28/22
Yr of Base Year $ 2020
Yr of Revenue Ops 2035

	Quantity	Base Year Dollars w/o Contingency (X000)	Base Year Dollars Allocated Contingency (X000)	Base Year Dollars TOTAL (X000)	Base Year Dollars Unit Cost (X000)	Base Year Dollars Percentage of Construction Cost	Base Year Dollars Percentage of Total Project Cost	YOE Dollars Total (X000)
10 GUIDEWAY & TRACK ELEMENTS (route miles)	**0.41**	24,087	6,022	**30,109**	**$72,589**	**57%**	**38%**	**0**
10.01 Guideway: At-grade exclusive right-of-way	0.00	0	0	0				0
10.02 Guideway: At-grade semi-exclusive (allows cross-traffic)	0.00	0	0	0				0
10.03 Guideway: At-grade in mixed traffic	0.00	0	0	0				0
10.04 Guideway: Aerial structure	0.11	9,720	2,430	12,150	$106,920			0
10.05 Guideway: Built-up fill	0.30	12,561	3,140	15,701	$52,138			0
10.06 Guideway: Underground cut & cover	0.00	0	0	0				0
10.07 Guideway: Underground tunnel	0.00	0	0	0				0
10.08 Guideway: Retained cut or fill	0.00	0	0	0				0
10.09 Track: Direct fixation	0.11	582	146	728	$6,402			0
10.10 Track: Embedded	0.00	0	0	0				0
10.11 Track: Ballasted	0.30	1,224	306	1,530	$5,081			0
10.12 Track: Special (switches, turnouts)		0	0	0				0
10.13 Track: Vibration and noise dampening		0	0	0				0
20 STATIONS, STOPS, TERMINALS, INTERMODAL (number)	**0**	0	0	**0**		**0%**	**0%**	**0**
20.01 At-grade station, stop, shelter, mall, terminal, platform	0	0	0	0				0
20.02 Aerial station, stop, shelter, mall, terminal, platform	0	0	0	0				0
20.03 Underground station, stop, shelter, mall, terminal, platform	0	0	0	0				0
20.04 Other stations, landings, terminals: Intermodal, ferry, trolley, etc.	0	0	0	0				0
20.05 Joint development	0	0	0	0				0
20.06 Automobile parking multi-story structure	0	0	0	0				0
20.07 Elevators, escalators	0	0	0	0				0
30 SUPPORT FACILITIES: YARDS, SHOPS, ADMIN. BLDGS	0.41	0	0	**0**	$0	**0%**	**0%**	**0**
30.01 Administration Building: Office, sales, storage, revenue counting		0	0	0				0
30.02 Light Maintenance Facility		0	0	0				0
30.03 Heavy Maintenance Facility		0	0	0				0
30.04 Storage or Maintenance of Way Building		0	0	0				0
30.05 Yard and Yard Track		0	0	0				0
40 SITEWORK & SPECIAL CONDITIONS	0.41	5,930	1,483	**7,413**	$17,871	**14%**	**9%**	**0**
40.01 Demolition, Clearing, Earthwork		1,871	468	2,339				0
40.02 Site Utilities, Utility Relocation		1,402	351	1,753				0
40.03 Haz. mat'l, contam'd soil removal/mitigation, ground water treatments		416	104	520				0
40.04 Environmental mitigation, e.g. wetlands, historic/archeologic, parks		175	44	219				0
40.05 Site structures including retaining walls, sound walls		621	155	776				0
40.06 Pedestrian / bike access and accommodation, landscaping		1,445	361	1,806				0
40.07 Automobile, bus, van accessways including roads, parking lots		0	0	0				0
40.08 Temporary Facilities and other indirect costs during construction		0	0	0				0
50 SYSTEMS	0.41	12,221	3,055	**15,276**	$36,829	**29%**	**19%**	**0**
50.01 Train control and signals		3,723	931	4,654				0
50.02 Traffic signals and crossing protection		0	0	0				0
50.03 Traction power supply: substations		0	0	0				0
50.04 Traction power distribution: catenary and third rail		1,993	498	2,491				0
50.05 Communications		6,505	1,626	8,131				0
50.06 Fare collection system and equipment		0	0	0				0
50.07 Central Control		0	0	0				0
Construction Subtotal (10 - 50)	0.41	42,238	10,560	**52,798**	$127,289	**100%**	**67%**	**0**
60 ROW, LAND, EXISTING IMPROVEMENTS	0.41	0	0	**0**	$0		**0%**	**0**
60.01 Purchase or lease of real estate		0	0	0				0
60.02 Relocation of existing households and businesses		0	0	0				0
70 VEHICLES (number)	**0**	0	0	**0**			**0%**	**0**
70.01 Light Rail	0	0	0	0				0
70.02 Heavy Rail	0	0	0	0				0
70.03 Commuter Rail	0	0	0	0				0
70.04 Bus	0	0	0	0				0
70.05 Other	0	0	0	0				0
70.06 Non-revenue vehicles	0	0	0	0				0
70.07 Spare parts	0	0	0	0				0
80 PROFESSIONAL SERVICES (applies to Cats. 10-50)	0.41	18,798	0	**18,798**	**$45,320**	**36%**	**24%**	**0**
80.01 Project Development		3,696		3,696				0
80.02 Engineering		4,224		4,224				0
80.03 Project Management for Design and Construction		5,280		5,280				0
80.04 Construction Administration & Management		2,640		2,640				0
80.05 Professional Liability and other Non-Construction Insurance		53		53				0
80.06 Legal; Permits; Review Fees by other agencies, cities, etc.		1,954		1,954				0
80.07 Surveys, Testing, Investigation, Inspection		106		106				0
80.08 Start up		845		845				0
Subtotal (10 - 80)	0.41	61,036	10,560	**71,596**	**$172,609**		**91%**	**0**
90 UNALLOCATED CONTINGENCY				**7,160**			**9%**	**0**
Subtotal (10 - 90)	0.41			**78,755**	**$189,870**		**100%**	**0**
100 FINANCE CHARGES				**0**			**0%**	**0**
Total Project Cost (10 - 100)	0.41			**78,755**	**$189,870**		**100%**	**0**
Allocated Contingency as % of Base Yr Dollars w/o Contingency				17.30%				
Unallocated Contingency as % of Base Yr Dollars w/o Contingency				11.73%				
Total Contingency as % of Base Yr Dollars w/o Contingency				29.03%				
Unallocated Contingency as % of Subtotal (10 - 80)				10.00%				
YOE Construction Cost per Mile (X000)								$0
YOE Total Project Cost per Mile Not Including Vehicles (X000)								$0
YOE Total Project Cost per Mile (X000)								$0

MAIN WORKSHEET-BUILD ALTERNATIVE

West Santa Ana Branch Transit Corridor
Environmental Study
Firestone Blvd. Grade Separation Option
(From 903+00.00 To 944+00.00)

Today's Date 11/28/22
Yr of Base Year $ 2020
Yr of Revenue Ops 2035

	Quantity	Base Year Dollars w/o Contingency (X000)	Base Year Dollars Allocated Contingency (X000)	Base Year Dollars TOTAL (X000)	Base Year Dollars Unit Cost (X000)	Base Year Dollars Percentage of Construction Cost	Base Year Dollars Percentage of Total Project Cost	YOE Dollars Total (X000)
10 GUIDEWAY & TRACK ELEMENTS (route miles)	**0.78**	46,803	11,701	**58,504**	**$75,341**	**39%**	**26%**	**0**
10.01 Guideway: At-grade exclusive right-of-way	0.01	100	25	125	$13,200			0
10.02 Guideway: At-grade semi-exclusive (allows cross-traffic)	0.00	0	0	0				0
10.03 Guideway: At-grade in mixed traffic	0.00	0	0	0				0
10.04 Guideway: Aerial structure	0.26	22,016	5,504	27,520	$106,921			0
10.05 Guideway: Built-up fill	0.51	21,258	5,315	26,573	$52,138			0
10.06 Guideway: Underground cut & cover	0.00	0	0	0				0
10.07 Guideway: Underground tunnel	0.00	0	0	0				0
10.08 Guideway: Retained cut or fill	0.00	0	0	0				0
10.09 Track: Direct fixation	0.26	1,318	330	1,648	$6,401			0
10.10 Track: Embedded	0.00	0	0	0				0
10.11 Track: Ballasted	0.52	2,111	528	2,639	$5,083			0
10.12 Track: Special (switches, turnouts)		0	0	0				0
10.13 Track: Vibration and noise dampening		0	0	0				0
20 STATIONS, STOPS, TERMINALS, INTERMODAL (number)	**1**	20,578	5,145	**25,723**	**$25,723**	**17%**	**12%**	**0**
20.01 At-grade station, stop, shelter, mall, terminal, platform	0	0	0	0				0
20.02 Aerial station, stop, shelter, mall, terminal, platform	1	15,796	3,949	19,745	$19,745			0
20.03 Underground station, stop, shelter, mall, terminal, platform	0	0	0	0				0
20.04 Other stations, landings, terminals: Intermodal, ferry, trolley, etc.	0	0	0	0				0
20.05 Joint development	0	0	0	0				0
20.06 Automobile parking multi-story structure	0	0	0	0				0
20.07 Elevators, escalators	4	4,782	1,196	5,978	$1,494			0
30 SUPPORT FACILITIES: YARDS, SHOPS, ADMIN. BLDGS	0.78	0	0	**0**	$0	**0%**	**0%**	**0**
30.01 Administration Building: Office, sales, storage, revenue counting		0	0	0				0
30.02 Light Maintenance Facility		0	0	0				0
30.03 Heavy Maintenance Facility		0	0	0				0
30.04 Storage or Maintenance of Way Building		0	0	0				0
30.05 Yard and Yard Track		0	0	0				0
40 SITEWORK & SPECIAL CONDITIONS	0.78	16,994	4,249	**21,243**	$27,356	**14%**	**10%**	**0**
40.01 Demolition, Clearing, Earthwork		3,502	876	4,378				0
40.02 Site Utilities, Utility Relocation		2,624	656	3,280				0
40.03 Haz. mat'l, contam'd soil removal/mitigation, ground water treatments		779	195	974				0
40.04 Environmental mitigation, e.g. wetlands, historic/archeologic, parks		328	82	410				0
40.05 Site structures including retaining walls, sound walls		39	10	49				0
40.06 Pedestrian / bike access and accommodation, landscaping		9,722	2,431	12,153				0
40.07 Automobile, bus, van accessways including roads, parking lots		0	0	0				0
40.08 Temporary Facilities and other indirect costs during construction		0	0	0				0
50 SYSTEMS	0.78	35,382	8,846	**44,228**	$56,956	**30%**	**20%**	**0**
50.01 Train control and signals		6,970	1,743	8,713				0
50.02 Traffic signals and crossing protection		73	18	91				0
50.03 Traction power supply: substations		11,391	2,848	14,239				0
50.04 Traction power distribution: catenary and third rail		3,731	933	4,664				0
50.05 Communications		12,177	3,044	15,221				0
50.06 Fare collection system and equipment		1,040	260	1,300				0
50.07 Central Control		0	0	0				0
Construction Subtotal (10 - 50)	0.78	119,757	29,939	**149,696**	$192,780	**100%**	**67%**	**0**
60 ROW, LAND, EXISTING IMPROVEMENTS	0.78	0	0	**0**	$0		**0%**	**0**
60.01 Purchase or lease of real estate		0	0	0				0
60.02 Relocation of existing households and businesses		0	0	0				0
70 VEHICLES (number)	**0**	0	0	**0**			**0%**	**0**
70.01 Light Rail	0	0	0	0				0
70.02 Heavy Rail	0	0	0	0				0
70.03 Commuter Rail	0	0	0	0				0
70.04 Bus	0	0	0	0				0
70.05 Other	0	0	0	0				0
70.06 Non-revenue vehicles	0	0	0	0				0
70.07 Spare parts	0	0	0	0				0
80 PROFESSIONAL SERVICES (applies to Cats. 10-50)	0.78	53,293	0	**53,293**	**$68,631**	**36%**	**24%**	**0**
80.01 Project Development		10,479		10,479				0
80.02 Engineering		11,976		11,976				0
80.03 Project Management for Design and Construction		14,970		14,970				0
80.04 Construction Administration & Management		7,485		7,485				0
80.05 Professional Liability and other Non-Construction Insurance		150		150				0
80.06 Legal; Permits; Review Fees by other agencies, cities, etc.		5,539		5,539				0
80.07 Surveys, Testing, Investigation, Inspection		299		299				0
80.08 Start up		2,395		2,395				0
Subtotal (10 - 80)	0.78	173,050	29,939	**202,989**	**$261,411**		**91%**	**0**
90 UNALLOCATED CONTINGENCY				**20,299**			**9%**	**0**
Subtotal (10 - 90)	0.78			**223,288**	**$287,552**		**100%**	**0**
100 FINANCE CHARGES				**0**			**0%**	**0**
Total Project Cost (10 - 100)	0.78			**223,288**	**$287,552**		**100%**	**0**
Allocated Contingency as % of Base Yr Dollars w/o Contingency				17.30%				
Unallocated Contingency as % of Base Yr Dollars w/o Contingency				11.73%				
Total Contingency as % of Base Yr Dollars w/o Contingency				29.03%				
Unallocated Contingency as % of Subtotal (10 - 80)				10.00%				
YOE Construction Cost per Mile (X000)								$0
YOE Total Project Cost per Mile Not Including Vehicles (X000)								$0
YOE Total Project Cost per Mile (X000)								$0

MAIN WORKSHEET-BUILD ALTERNATIVE

West Santa Ana Branch Transit Corridor
Environmental Study
Imperial Hwy & Garfield Ave Grade Separation Option
(From 1004+00.00 To 1036+61.56)

Today's Date **11/28/22**
Yr of Base Year $ 2020
Yr of Revenue Ops 2035

	Quantity	Base Year Dollars w/o Contingency (X000)	Base Year Dollars Allocated Contingency (X000)	Base Year Dollars TOTAL (X000)	Base Year Dollars Unit Cost (X000)	Base Year Dollars Percentage of Construction Cost	Base Year Dollars Percentage of Total Project Cost	YOE Dollars Total (X000)
10 GUIDEWAY & TRACK ELEMENTS (route miles)	**0.62**	31,950	7,988	**39,938**	**$64,653**	**53%**	**35%**	**0**
10.01 Guideway: At-grade exclusive right-of-way	0.13	1,317	329	1,646	$13,139			0
10.02 Guideway: At-grade semi-exclusive (allows cross-traffic)	0.00	0	0	0				0
10.03 Guideway: At-grade in mixed traffic	0.00	0	0	0				0
10.04 Guideway: Aerial structure	0.17	14,450	3,613	18,063	$106,917			0
10.05 Guideway: Built-up fill	0.32	13,493	3,373	16,866	$52,139			0
10.06 Guideway: Underground cut & cover	0.00	0	0	0				0
10.07 Guideway: Underground tunnel	0.00	0	0	0				0
10.08 Guideway: Retained cut or fill	0.00	0	0	0				0
10.09 Track: Direct fixation	0.17	865	216	1,081	$6,400			0
10.10 Track: Embedded	0.00	0	0	0				0
10.11 Track: Ballasted	0.45	1,825	456	2,281	$5,083			0
10.12 Track: Special (switches, turnouts)		0	0	0				0
10.13 Track: Vibration and noise dampening		0	0	0				0
20 STATIONS, STOPS, TERMINALS, INTERMODAL (number)	**0**	0	0	**0**		**0%**	**0%**	**0**
20.01 At-grade station, stop, shelter, mall, terminal, platform	0	0	0	0				0
20.02 Aerial station, stop, shelter, mall, terminal, platform	0	0	0	0				0
20.03 Underground station, stop, shelter, mall, terminal, platform	0	0	0	0				0
20.04 Other stations, landings, terminals: Intermodal, ferry, trolley, etc.	0	0	0	0				0
20.05 Joint development	0	0	0	0				0
20.06 Automobile parking multi-story structure	0	0	0	0				0
20.07 Elevators, escalators	0	0	0	0				0
30 SUPPORT FACILITIES: YARDS, SHOPS, ADMIN. BLDGS	0.62	0	0	**0**	$0	**0%**	**0%**	**0**
30.01 Administration Building: Office, sales, storage, revenue counting		0	0	0				0
30.02 Light Maintenance Facility		0	0	0				0
30.03 Heavy Maintenance Facility		0	0	0				0
30.04 Storage or Maintenance of Way Building		0	0	0				0
30.05 Yard and Yard Track		0	0	0				0
40 SITEWORK & SPECIAL CONDITIONS	0.62	7,907	1,977	**9,884**	$16,000	**13%**	**9%**	**0**
40.01 Demolition, Clearing, Earthwork		2,786	697	3,483				0
40.02 Site Utilities, Utility Relocation		2,087	522	2,609				0
40.03 Haz. mat'l, contam'd soil removal/mitigation, ground water treatments		620	155	775				0
40.04 Environmental mitigation, e.g. wetlands, historic/archeologic, parks		261	65	326				0
40.05 Site structures including retaining walls, sound walls		0	0	0				0
40.06 Pedestrian / bike access and accommodation, landscaping		2,153	538	2,691				0
40.07 Automobile, bus, van accessways including roads, parking lots		0	0	0				0
40.08 Temporary Facilities and other indirect costs during construction		0	0	0				0
50 SYSTEMS	0.62	20,792	5,198	**25,990**	$42,074	**34%**	**23%**	**0**
50.01 Train control and signals		5,545	1,386	6,931				0
50.02 Traffic signals and crossing protection		2,592	648	3,240				0
50.03 Traction power supply: substations		0	0	0				0
50.04 Traction power distribution: catenary and third rail		2,968	742	3,710				0
50.05 Communications		9,687	2,422	12,109				0
50.06 Fare collection system and equipment		0	0	0				0
50.07 Central Control		0	0	0				0
Construction Subtotal (10 - 50)	0.62	60,649	15,162	**75,811**	$122,728	**100%**	**67%**	**0**
60 ROW, LAND, EXISTING IMPROVEMENTS	0.62	0	0	**0**	$0		**0%**	**0**
60.01 Purchase or lease of real estate		0	0	0				0
60.02 Relocation of existing households and businesses		0	0	0				0
70 VEHICLES (number)	**0**	0	0	**0**			**0%**	**0**
70.01 Light Rail	0	0	0	0				0
70.02 Heavy Rail	0	0	0	0				0
70.03 Commuter Rail	0	0	0	0				0
70.04 Bus	0	0	0	0				0
70.05 Other	0	0	0	0				0
70.06 Non-revenue vehicles	0	0	0	0				0
70.07 Spare parts	0	0	0	0				0
80 PROFESSIONAL SERVICES (applies to Cats. 10-50)	0.62	26,990	0	**26,990**	**$43,693**	**36%**	**24%**	**0**
80.01 Project Development		5,307		5,307				0
80.02 Engineering		6,065		6,065				0
80.03 Project Management for Design and Construction		7,581		7,581				0
80.04 Construction Administration & Management		3,791		3,791				0
80.05 Professional Liability and other Non-Construction Insurance		76		76				0
80.06 Legal; Permits; Review Fees by other agencies, cities, etc.		2,805		2,805				0
80.07 Surveys, Testing, Investigation, Inspection		152		152				0
80.08 Start up		1,213		1,213				0
Subtotal (10 - 80)	0.62	87,639	15,162	**102,801**	**$166,421**		**91%**	**0**
90 UNALLOCATED CONTINGENCY				**10,280**			**9%**	**0**
Subtotal (10 - 90)	0.62			**113,081**	**$183,063**		**100%**	**0**
100 FINANCE CHARGES				**0**			**0%**	**0**
Total Project Cost (10 - 100)	0.62			**113,081**	**$183,063**		**100%**	**0**
Allocated Contingency as % of Base Yr Dollars w/o Contingency				17.30%				
Unallocated Contingency as % of Base Yr Dollars w/o Contingency				11.73%				
Total Contingency as % of Base Yr Dollars w/o Contingency				29.03%				
Unallocated Contingency as % of Subtotal (10 - 80)				10.00%				
YOE Construction Cost per Mile (X000)								$0
YOE Total Project Cost per Mile Not Including Vehicles (X000)								$0
YOE Total Project Cost per Mile (X000)								$0

MAIN WORKSHEET-BUILD ALTERNATIVE

West Santa Ana Branch Transit Corridor
Environmental Study
Paramount Blvd. & Rosecrans Blvd. Grade Separation Study
(From 1093+11.91 To 1167+00.00)

Today's Date **11/28/22**
Yr of Base Year $ 2020
Yr of Revenue Ops 2035

	Quantity	Base Year Dollars w/o Contingency (X000)	Base Year Dollars Allocated Contingency (X000)	Base Year Dollars TOTAL (X000)	Base Year Dollars Unit Cost (X000)	Base Year Dollars Percentage of Construction Cost	Base Year Dollars Percentage of Total Project Cost	YOE Dollars Total (X000)
10 GUIDEWAY & TRACK ELEMENTS (route miles)	**1.40**	85,211	21,303	**106,514**	**$76,122**	**46%**	**31%**	**0**
10.01 Guideway: At-grade exclusive right-of-way	0.13	1,410	353	1,763	$13,133			0
10.02 Guideway: At-grade semi-exclusive (allows cross-traffic)	0.00	0	0	0				0
10.03 Guideway: At-grade in mixed traffic	0.00	0	0	0				0
10.04 Guideway: Aerial structure	0.56	48,305	12,076	60,381	$106,919			0
10.05 Guideway: Built-up fill	0.70	29,211	7,303	36,514	$52,139			0
10.06 Guideway: Underground cut & cover	0.00	0	0	0				0
10.07 Guideway: Underground tunnel	0.00	0	0	0				0
10.08 Guideway: Retained cut or fill	0.00	0	0	0				0
10.09 Track: Direct fixation		2,892	723	3,615				0
10.10 Track: Embedded		0	0	0				0
10.11 Track: Ballasted		3,393	848	4,241				0
10.12 Track: Special (switches, turnouts)		0	0	0				0
10.13 Track: Vibration and noise dampening		0	0	0				0
20 STATIONS, STOPS, TERMINALS, INTERMODAL (number)	**1**	20,578	5,145	**25,723**	**$25,723**	**11%**	**7%**	**0**
20.01 At-grade station, stop, shelter, mall, terminal, platform	0	0	0	0				0
20.02 Aerial station, stop, shelter, mall, terminal, platform	1	15,796	3,949	19,745	$19,745			0
20.03 Underground station, stop, shelter, mall, terminal, platform	0	0	0	0				0
20.04 Other stations, landings, terminals: Intermodal, ferry, trolley, etc.	0	0	0	0				0
20.05 Joint development	0	0	0	0				0
20.06 Automobile parking multi-story structure	0	0	0	0				0
20.07 Elevators, escalators	4	4,782	1,196	5,978	$1,494			0
30 SUPPORT FACILITIES: YARDS, SHOPS, ADMIN. BLDGS	1.40	0	0	**0**	$0	**0%**	**0%**	**0**
30.01 Administration Building: Office, sales, storage, revenue counting		0	0	0				0
30.02 Light Maintenance Facility		0	0	0				0
30.03 Heavy Maintenance Facility		0	0	0				0
30.04 Storage or Maintenance of Way Building		0	0	0				0
30.05 Yard and Yard Track		0	0	0				0
40 SITEWORK & SPECIAL CONDITIONS	1.40	27,611	6,903	**34,514**	$24,666	**15%**	**10%**	**0**
40.01 Demolition, Clearing, Earthwork		6,311	1,578	7,889				0
40.02 Site Utilities, Utility Relocation		4,728	1,182	5,910				0
40.03 Haz. mat'l, contam'd soil removal/mitigation, ground water treatments		1,404	351	1,755				0
40.04 Environmental mitigation, e.g. wetlands, historic/archeologic, parks		591	148	739				0
40.05 Site structures including retaining walls, sound walls		2,770	693	3,463				0
40.06 Pedestrian / bike access and accommodation, landscaping		11,807	2,952	14,759				0
40.07 Automobile, bus, van accessways including roads, parking lots		0	0	0				0
40.08 Temporary Facilities and other indirect costs during construction		0	0	0				0
50 SYSTEMS	1.40	53,733	13,433	**67,166**	$48,001	**29%**	**19%**	**0**
50.01 Train control and signals		12,560	3,140	15,700				0
50.02 Traffic signals and crossing protection		73	18	91				0
50.03 Traction power supply: substations		11,391	2,848	14,239				0
50.04 Traction power distribution: catenary and third rail		6,723	1,681	8,404				0
50.05 Communications		21,946	5,487	27,433				0
50.06 Fare collection system and equipment		1,040	260	1,300				0
50.07 Central Control		0	0	0				0
Construction Subtotal (10 - 50)	1.40	187,133	46,783	**233,916**	$167,171	**100%**	**67%**	**0**
60 ROW, LAND, EXISTING IMPROVEMENTS	1.40	0	0	**0**	$0		**0%**	**0**
60.01 Purchase or lease of real estate		0	0	0				0
60.02 Relocation of existing households and businesses		0	0	0				0
70 VEHICLES (number)	**0**	0	0	**0**			**0%**	**0**
70.01 Light Rail	0	0	0	0				0
70.02 Heavy Rail	0	0	0	0				0
70.03 Commuter Rail	0	0	0	0				0
70.04 Bus	0	0	0	0				0
70.05 Other	0	0	0	0				0
70.06 Non-revenue vehicles	0	0	0	0				0
70.07 Spare parts	0	0	0	0				0
80 PROFESSIONAL SERVICES (applies to Cats. 10-50)	1.40	83,275	0	**83,275**	**$59,514**	**36%**	**24%**	**0**
80.01 Project Development		16,374		16,374				0
80.02 Engineering		18,713		18,713				0
80.03 Project Management for Design and Construction		23,392		23,392				0
80.04 Construction Administration & Management		11,696		11,696				0
80.05 Professional Liability and other Non-Construction Insurance		234		234				0
80.06 Legal; Permits; Review Fees by other agencies, cities, etc.		8,655		8,655				0
80.07 Surveys, Testing, Investigation, Inspection		468		468				0
80.08 Start up		3,743		3,743				0
Subtotal (10 - 80)	1.40	270,408	46,783	**317,191**	**$226,685**		**91%**	**0**
90 UNALLOCATED CONTINGENCY				**31,719**			**9%**	**0**
Subtotal (10 - 90)	1.40			**348,910**	**$249,354**		**100%**	**0**
100 FINANCE CHARGES				**0**			**0%**	**0**
Total Project Cost (10 - 100)	1.40			**348,910**	**$249,354**		**100%**	**0**
Allocated Contingency as % of Base Yr Dollars w/o Contingency				17.30%				
Unallocated Contingency as % of Base Yr Dollars w/o Contingency				11.73%				
Total Contingency as % of Base Yr Dollars w/o Contingency				29.03%				
Unallocated Contingency as % of Subtotal (10 - 80)				10.00%				
YOE Construction Cost per Mile (X000)								$0
YOE Total Project Cost per Mile Not Including Vehicles (X000)								$0
YOE Total Project Cost per Mile (X000)								$0

MAIN WORKSHEET-BUILD ALTERNATIVE

West Santa Ana Branch Transit Corridor
Environmental Study
Flower St. & Woodruff Ave. Grade Separation Option
(From 1259+27.93 To 1288+98.93)

Today's Date 11/28/22
Yr of Base Year $ 2020
Yr of Revenue Ops 2035

	Quantity	Base Year Dollars w/o Contingency (X000)	Base Year Dollars Allocated Contingency (X000)	Base Year Dollars TOTAL (X000)	Base Year Dollars Unit Cost (X000)	Base Year Dollars Percentage of Construction Cost	Base Year Dollars Percentage of Total Project Cost	YOE Dollars Total (X000)
10 GUIDEWAY & TRACK ELEMENTS (route miles)	**0.56**	27,905	6,976	**34,881**	**$61,990**	**53%**	**35%**	**0**
10.01 Guideway: At-grade exclusive right-of-way	0.09	937	234	1,171	$13,130			0
10.02 Guideway: At-grade semi-exclusive (allows cross-traffic)	0.00	0	0	0				0
10.03 Guideway: At-grade in mixed traffic	0.00	0	0	0				0
10.04 Guideway: Aerial structure	0.11	9,396	2,349	11,745	$106,920			0
10.05 Guideway: Built-up fill	0.36	15,168	3,792	18,960	$52,140			0
10.06 Guideway: Underground cut & cover	0.00	0	0	0				0
10.07 Guideway: Underground tunnel	0.00	0	0	0				0
10.08 Guideway: Retained cut or fill	0.00	0	0	0				0
10.09 Track: Direct fixation		563	141	704				0
10.10 Track: Embedded		0	0	0				0
10.11 Track: Ballasted		1,841	460	2,301				0
10.12 Track: Special (switches, turnouts)		0	0	0				0
10.13 Track: Vibration and noise dampening		0	0	0				0
20 STATIONS, STOPS, TERMINALS, INTERMODAL (number)	**0**	0	0	**0**		**0%**	**0%**	**0**
20.01 At-grade station, stop, shelter, mall, terminal, platform	0	0	0	0				0
20.02 Aerial station, stop, shelter, mall, terminal, platform	0	0	0	0				0
20.03 Underground station, stop, shelter, mall, terminal, platform	0	0	0	0				0
20.04 Other stations, landings, terminals: Intermodal, ferry, trolley, etc.	0	0	0	0				0
20.05 Joint development	0	0	0	0				0
20.06 Automobile parking multi-story structure	0	0	0	0				0
20.07 Elevators, escalators	0	0	0	0				0
30 SUPPORT FACILITIES: YARDS, SHOPS, ADMIN. BLDGS	0.56	0	0	**0**	$0	**0%**	**0%**	**0**
30.01 Administration Building: Office, sales, storage, revenue counting		0	0	0				0
30.02 Light Maintenance Facility		0	0	0				0
30.03 Heavy Maintenance Facility		0	0	0				0
30.04 Storage or Maintenance of Way Building		0	0	0				0
30.05 Yard and Yard Track		0	0	0				0
40 SITEWORK & SPECIAL CONDITIONS	0.56	8,414	2,104	**10,518**	$18,691	**16%**	**11%**	**0**
40.01 Demolition, Clearing, Earthwork		2,538	635	3,173				0
40.02 Site Utilities, Utility Relocation		1,901	475	2,376				0
40.03 Haz. mat'l, contam'd soil removal/mitigation, ground water treatments		564	141	705				0
40.04 Environmental mitigation, e.g. wetlands, historic/archeologic, parks		238	60	298				0
40.05 Site structures including retaining walls, sound walls		1,212	303	1,515				0
40.06 Pedestrian / bike access and accommodation, landscaping		1,961	490	2,451				0
40.07 Automobile, bus, van accessways including roads, parking lots		0	0	0				0
40.08 Temporary Facilities and other indirect costs during construction		0	0	0				0
50 SYSTEMS	0.56	16,726	4,182	**20,908**	$37,156	**32%**	**21%**	**0**
50.01 Train control and signals		5,051	1,263	6,314				0
50.02 Traffic signals and crossing protection		146	37	183				0
50.03 Traction power supply: substations		0	0	0				0
50.04 Traction power distribution: catenary and third rail		2,704	676	3,380				0
50.05 Communications		8,825	2,206	11,031				0
50.06 Fare collection system and equipment		0	0	0				0
50.07 Central Control		0	0	0				0
Construction Subtotal (10 - 50)	0.56	53,045	13,261	**66,306**	$117,838	**100%**	**67%**	**0**
60 ROW, LAND, EXISTING IMPROVEMENTS	0.56	0	0	**0**	$0		**0%**	**0**
60.01 Purchase or lease of real estate		0	0	0				0
60.02 Relocation of existing households and businesses		0	0	0				0
70 VEHICLES (number)	**0**	0	0	**0**			**0%**	**0**
70.01 Light Rail	0	0	0	0				0
70.02 Heavy Rail	0	0	0	0				0
70.03 Commuter Rail	0	0	0	0				0
70.04 Bus	0	0	0	0				0
70.05 Other	0	0	0	0				0
70.06 Non-revenue vehicles	0	0	0	0				0
70.07 Spare parts	0	0	0	0				0
80 PROFESSIONAL SERVICES (applies to Cats. 10-50)	0.56	23,605	0	**23,605**	**$41,950**	**36%**	**24%**	**0**
80.01 Project Development		4,641		4,641				0
80.02 Engineering		5,305		5,305				0
80.03 Project Management for Design and Construction		6,631		6,631				0
80.04 Construction Administration & Management		3,315		3,315				0
80.05 Professional Liability and other Non-Construction Insurance		66		66				0
80.06 Legal; Permits; Review Fees by other agencies, cities, etc.		2,453		2,453				0
80.07 Surveys, Testing, Investigation, Inspection		133		133				0
80.08 Start up		1,061		1,061				0
Subtotal (10 - 80)	0.56	76,650	13,261	**89,911**	**$159,788**		**91%**	**0**
90 UNALLOCATED CONTINGENCY				**8,991**			**9%**	**0**
Subtotal (10 - 90)	0.56			**98,902**	**$175,767**		**100%**	**0**
100 FINANCE CHARGES				**0**			**0%**	**0**
Total Project Cost (10 - 100)	0.56			**98,902**	**$175,767**		**100%**	**0**
Allocated Contingency as % of Base Yr Dollars w/o Contingency				17.30%				
Unallocated Contingency as % of Base Yr Dollars w/o Contingency				11.73%				
Total Contingency as % of Base Yr Dollars w/o Contingency				29.03%				
Unallocated Contingency as % of Subtotal (10 - 80)				10.00%				
YOE Construction Cost per Mile (X000)								$0
YOE Total Project Cost per Mile Not Including Vehicles (X000)								$0
YOE Total Project Cost per Mile (X000)								$0

MAIN WORKSHEET-BUILD ALTERNATIVE

West Santa Ana Branch Transit Corridor
Environmental Study
183rd & Gridley Ave. Grade Separation Option With Station
(From 1357+00.00 To 1390+00.00)

Today's Date 11/28/22
Yr of Base Year $ 2020
Yr of Revenue Ops 2035

	Quantity	Base Year Dollars w/o Contingency (X000)	Base Year Dollars Allocated Contingency (X000)	Base Year Dollars TOTAL (X000)	Base Year Dollars Unit Cost (X000)	Base Year Dollars Percentage of Construction Cost	Base Year Dollars Percentage of Total Project Cost	YOE Dollars Total (X000)
10 GUIDEWAY & TRACK ELEMENTS (route miles)	**0.63**	32,375	8,094	**40,469**	**$64,750**	**33%**	**22%**	**0**
10.01 Guideway: At-grade exclusive right-of-way	0.11	1,194	299	1,493	$13,134			0
10.02 Guideway: At-grade semi-exclusive (allows cross-traffic)	0.00	0	0	0				0
10.03 Guideway: At-grade in mixed traffic	0.00	0	0	0				0
10.04 Guideway: Aerial structure	0.16	13,932	3,483	17,415	$106,920			0
10.05 Guideway: Built-up fill	0.35	14,536	3,634	18,170	$52,140			0
10.06 Guideway: Underground cut & cover	0.00	0	0	0				0
10.07 Guideway: Underground tunnel	0.00	0	0	0				0
10.08 Guideway: Retained cut or fill	0.00	0	0	0				0
10.09 Track: Direct fixation		834	209	1,043				0
10.10 Track: Embedded		0	0	0				0
10.11 Track: Ballasted		1,879	470	2,349				0
10.12 Track: Special (switches, turnouts)		0	0	0				0
10.13 Track: Vibration and noise dampening		0	0	0				0
20 STATIONS, STOPS, TERMINALS, INTERMODAL (number)	**1**	20,578	5,145	**25,723**	**$25,723**	**21%**	**14%**	**0**
20.01 At-grade station, stop, shelter, mall, terminal, platform	0	0	0	0				0
20.02 Aerial station, stop, shelter, mall, terminal, platform	1	15,796	3,949	19,745	$19,745			0
20.03 Underground station, stop, shelter, mall, terminal, platform	0	0	0	0				0
20.04 Other stations, landings, terminals: Intermodal, ferry, trolley, etc.	0	0	0	0				0
20.05 Joint development	0	0	0	0				0
20.06 Automobile parking multi-story structure	0	0	0	0				0
20.07 Elevators, escalators	4	4,782	1,196	5,978	$1,494			0
30 SUPPORT FACILITIES: YARDS, SHOPS, ADMIN. BLDGS	0.63	0	0	**0**	$0	**0%**	**0%**	**0**
30.01 Administration Building: Office, sales, storage, revenue counting		0	0	0				0
30.02 Light Maintenance Facility		0	0	0				0
30.03 Heavy Maintenance Facility		0	0	0				0
30.04 Storage or Maintenance of Way Building		0	0	0				0
30.05 Yard and Yard Track		0	0	0				0
40 SITEWORK & SPECIAL CONDITIONS	0.63	15,401	3,850	**19,251**	$30,802	**16%**	**10%**	**0**
40.01 Demolition, Clearing, Earthwork		2,819	705	3,524				0
40.02 Site Utilities, Utility Relocation		2,112	528	2,640				0
40.03 Haz. mat'l, contam'd soil removal/mitigation, ground water treatments		627	157	784				0
40.04 Environmental mitigation, e.g. wetlands, historic/archeologic, parks		264	66	330				0
40.05 Site structures including retaining walls, sound walls		907	227	1,134				0
40.06 Pedestrian / bike access and accommodation, landscaping		8,672	2,168	10,840				0
40.07 Automobile, bus, van accessways including roads, parking lots		0	0	0				0
40.08 Temporary Facilities and other indirect costs during construction		0	0	0				0
50 SYSTEMS	0.63	30,919	7,730	**38,649**	$61,838	**31%**	**21%**	**0**
50.01 Train control and signals		5,610	1,403	7,013				0
50.02 Traffic signals and crossing protection		73	18	91				0
50.03 Traction power supply: substations		11,391	2,848	14,239				0
50.04 Traction power distribution: catenary and third rail		3,003	751	3,754				0
50.05 Communications		9,802	2,451	12,253				0
50.06 Fare collection system and equipment		1,040	260	1,300				0
50.07 Central Control		0	0	0				0
Construction Subtotal (10 - 50)	0.63	99,273	24,818	**124,091**	$198,546	**100%**	**67%**	**0**
60 ROW, LAND, EXISTING IMPROVEMENTS	0.63	0	0	**0**	$0		**0%**	**0**
60.01 Purchase or lease of real estate		0	0	0				0
60.02 Relocation of existing households and businesses		0	0	0				0
70 VEHICLES (number)	**0**	0	0	**0**			**0%**	**0**
70.01 Light Rail	0	0	0	0				0
70.02 Heavy Rail	0	0	0	0				0
70.03 Commuter Rail	0	0	0	0				0
70.04 Bus	0	0	0	0				0
70.05 Other	0	0	0	0				0
70.06 Non-revenue vehicles	0	0	0	0				0
70.07 Spare parts	0	0	0	0				0
80 PROFESSIONAL SERVICES (applies to Cats. 10-50)	0.63	44,175	0	**44,175**	**$70,680**	**36%**	**24%**	**0**
80.01 Project Development		8,686		8,686				0
80.02 Engineering		9,927		9,927				0
80.03 Project Management for Design and Construction		12,409		12,409				0
80.04 Construction Administration & Management		6,205		6,205				0
80.05 Professional Liability and other Non-Construction Insurance		124		124				0
80.06 Legal; Permits; Review Fees by other agencies, cities, etc.		4,591		4,591				0
80.07 Surveys, Testing, Investigation, Inspection		248		248				0
80.08 Start up		1,985		1,985				0
Subtotal (10 - 80)	0.63	143,448	24,818	**168,266**	**$269,226**		**91%**	**0**
90 UNALLOCATED CONTINGENCY				**16,827**			**9%**	**0**
Subtotal (10 - 90)	0.63			**185,093**	**$296,149**		**100%**	**0**
100 FINANCE CHARGES				**0**			**0%**	**0**
Total Project Cost (10 - 100)	0.63			**185,093**	**$296,149**		**100%**	**0**
Allocated Contingency as % of Base Yr Dollars w/o Contingency				17.30%				
Unallocated Contingency as % of Base Yr Dollars w/o Contingency				11.73%				
Total Contingency as % of Base Yr Dollars w/o Contingency				29.03%				
Unallocated Contingency as % of Subtotal (10 - 80)				10.00%				
YOE Construction Cost per Mile (X000)								$0
YOE Total Project Cost per Mile Not Including Vehicles (X000)								$0
YOE Total Project Cost per Mile (X000)								$0

MAIN WORKSHEET-BUILD ALTERNATIVE

West Santa Ana Branch Transit Corridor
Environmental Study
183rd & Gridley Ave. Grade Separation Option Without Station
(From 1357+00.00 To 1390+00.00)

Today's Date 11/28/22
Yr of Base Year $ 2020
Yr of Revenue Ops 2035

	Quantity	Base Year Dollars w/o Contingency (X000)	Base Year Dollars Allocated Contingency (X000)	Base Year Dollars TOTAL (X000)	Base Year Dollars Unit Cost (X000)	Base Year Dollars Percentage of Construction Cost	Base Year Dollars Percentage of Total Project Cost	YOE Dollars Total (X000)
10 GUIDEWAY & TRACK ELEMENTS (route miles)	**0.63**	32,375	8,094	**40,469**	**$64,750**	**45%**	**30%**	**0**
10.01 Guideway: At-grade exclusive right-of-way	0.11	1,194	299	1,493	$13,134			0
10.02 Guideway: At-grade semi-exclusive (allows cross-traffic)	0.00	0	0	0				0
10.03 Guideway: At-grade in mixed traffic	0.00	0	0	0				0
10.04 Guideway: Aerial structure	0.16	13,932	3,483	17,415	$106,920			0
10.05 Guideway: Built-up fill	0.35	14,536	3,634	18,170	$52,140			0
10.06 Guideway: Underground cut & cover	0.00	0	0	0				0
10.07 Guideway: Underground tunnel	0.00	0	0	0				0
10.08 Guideway: Retained cut or fill	0.00	0	0	0				0
10.09 Track: Direct fixation		834	209	1,043				0
10.10 Track: Embedded		0	0	0				0
10.11 Track: Ballasted		1,879	470	2,349				0
10.12 Track: Special (switches, turnouts)		0	0	0				0
10.13 Track: Vibration and noise dampening		0	0	0				0
20 STATIONS, STOPS, TERMINALS, INTERMODAL (number)	**0**	0	0	**0**		**0%**	**0%**	**0**
20.01 At-grade station, stop, shelter, mall, terminal, platform	0	0	0	0				0
20.02 Aerial station, stop, shelter, mall, terminal, platform	0	0	0	0				0
20.03 Underground station, stop, shelter, mall, terminal, platform	0	0	0	0				0
20.04 Other stations, landings, terminals: Intermodal, ferry, trolley, etc.	0	0	0	0				0
20.05 Joint development	0	0	0	0				0
20.06 Automobile parking multi-story structure	0	0	0	0				0
20.07 Elevators, escalators	0	0	0	0				0
30 SUPPORT FACILITIES: YARDS, SHOPS, ADMIN. BLDGS	0.63	0	0	**0**	$0	**0%**	**0%**	**0**
30.01 Administration Building: Office, sales, storage, revenue counting		0	0	0				0
30.02 Light Maintenance Facility		0	0	0				0
30.03 Heavy Maintenance Facility		0	0	0				0
30.04 Storage or Maintenance of Way Building		0	0	0				0
30.05 Yard and Yard Track		0	0	0				0
40 SITEWORK & SPECIAL CONDITIONS	0.63	8,907	2,227	**11,134**	$17,814	**12%**	**8%**	**0**
40.01 Demolition, Clearing, Earthwork		2,819	705	3,524				0
40.02 Site Utilities, Utility Relocation		2,112	528	2,640				0
40.03 Haz. mat'l, contam'd soil removal/mitigation, ground water treatments		627	157	784				0
40.04 Environmental mitigation, e.g. wetlands, historic/archeologic, parks		264	66	330				0
40.05 Site structures including retaining walls, sound walls		907	227	1,134				0
40.06 Pedestrian / bike access and accommodation, landscaping		2,178	545	2,723				0
40.07 Automobile, bus, van accessways including roads, parking lots		0	0	0				0
40.08 Temporary Facilities and other indirect costs during construction		0	0	0				0
50 SYSTEMS	0.63	30,919	7,730	**38,649**	$61,838	**43%**	**29%**	**0**
50.01 Train control and signals		5,610	1,403	7,013				0
50.02 Traffic signals and crossing protection		73	18	91				0
50.03 Traction power supply: substations		11,391	2,848	14,239				0
50.04 Traction power distribution: catenary and third rail		3,003	751	3,754				0
50.05 Communications		9,802	2,451	12,253				0
50.06 Fare collection system and equipment		1,040	260	1,300				0
50.07 Central Control		0	0	0				0
Construction Subtotal (10 - 50)	0.63	72,201	18,050	**90,251**	$144,402	**100%**	**67%**	**0**
60 ROW, LAND, EXISTING IMPROVEMENTS	0.63	0	0	**0**	$0		**0%**	**0**
60.01 Purchase or lease of real estate		0	0	0				0
60.02 Relocation of existing households and businesses		0	0	0				0
70 VEHICLES (number)	**0**	0	0	**0**			**0%**	**0**
70.01 Light Rail	0	0	0	0				0
70.02 Heavy Rail	0	0	0	0				0
70.03 Commuter Rail	0	0	0	0				0
70.04 Bus	0	0	0	0				0
70.05 Other	0	0	0	0				0
70.06 Non-revenue vehicles	0	0	0	0				0
70.07 Spare parts	0	0	0	0				0
80 PROFESSIONAL SERVICES (applies to Cats. 10-50)	0.63	32,130	0	**32,130**	**$51,408**	**36%**	**24%**	**0**
80.01 Project Development		6,318		6,318				0
80.02 Engineering		7,220		7,220				0
80.03 Project Management for Design and Construction		9,025		9,025				0
80.04 Construction Administration & Management		4,513		4,513				0
80.05 Professional Liability and other Non-Construction Insurance		90		90				0
80.06 Legal; Permits; Review Fees by other agencies, cities, etc.		3,339		3,339				0
80.07 Surveys, Testing, Investigation, Inspection		181		181				0
80.08 Start up		1,444		1,444				0
Subtotal (10 - 80)	0.63	104,331	18,050	**122,381**	**$195,810**		**91%**	**0**
90 UNALLOCATED CONTINGENCY				**12,238**			**9%**	**0**
Subtotal (10 - 90)	0.63			**134,619**	**$215,391**		**100%**	**0**
100 FINANCE CHARGES				**0**			**0%**	**0**
Total Project Cost (10 - 100)	0.63			**134,619**	**$215,391**		**100%**	**0**
Allocated Contingency as % of Base Yr Dollars w/o Contingency				17.30%				
Unallocated Contingency as % of Base Yr Dollars w/o Contingency				11.73%				
Total Contingency as % of Base Yr Dollars w/o Contingency				29.03%				
Unallocated Contingency as % of Subtotal (10 - 80)				10.00%				
YOE Construction Cost per Mile (X000)								$0
YOE Total Project Cost per Mile Not Including Vehicles (X000)								$0
YOE Total Project Cost per Mile (X000)								$0

MAIN WORKSHEET-BUILD ALTERNATIVE

West Santa Ana Branch Transit Corridor
Environmental Study
Randolph St. Cut-and-Cover Study
(From 776+85.43 To 798+75.49)

Today's Date 12/7/22
Yr of Base Year $ 2020
Yr of Revenue Ops 2035

	Quantity	Base Year Dollars w/o Contingency (X000)	Base Year Dollars Allocated Contingency (X000)	Base Year Dollars TOTAL (X000)	Base Year Dollars Unit Cost (X000)	Base Year Dollars Percentage of Construction Cost	Base Year Dollars Percentage of Total Project Cost	YOE Dollars Total (X000)
10 GUIDEWAY & TRACK ELEMENTS (route miles)	**0.41**	32,750	9,825	**42,575**	**$102,644**	**64%**	**41%**	**0**
10.01 Guideway: At-grade exclusive right-of-way	0.00	0	0	0				0
10.02 Guideway: At-grade semi-exclusive (allows cross-traffic)	0.00	0	0	0				0
10.03 Guideway: At-grade in mixed traffic	0.00	0	0	0				0
10.04 Guideway: Aerial structure	0.00	0	0	0				0
10.05 Guideway: Built-up fill	0.00	0	0	0				0
10.06 Guideway: Underground cut & cover	0.12	17,501	5,250	22,751	$189,570			0
10.07 Guideway: Underground tunnel	0.00	0	0	0				0
10.08 Guideway: Retained cut or fill	0.29	13,125	3,938	17,063	$57,884			0
10.09 Track: Direct fixation	0.41	2,124	637	2,761	$6,657			0
10.10 Track: Embedded	0.00	0	0	0				0
10.11 Track: Ballasted	0.00	0	0	0				0
10.12 Track: Special (switches, turnouts)		0	0	0				0
10.13 Track: Vibration and noise dampening		0	0	0				0
20 STATIONS, STOPS, TERMINALS, INTERMODAL (number)	**0**	0	0	**0**		**0%**	**0%**	**0**
20.01 At-grade station, stop, shelter, mall, terminal, platform	0	0	0	0				0
20.02 Aerial station, stop, shelter, mall, terminal, platform	0	0	0	0				0
20.03 Underground station, stop, shelter, mall, terminal, platform	0	0	0	0				0
20.04 Other stations, landings, terminals: Intermodal, ferry, trolley, etc.	0	0	0	0				0
20.05 Joint development	0	0	0	0				0
20.06 Automobile parking multi-story structure	0	0	0	0				0
20.07 Elevators, escalators	0	0	0	0				0
30 SUPPORT FACILITIES: YARDS, SHOPS, ADMIN. BLDGS	0.41	0	0	**0**	$0	**0%**	**0%**	**0**
30.01 Administration Building: Office, sales, storage, revenue counting		0	0	0				0
30.02 Light Maintenance Facility		0	0	0				0
30.03 Heavy Maintenance Facility		0	0	0				0
30.04 Storage or Maintenance of Way Building		0	0	0				0
30.05 Yard and Yard Track		0	0	0				0
40 SITEWORK & SPECIAL CONDITIONS	0.41	6,013	2,015	**8,028**	$19,353	**12%**	**8%**	**0**
40.01 Demolition, Clearing, Earthwork		1,871	561	2,432				0
40.02 Site Utilities, Utility Relocation		2,106	842	2,948				0
40.03 Haz. mat'l, contam'd soil removal/mitigation, ground water treatments		416	125	541				0
40.04 Environmental mitigation, e.g. wetlands, historic/archeologic, parks		175	53	228				0
40.05 Site structures including retaining walls, sound walls		0	0	0				0
40.06 Pedestrian / bike access and accommodation, landscaping		1,445	434	1,879				0
40.07 Automobile, bus, van accessways including roads, parking lots		0	0	0				0
40.08 Temporary Facilities and other indirect costs during construction		0	0	0				0
50 SYSTEMS	0.41	12,221	3,666	**15,887**	$38,303	**24%**	**15%**	**0**
50.01 Train control and signals		3,723	1,117	4,840				0
50.02 Traffic signals and crossing protection		0	0	0				0
50.03 Traction power supply: substations		0	0	0				0
50.04 Traction power distribution: catenary and third rail		1,993	598	2,591				0
50.05 Communications		6,505	1,952	8,457				0
50.06 Fare collection system and equipment		0	0	0				0
50.07 Central Control		0	0	0				0
Construction Subtotal (10 - 50)	0.41	50,984	15,506	**66,490**	$160,300	**100%**	**64%**	**0**
60 ROW, LAND, EXISTING IMPROVEMENTS	0.41	0	0	**0**	$0		**0%**	**0**
60.01 Purchase or lease of real estate		0	0	0				0
60.02 Relocation of existing households and businesses		0	0	0				0
70 VEHICLES (number)	**0**	0	0	**0**			**0%**	**0**
70.01 Light Rail	0	0	0	0				0
70.02 Heavy Rail	0	0	0	0				0
70.03 Commuter Rail	0	0	0	0				0
70.04 Bus	0	0	0	0				0
70.05 Other	0	0	0	0				0
70.06 Non-revenue vehicles	0	0	0	0				0
70.07 Spare parts	0	0	0	0				0
80 PROFESSIONAL SERVICES (applies to Cats. 10-50)	0.41	23,669	0	**23,669**	**$57,063**	**36%**	**23%**	**0**
80.01 Project Development		4,654		4,654				0
80.02 Engineering		5,319		5,319				0
80.03 Project Management for Design and Construction		6,649		6,649				0
80.04 Construction Administration & Management		3,324		3,324				0
80.05 Professional Liability and other Non-Construction Insurance		66		66				0
80.06 Legal; Permits; Review Fees by other agencies, cities, etc.		2,460		2,460				0
80.07 Surveys, Testing, Investigation, Inspection		133		133				0
80.08 Start up		1,064		1,064				0
Subtotal (10 - 80)	0.41	74,653	15,506	**90,159**	**$217,363**		**87%**	**0**
90 UNALLOCATED CONTINGENCY				**13,524**			**13%**	**0**
Subtotal (10 - 90)	0.41			**103,683**	**$249,968**		**100%**	**0**
100 FINANCE CHARGES				**0**			**0%**	**0**
Total Project Cost (10 - 100)	0.41			**103,683**	**$249,968**		**100%**	**0**
Allocated Contingency as % of Base Yr Dollars w/o Contingency				20.77%				
Unallocated Contingency as % of Base Yr Dollars w/o Contingency				18.12%				
Total Contingency as % of Base Yr Dollars w/o Contingency				38.89%				
Unallocated Contingency as % of Subtotal (10 - 80)				15.00%				
YOE Construction Cost per Mile (X000)								$0
YOE Total Project Cost per Mile Not Including Vehicles (X000)								$0
YOE Total Project Cost per Mile (X000)								$0

MAIN WORKSHEET-BUILD ALTERNATIVE

West Santa Ana Branch Transit Corridor
Environmental Study
Firestone Blvd. Cut-and-Cover Study
(From 903+00.00 To 944+00.00)

Today's Date 12/7/22
Yr of Base Year $ 2020
Yr of Revenue Ops 2035

	Quantity	Base Year Dollars w/o Contingency (X000)	Base Year Dollars Allocated Contingency (X000)	Base Year Dollars TOTAL (X000)	Base Year Dollars Unit Cost (X000)	Base Year Dollars Percentage of Construction Cost	Base Year Dollars Percentage of Total Project Cost	YOE Dollars Total (X000)
10 GUIDEWAY & TRACK ELEMENTS (route miles)	**0.78**	107,060	32,118	**139,178**	**$179,234**	**24%**	**15%**	**0**
10.01 Guideway: At-grade exclusive right-of-way	0.00	0	0	0				0
10.02 Guideway: At-grade semi-exclusive (allows cross-traffic)	0.00	0	0	0				0
10.03 Guideway: At-grade in mixed traffic	0.00	0	0	0				0
10.04 Guideway: Aerial structure	0.00	0	0	0				0
10.05 Guideway: Built-up fill	0.00	0	0	0				0
10.06 Guideway: Underground cut & cover	0.63	96,312	28,894	125,206	$198,823			0
10.07 Guideway: Underground tunnel	0.00	0	0	0				0
10.08 Guideway: Retained cut or fill	0.15	6,771	2,031	8,802	$59,969			0
10.09 Track: Direct fixation	0.78	3,977	1,193	5,170	$6,658			0
10.10 Track: Embedded	0.00	0	0	0				0
10.11 Track: Ballasted	0.00	0	0	0				0
10.12 Track: Special (switches, turnouts)		0	0	0				0
10.13 Track: Vibration and noise dampening		0	0	0				0
20 STATIONS, STOPS, TERMINALS, INTERMODAL (number)	**1**	230,261	69,078	**299,339**	**$299,339**	**52%**	**33%**	**0**
20.01 At-grade station, stop, shelter, mall, terminal, platform	0	0	0	0				0
20.02 Aerial station, stop, shelter, mall, terminal, platform	0	0	0	0				0
20.03 Underground station, stop, shelter, mall, terminal, platform	1	213,299	63,990	277,289	$277,289			0
20.04 Other stations, landings, terminals: Intermodal, ferry, trolley, etc.	0	0	0	0				0
20.05 Joint development	0	0	0	0				0
20.06 Automobile parking multi-story structure	0	0	0	0				0
20.07 Elevators, escalators	14	16,962	5,089	22,051	$1,575			0
30 SUPPORT FACILITIES: YARDS, SHOPS, ADMIN. BLDGS	0.78	0	0	**0**	$0	**0%**	**0%**	**0**
30.01 Administration Building: Office, sales, storage, revenue counting		0	0	0				0
30.02 Light Maintenance Facility		0	0	0				0
30.03 Heavy Maintenance Facility		0	0	0				0
30.04 Storage or Maintenance of Way Building		0	0	0				0
30.05 Yard and Yard Track		0	0	0				0
40 SITEWORK & SPECIAL CONDITIONS	0.78	65,151	23,280	**88,431**	$113,882	**15%**	**10%**	**0**
40.01 Demolition, Clearing, Earthwork		3,502	1,051	4,553				0
40.02 Site Utilities, Utility Relocation		37,348	14,939	52,287				0
40.03 Haz. mat'l, contam'd soil removal/mitigation, ground water treatments		779	234	1,013				0
40.04 Environmental mitigation, e.g. wetlands, historic/archeologic, parks		328	98	426				0
40.05 Site structures including retaining walls, sound walls		0	0	0				0
40.06 Pedestrian / bike access and accommodation, landscaping		14,934	4,480	19,414				0
40.07 Automobile, bus, van accessways including roads, parking lots		8,260	2,478	10,738				0
40.08 Temporary Facilities and other indirect costs during construction		0	0	0				0
50 SYSTEMS	0.78	37,647	11,294	**48,941**	$63,027	**8%**	**5%**	**0**
50.01 Train control and signals		6,970	2,091	9,061				0
50.02 Traffic signals and crossing protection		1,296	389	1,685				0
50.03 Traction power supply: substations		11,391	3,417	14,808				0
50.04 Traction power distribution: catenary and third rail		3,731	1,119	4,850				0
50.05 Communications		12,179	3,654	15,833				0
50.06 Fare collection system and equipment		2,080	624	2,704				0
50.07 Central Control		0	0	0				0
Construction Subtotal (10 - 50)	0.78	440,119	135,771	**575,890**	$741,633	**100%**	**64%**	**0**
60 ROW, LAND, EXISTING IMPROVEMENTS	0.78	0	0	**0**	$0		**0%**	**0**
60.01 Purchase or lease of real estate		0	0	0				0
60.02 Relocation of existing households and businesses		0	0	0				0
70 VEHICLES (number)	**0**	0	0	**0**			**0%**	**0**
70.01 Light Rail	0	0	0	0				0
70.02 Heavy Rail	0	0	0	0				0
70.03 Commuter Rail	0	0	0	0				0
70.04 Bus	0	0	0	0				0
70.05 Other	0	0	0	0				0
70.06 Non-revenue vehicles	0	0	0	0				0
70.07 Spare parts	0	0	0	0				0
80 PROFESSIONAL SERVICES (applies to Cats. 10-50)	0.78	205,016	0	**205,016**	**$264,021**	**36%**	**23%**	**0**
80.01 Project Development		40,312		40,312				0
80.02 Engineering		46,071		46,071				0
80.03 Project Management for Design and Construction		57,589		57,589				0
80.04 Construction Administration & Management		28,794		28,794				0
80.05 Professional Liability and other Non-Construction Insurance		576		576				0
80.06 Legal; Permits; Review Fees by other agencies, cities, etc.		21,308		21,308				0
80.07 Surveys, Testing, Investigation, Inspection		1,152		1,152				0
80.08 Start up		9,214		9,214				0
Subtotal (10 - 80)	0.78	645,135	135,771	**780,906**	**$1,005,654**		**87%**	**0**
90 UNALLOCATED CONTINGENCY				**117,136**			**13%**	**0**
Subtotal (10 - 90)	0.78			**898,041**	**$1,156,502**		**100%**	**0**
100 FINANCE CHARGES				**0**			**0%**	**0**
Total Project Cost (10 - 100)	0.78			**898,041**	**$1,156,502**		**100%**	**0**
Allocated Contingency as % of Base Yr Dollars w/o Contingency				21.05%				
Unallocated Contingency as % of Base Yr Dollars w/o Contingency				18.16%				
Total Contingency as % of Base Yr Dollars w/o Contingency				39.20%				
Unallocated Contingency as % of Subtotal (10 - 80)				15.00%				
YOE Construction Cost per Mile (X000)								$0
YOE Total Project Cost per Mile Not Including Vehicles (X000)								$0
YOE Total Project Cost per Mile (X000)								$0

MAIN WORKSHEET-BUILD ALTERNATIVE

West Santa Ana Branch Transit Corridor
Environmental Study
Imperial Hwy & Garfield Ave Cut-and-Cover Study
(From 1004+00.00 To 1036+61.56)

Today's Date 12/7/22
Yr of Base Year $ 2020
Yr of Revenue Ops 2035

	Quantity	Base Year Dollars w/o Contingency (X000)	Base Year Dollars Allocated Contingency (X000)	Base Year Dollars TOTAL (X000)	Base Year Dollars Unit Cost (X000)	Base Year Dollars Percentage of Construction Cost	Base Year Dollars Percentage of Total Project Cost	YOE Dollars Total (X000)
10 GUIDEWAY & TRACK ELEMENTS (route miles)	**0.62**	71,368	21,410	**92,778**	**$150,195**	**73%**	**47%**	**0**
10.01 Guideway: At-grade exclusive right-of-way	0.00	0	0	0				0
10.02 Guideway: At-grade semi-exclusive (allows cross-traffic)	0.00	0	0	0				0
10.03 Guideway: At-grade in mixed traffic	0.00	0	0	0				0
10.04 Guideway: Aerial structure	0.00	0	0	0				0
10.05 Guideway: Built-up fill	0.00	0	0	0				0
10.06 Guideway: Underground cut & cover	0.38	57,235	17,171	74,406	$196,170			0
10.07 Guideway: Underground tunnel	0.00	0	0	0				0
10.08 Guideway: Retained cut or fill	0.24	10,969	3,291	14,260	$59,807			0
10.09 Track: Direct fixation	0.62	3,164	949	4,113	$6,659			0
10.10 Track: Embedded	0.00	0	0	0				0
10.11 Track: Ballasted	0.00	0	0	0				0
10.12 Track: Special (switches, turnouts)		0	0	0				0
10.13 Track: Vibration and noise dampening		0	0	0				0
20 STATIONS, STOPS, TERMINALS, INTERMODAL (number)	**0**	0	0	**0**		**0%**	**0%**	**0**
20.01 At-grade station, stop, shelter, mall, terminal, platform	0	0	0	0				0
20.02 Aerial station, stop, shelter, mall, terminal, platform	0	0	0	0				0
20.03 Underground station, stop, shelter, mall, terminal, platform	0	0	0	0				0
20.04 Other stations, landings, terminals: Intermodal, ferry, trolley, etc.	0	0	0	0				0
20.05 Joint development	0	0	0	0				0
20.06 Automobile parking multi-story structure	0	0	0	0				0
20.07 Elevators, escalators	0	0	0	0				0
30 SUPPORT FACILITIES: YARDS, SHOPS, ADMIN. BLDGS	0.62	0	0	**0**	$0	**0%**	**0%**	**0**
30.01 Administration Building: Office, sales, storage, revenue counting		0	0	0				0
30.02 Light Maintenance Facility		0	0	0				0
30.03 Heavy Maintenance Facility		0	0	0				0
30.04 Storage or Maintenance of Way Building		0	0	0				0
30.05 Yard and Yard Track		0	0	0				0
40 SITEWORK & SPECIAL CONDITIONS	0.62	6,360	2,177	**8,537**	$13,821	**7%**	**4%**	**0**
40.01 Demolition, Clearing, Earthwork		2,786	836	3,622				0
40.02 Site Utilities, Utility Relocation		2,693	1,077	3,770				0
40.03 Haz. mat'l, contam'd soil removal/mitigation, ground water treatments		620	186	806				0
40.04 Environmental mitigation, e.g. wetlands, historic/archeologic, parks		261	78	339				0
40.05 Site structures including retaining walls, sound walls		0	0	0				0
40.06 Pedestrian / bike access and accommodation, landscaping		0	0	0				0
40.07 Automobile, bus, van accessways including roads, parking lots		0	0	0				0
40.08 Temporary Facilities and other indirect costs during construction		0	0	0				0
50 SYSTEMS	0.62	19,497	5,849	**25,346**	$41,032	**20%**	**13%**	**0**
50.01 Train control and signals		5,545	1,664	7,209				0
50.02 Traffic signals and crossing protection		1,296	389	1,685				0
50.03 Traction power supply: substations		0	0	0				0
50.04 Traction power distribution: catenary and third rail		2,968	890	3,858				0
50.05 Communications		9,688	2,906	12,594				0
50.06 Fare collection system and equipment		0	0	0				0
50.07 Central Control		0	0	0				0
Construction Subtotal (10 - 50)	0.62	97,225	29,437	**126,662**	$205,047	**100%**	**64%**	**0**
60 ROW, LAND, EXISTING IMPROVEMENTS	0.62	0	0	**0**	$0		**0%**	**0**
60.01 Purchase or lease of real estate		0	0	0				0
60.02 Relocation of existing households and businesses		0	0	0				0
70 VEHICLES (number)	**0**	0	0	**0**			**0%**	**0**
70.01 Light Rail	0	0	0	0				0
70.02 Heavy Rail	0	0	0	0				0
70.03 Commuter Rail	0	0	0	0				0
70.04 Bus	0	0	0	0				0
70.05 Other	0	0	0	0				0
70.06 Non-revenue vehicles	0	0	0	0				0
70.07 Spare parts	0	0	0	0				0
80 PROFESSIONAL SERVICES (applies to Cats. 10-50)	0.62	45,091	0	**45,091**	**$72,996**	**36%**	**23%**	**0**
80.01 Project Development		8,866		8,866				0
80.02 Engineering		10,133		10,133				0
80.03 Project Management for Design and Construction		12,666		12,666				0
80.04 Construction Administration & Management		6,333		6,333				0
80.05 Professional Liability and other Non-Construction Insurance		127		127				0
80.06 Legal; Permits; Review Fees by other agencies, cities, etc.		4,686		4,686				0
80.07 Surveys, Testing, Investigation, Inspection		253		253				0
80.08 Start up		2,027		2,027				0
Subtotal (10 - 80)	0.62	142,316	29,437	**171,753**	**$278,043**		**87%**	**0**
90 UNALLOCATED CONTINGENCY				**25,763**			**13%**	**0**
Subtotal (10 - 90)	0.62			**197,516**	**$319,750**		**100%**	**0**
100 FINANCE CHARGES				**0**			**0%**	**0**
Total Project Cost (10 - 100)	0.62			**197,516**	**$319,750**		**100%**	**0**

Allocated Contingency as % of Base Yr Dollars w/o Contingency	20.68%
Unallocated Contingency as % of Base Yr Dollars w/o Contingency	18.10%
Total Contingency as % of Base Yr Dollars w/o Contingency	38.79%
Unallocated Contingency as % of Subtotal (10 - 80)	15.00%

YOE Construction Cost per Mile (X000)	$0
YOE Total Project Cost per Mile Not Including Vehicles (X000)	$0
YOE Total Project Cost per Mile (X000)	$0

MAIN WORKSHEET-BUILD ALTERNATIVE

West Santa Ana Branch Transit Corridor
Environmental Study
Paramount Blvd. & Rosecrans Blvd. Cut-and-Cover Study
(From 1093+11.91 To 1167+00.00)

Today's Date **12/7/22**
Yr of Base Year $ 2020
Yr of Revenue Ops 2035

	Quantity	Base Year Dollars w/o Contingency (X000)	Base Year Dollars Allocated Contingency (X000)	Base Year Dollars TOTAL (X000)	Base Year Dollars Unit Cost (X000)	Base Year Dollars Percentage of Construction Cost	Base Year Dollars Percentage of Total Project Cost	YOE Dollars Total (X000)
10 GUIDEWAY & TRACK ELEMENTS (route miles)	**1.40**	196,447	58,934	**255,381**	**$182,512**	**35%**	**22%**	**0**
10.01 Guideway: At-grade exclusive right-of-way	0.03	296	89	385	$13,673			0
10.02 Guideway: At-grade semi-exclusive (allows cross-traffic)	0.00	0	0	0				0
10.03 Guideway: At-grade in mixed traffic	0.00	0	0	0				0
10.04 Guideway: Aerial structure	0.00	0	0	0				0
10.05 Guideway: Built-up fill	0.00	0	0	0				0
10.06 Guideway: Underground cut & cover	1.14	178,547	53,564	232,111	$203,597			0
10.07 Guideway: Underground tunnel	0.00	0	0	0				0
10.08 Guideway: Retained cut or fill	0.23	10,468	3,140	13,608	$58,894			0
10.09 Track: Direct fixation	1.37	7,022	2,107	9,129	$6,658			0
10.10 Track: Embedded	0.00	0	0	0				0
10.11 Track: Ballasted	0.03	114	34	148	$5,266			0
10.12 Track: Special (switches, turnouts)		0	0	0				0
10.13 Track: Vibration and noise dampening		0	0	0				0
20 STATIONS, STOPS, TERMINALS, INTERMODAL (number)	**1**	230,261	69,078	**299,339**	**$299,339**	**41%**	**26%**	**0**
20.01 At-grade station, stop, shelter, mall, terminal, platform	0	0	0	0				0
20.02 Aerial station, stop, shelter, mall, terminal, platform	0	0	0	0				0
20.03 Underground station, stop, shelter, mall, terminal, platform	1	213,299	63,990	277,289	$277,289			0
20.04 Other stations, landings, terminals: Intermodal, ferry, trolley, etc.	0	0	0	0				0
20.05 Joint development	0	0	0	0				0
20.06 Automobile parking multi-story structure	0	0	0	0				0
20.07 Elevators, escalators	14	16,962	5,089	22,051	$1,575			0
30 SUPPORT FACILITIES: YARDS, SHOPS, ADMIN. BLDGS	1.40	0	0	**0**	$0	**0%**	**0%**	**0**
30.01 Administration Building: Office, sales, storage, revenue counting		0	0	0				0
30.02 Light Maintenance Facility		0	0	0				0
30.03 Heavy Maintenance Facility		0	0	0				0
30.04 Storage or Maintenance of Way Building		0	0	0				0
30.05 Yard and Yard Track		0	0	0				0
40 SITEWORK & SPECIAL CONDITIONS	1.40	74,635	26,650	**101,285**	$72,385	**14%**	**9%**	**0**
40.01 Demolition, Clearing, Earthwork		6,311	1,893	8,204				0
40.02 Site Utilities, Utility Relocation		42,592	17,037	59,629				0
40.03 Haz. mat'l, contam'd soil removal/mitigation, ground water treatments		1,404	421	1,825				0
40.04 Environmental mitigation, e.g. wetlands, historic/archeologic, parks		591	177	768				0
40.05 Site structures including retaining walls, sound walls		0	0	0				0
40.06 Pedestrian / bike access and accommodation, landscaping		15,477	4,643	20,120				0
40.07 Automobile, bus, van accessways including roads, parking lots		8,260	2,478	10,738				0
40.08 Temporary Facilities and other indirect costs during construction		0	0	0				0
50 SYSTEMS	1.40	55,996	16,799	**72,795**	$52,024	**10%**	**6%**	**0**
50.01 Train control and signals		12,560	3,768	16,328				0
50.02 Traffic signals and crossing protection		1,296	389	1,685				0
50.03 Traction power supply: substations		11,391	3,417	14,808				0
50.04 Traction power distribution: catenary and third rail		6,723	2,017	8,740				0
50.05 Communications		21,946	6,584	28,530				0
50.06 Fare collection system and equipment		2,080	624	2,704				0
50.07 Central Control		0	0	0				0
Construction Subtotal (10 - 50)	1.40	557,339	171,461	**728,800**	$520,847	**100%**	**64%**	**0**
60 ROW, LAND, EXISTING IMPROVEMENTS	1.40	0	0	**0**	$0		**0%**	**0**
60.01 Purchase or lease of real estate		0	0	0				0
60.02 Relocation of existing households and businesses		0	0	0				0
70 VEHICLES (number)	**0**	0	0	**0**			**0%**	**0**
70.01 Light Rail	0	0	0	0				0
70.02 Heavy Rail	0	0	0	0				0
70.03 Commuter Rail	0	0	0	0				0
70.04 Bus	0	0	0	0				0
70.05 Other	0	0	0	0				0
70.06 Non-revenue vehicles	0	0	0	0				0
70.07 Spare parts	0	0	0	0				0
80 PROFESSIONAL SERVICES (applies to Cats. 10-50)	1.40	259,454	0	**259,454**	**$185,422**	**36%**	**23%**	**0**
80.01 Project Development		51,016		51,016				0
80.02 Engineering		58,304		58,304				0
80.03 Project Management for Design and Construction		72,880		72,880				0
80.04 Construction Administration & Management		36,440		36,440				0
80.05 Professional Liability and other Non-Construction Insurance		729		729				0
80.06 Legal; Permits; Review Fees by other agencies, cities, etc.		26,966		26,966				0
80.07 Surveys, Testing, Investigation, Inspection		1,458		1,458				0
80.08 Start up		11,661		11,661				0
Subtotal (10 - 80)	1.40	816,793	171,461	**988,254**	**$706,269**		**87%**	**0**
90 UNALLOCATED CONTINGENCY				**148,238**			**13%**	**0**
Subtotal (10 - 90)	1.40			**1,136,492**	**$812,210**		**100%**	**0**
100 FINANCE CHARGES				**0**			**0%**	**0**
Total Project Cost (10 - 100)	1.40			**1,136,492**	**$812,210**		**100%**	**0**
Allocated Contingency as % of Base Yr Dollars w/o Contingency				20.99%				
Unallocated Contingency as % of Base Yr Dollars w/o Contingency				18.15%				
Total Contingency as % of Base Yr Dollars w/o Contingency				39.14%				
Unallocated Contingency as % of Subtotal (10 - 80)				15.00%				
YOE Construction Cost per Mile (X000)								$0
YOE Total Project Cost per Mile Not Including Vehicles (X000)								$0
YOE Total Project Cost per Mile (X000)								$0

MAIN WORKSHEET-BUILD ALTERNATIVE

West Santa Ana Branch Transit Corridor
Environmental Study
Flower St. & Woodruff Ave. Cut-and-Cover Study
(From 1259+27.93 To 1288+98.93)

Today's Date 12/7/22
Yr of Base Year $ 2020
Yr of Revenue Ops 2035

	Quantity	Base Year Dollars w/o Contingency (X000)	Base Year Dollars Allocated Contingency (X000)	Base Year Dollars TOTAL (X000)	Base Year Dollars Unit Cost (X000)	Base Year Dollars Percentage of Construction Cost	Base Year Dollars Percentage of Total Project Cost	YOE Dollars Total (X000)
10 GUIDEWAY & TRACK ELEMENTS (route miles)	**0.56**	35,414	10,624	**46,038**	**$81,818**	**59%**	**38%**	**0**
10.01 Guideway: At-grade exclusive right-of-way	0.00	0	0	0				0
10.02 Guideway: At-grade semi-exclusive (allows cross-traffic)	0.00	0	0	0				0
10.03 Guideway: At-grade in mixed traffic	0.00	0	0	0				0
10.04 Guideway: Aerial structure	0.00	0	0	0				0
10.05 Guideway: Built-up fill	0.00	0	0	0				0
10.06 Guideway: Underground cut & cover	0.10	13,125	3,938	17,063	$175,102			0
10.07 Guideway: Underground tunnel	0.00	0	0	0				0
10.08 Guideway: Retained cut or fill	0.47	19,407	5,822	25,229	$54,227			0
10.09 Track: Direct fixation	0.56	2,882	865	3,747	$6,658			0
10.10 Track: Embedded	0.00	0	0	0				0
10.11 Track: Ballasted	0.00	0	0	0				0
10.12 Track: Special (switches, turnouts)		0	0	0				0
10.13 Track: Vibration and noise dampening		0	0	0				0
20 STATIONS, STOPS, TERMINALS, INTERMODAL (number)	**0**	0	0	**0**		**0%**	**0%**	**0**
20.01 At-grade station, stop, shelter, mall, terminal, platform	0	0	0	0				0
20.02 Aerial station, stop, shelter, mall, terminal, platform	0	0	0	0				0
20.03 Underground station, stop, shelter, mall, terminal, platform	0	0	0	0				0
20.04 Other stations, landings, terminals: Intermodal, ferry, trolley, etc.	0	0	0	0				0
20.05 Joint development	0	0	0	0				0
20.06 Automobile parking multi-story structure	0	0	0	0				0
20.07 Elevators, escalators	0	0	0	0				0
30 SUPPORT FACILITIES: YARDS, SHOPS, ADMIN. BLDGS	0.56	0	0	**0**	$0	**0%**	**0%**	**0**
30.01 Administration Building: Office, sales, storage, revenue counting		0	0	0				0
30.02 Light Maintenance Facility		0	0	0				0
30.03 Heavy Maintenance Facility		0	0	0				0
30.04 Storage or Maintenance of Way Building		0	0	0				0
30.05 Yard and Yard Track		0	0	0				0
40 SITEWORK & SPECIAL CONDITIONS	0.56	5,684	1,940	**7,624**	$13,549	**10%**	**6%**	**0**
40.01 Demolition, Clearing, Earthwork		2,538	761	3,299				0
40.02 Site Utilities, Utility Relocation		2,344	938	3,282				0
40.03 Haz. mat'l, contam'd soil removal/mitigation, ground water treatments		564	169	733				0
40.04 Environmental mitigation, e.g. wetlands, historic/archeologic, parks		238	71	309				0
40.05 Site structures including retaining walls, sound walls		0	0	0				0
40.06 Pedestrian / bike access and accommodation, landscaping		0	0	0				0
40.07 Automobile, bus, van accessways including roads, parking lots		0	0	0				0
40.08 Temporary Facilities and other indirect costs during construction		0	0	0				0
50 SYSTEMS	0.56	19,172	5,752	**24,924**	$44,294	**32%**	**20%**	**0**
50.01 Train control and signals		5,051	1,515	6,566				0
50.02 Traffic signals and crossing protection		2,592	778	3,370				0
50.03 Traction power supply: substations		0	0	0				0
50.04 Traction power distribution: catenary and third rail		2,704	811	3,515				0
50.05 Communications		8,825	2,648	11,473				0
50.06 Fare collection system and equipment		0	0	0				0
50.07 Central Control		0	0	0				0
Construction Subtotal (10 - 50)	0.56	60,270	18,315	**78,585**	$139,660	**100%**	**64%**	**0**
60 ROW, LAND, EXISTING IMPROVEMENTS	0.56	0	0	**0**	$0		**0%**	**0**
60.01 Purchase or lease of real estate		0	0	0				0
60.02 Relocation of existing households and businesses		0	0	0				0
70 VEHICLES (number)	**0**	0	0	**0**			**0%**	**0**
70.01 Light Rail	0	0	0	0				0
70.02 Heavy Rail	0	0	0	0				0
70.03 Commuter Rail	0	0	0	0				0
70.04 Bus	0	0	0	0				0
70.05 Other	0	0	0	0				0
70.06 Non-revenue vehicles	0	0	0	0				0
70.07 Spare parts	0	0	0	0				0
80 PROFESSIONAL SERVICES (applies to Cats. 10-50)	0.56	27,977	0	**27,977**	**$49,720**	**36%**	**23%**	**0**
80.01 Project Development		5,501		5,501				0
80.02 Engineering		6,287		6,287				0
80.03 Project Management for Design and Construction		7,859		7,859				0
80.04 Construction Administration & Management		3,929		3,929				0
80.05 Professional Liability and other Non-Construction Insurance		79		79				0
80.06 Legal; Permits; Review Fees by other agencies, cities, etc.		2,908		2,908				0
80.07 Surveys, Testing, Investigation, Inspection		157		157				0
80.08 Start up		1,257		1,257				0
Subtotal (10 - 80)	0.56	88,247	18,315	**106,562**	**$189,381**		**87%**	**0**
90 UNALLOCATED CONTINGENCY				**15,984**			**13%**	**0**
Subtotal (10 - 90)	0.56			**122,547**	**$217,788**		**100%**	**0**
100 FINANCE CHARGES				**0**			**0%**	**0**
Total Project Cost (10 - 100)	0.56			**122,547**	**$217,788**		**100%**	**0**
Allocated Contingency as % of Base Yr Dollars w/o Contingency				20.75%				
Unallocated Contingency as % of Base Yr Dollars w/o Contingency				18.11%				
Total Contingency as % of Base Yr Dollars w/o Contingency				38.87%				
Unallocated Contingency as % of Subtotal (10 - 80)				15.00%				
YOE Construction Cost per Mile (X000)								$0
YOE Total Project Cost per Mile Not Including Vehicles (X000)								$0
YOE Total Project Cost per Mile (X000)								$0

MAIN WORKSHEET-BUILD ALTERNATIVE

West Santa Ana Branch Transit Corridor
Environmental Study
183rd & Gridley Ave. Cut-and-Cover Option Without Station
(From 1357+00.00 To 1390+00.00)

Today's Date 12/7/22
Yr of Base Year $ 2020
Yr of Revenue Ops 2035

	Quantity	Base Year Dollars w/o Contingency (X000)	Base Year Dollars Allocated Contingency (X000)	Base Year Dollars TOTAL (X000)	Base Year Dollars Unit Cost (X000)	Base Year Dollars Percentage of Construction Cost	Base Year Dollars Percentage of Total Project Cost	YOE Dollars Total (X000)
10 GUIDEWAY & TRACK ELEMENTS (route miles)	**0.63**	64,192	19,258	**83,450**	**$133,519**	**34%**	**22%**	**0**
10.01 Guideway: At-grade exclusive right-of-way	0.00	0	0	0				0
10.02 Guideway: At-grade semi-exclusive (allows cross-traffic)	0.00	0	0	0				0
10.03 Guideway: At-grade in mixed traffic	0.00	0	0	0				0
10.04 Guideway: Aerial structure	0.00	0	0	0				0
10.05 Guideway: Built-up fill	0.00	0	0	0				0
10.06 Guideway: Underground cut & cover	0.38	50,586	15,176	65,762	$175,099			0
10.07 Guideway: Underground tunnel	0.00	0	0	0				0
10.08 Guideway: Retained cut or fill	0.25	10,405	3,122	13,527	$54,229			0
10.09 Track: Direct fixation	0.63	3,201	960	4,161	$6,658			0
10.10 Track: Embedded	0.00	0	0	0				0
10.11 Track: Ballasted	0.00	0	0	0				0
10.12 Track: Special (switches, turnouts)		0	0	0				0
10.13 Track: Vibration and noise dampening		0	0	0				0
20 STATIONS, STOPS, TERMINALS, INTERMODAL (number)	**0**	25,000	7,500	**32,500**		**13%**	**9%**	**0**
20.01 At-grade station, stop, shelter, mall, terminal, platform	0	0	0	0				0
20.02 Aerial station, stop, shelter, mall, terminal, platform	0	0	0	0				0
20.03 Underground station, stop, shelter, mall, terminal, platform	0	25,000	7,500	32,500				0
20.04 Other stations, landings, terminals: Intermodal, ferry, trolley, etc.	0	0	0	0				0
20.05 Joint development	0	0	0	0				0
20.06 Automobile parking multi-story structure	0	0	0	0				0
20.07 Elevators, escalators	0	0	0	0				0
30 SUPPORT FACILITIES: YARDS, SHOPS, ADMIN. BLDGS	0.63	0	0	**0**	$0	**0%**	**0%**	**0**
30.01 Administration Building: Office, sales, storage, revenue counting		0	0	0				0
30.02 Light Maintenance Facility		0	0	0				0
30.03 Heavy Maintenance Facility		0	0	0				0
30.04 Storage or Maintenance of Way Building		0	0	0				0
30.05 Yard and Yard Track		0	0	0				0
40 SITEWORK & SPECIAL CONDITIONS	0.63	64,138	23,174	**87,312**	$139,700	**36%**	**23%**	**0**
40.01 Demolition, Clearing, Earthwork		2,819	846	3,665				0
40.02 Site Utilities, Utility Relocation		39,328	15,731	55,059				0
40.03 Haz. mat'l, contam'd soil removal/mitigation, ground water treatments		627	188	815				0
40.04 Environmental mitigation, e.g. wetlands, historic/archeologic, parks		264	79	343				0
40.05 Site structures including retaining walls, sound walls		0	0	0				0
40.06 Pedestrian / bike access and accommodation, landscaping		12,840	3,852	16,692				0
40.07 Automobile, bus, van accessways including roads, parking lots		8,260	2,478	10,738				0
40.08 Temporary Facilities and other indirect costs during construction		0	0	0				0
50 SYSTEMS	0.63	31,102	9,331	**40,433**	$64,692	**17%**	**11%**	**0**
50.01 Train control and signals		5,610	1,683	7,293				0
50.02 Traffic signals and crossing protection		1,296	389	1,685				0
50.03 Traction power supply: substations		11,391	3,417	14,808				0
50.04 Traction power distribution: catenary and third rail		3,003	901	3,904				0
50.05 Communications		9,802	2,941	12,743				0
50.06 Fare collection system and equipment		0	0	0				0
50.07 Central Control		0	0	0				0
Construction Subtotal (10 - 50)	0.63	184,432	59,262	**243,694**	$389,911	**100%**	**64%**	**0**
60 ROW, LAND, EXISTING IMPROVEMENTS	0.63	0	0	**0**	$0		**0%**	**0**
60.01 Purchase or lease of real estate		0	0	0				0
60.02 Relocation of existing households and businesses		0	0	0				0
70 VEHICLES (number)	**0**	0	0	**0**			**0%**	**0**
70.01 Light Rail	0	0	0	0				0
70.02 Heavy Rail	0	0	0	0				0
70.03 Commuter Rail	0	0	0	0				0
70.04 Bus	0	0	0	0				0
70.05 Other	0	0	0	0				0
70.06 Non-revenue vehicles	0	0	0	0				0
70.07 Spare parts	0	0	0	0				0
80 PROFESSIONAL SERVICES (applies to Cats. 10-50)	0.63	86,756	0	**86,756**	**$138,810**	**36%**	**23%**	**0**
80.01 Project Development		17,059		17,059				0
80.02 Engineering		19,496		19,496				0
80.03 Project Management for Design and Construction		24,369		24,369				0
80.04 Construction Administration & Management		12,185		12,185				0
80.05 Professional Liability and other Non-Construction Insurance		244		244				0
80.06 Legal; Permits; Review Fees by other agencies, cities, etc.		9,017		9,017				0
80.07 Surveys, Testing, Investigation, Inspection		487		487				0
80.08 Start up		3,899		3,899				0
Subtotal (10 - 80)	0.63	271,188	59,262	**330,450**	**$528,721**		**87%**	**0**
90 UNALLOCATED CONTINGENCY				**49,568**			**13%**	**0**
Subtotal (10 - 90)	0.63			**380,018**	**$608,029**		**100%**	**0**
100 FINANCE CHARGES				**0**			**0%**	**0**
Total Project Cost (10 - 100)	0.63			**380,018**	**$608,029**		**100%**	**0**

Allocated Contingency as % of Base Yr Dollars w/o Contingency	21.85%
Unallocated Contingency as % of Base Yr Dollars w/o Contingency	18.28%
Total Contingency as % of Base Yr Dollars w/o Contingency	40.13%
Unallocated Contingency as % of Subtotal (10 - 80)	15.00%

YOE Construction Cost per Mile (X000)	$0
YOE Total Project Cost per Mile Not Including Vehicles (X000)	$0
YOE Total Project Cost per Mile (X000)	$0

MAIN WORKSHEET-BUILD ALTERNATIVE

West Santa Ana Branch Transit Corridor
Environmental Study
183rd & Gridley Ave. Cut-and-Cover Option With Station
(From 1357+00.00 To 1390+00.00)

Today's Date 12/7/22
Yr of Base Year $ 2020
Yr of Revenue Ops 2035

	Quantity	Base Year Dollars w/o Contingency (X000)	Base Year Dollars Allocated Contingency (X000)	Base Year Dollars TOTAL (X000)	Base Year Dollars Unit Cost (X000)	Base Year Dollars Percentage of Construction Cost	Base Year Dollars Percentage of Total Project Cost	YOE Dollars Total (X000)
10 GUIDEWAY & TRACK ELEMENTS (route miles)	**0.63**	64,192	19,258	**83,450**	**$133,519**	**16%**	**10%**	**0**
10.01 Guideway: At-grade exclusive right-of-way	0.00	0	0	0				0
10.02 Guideway: At-grade semi-exclusive (allows cross-traffic)	0.00	0	0	0				0
10.03 Guideway: At-grade in mixed traffic	0.00	0	0	0				0
10.04 Guideway: Aerial structure	0.00	0	0	0				0
10.05 Guideway: Built-up fill	0.00	0	0	0				0
10.06 Guideway: Underground cut & cover	0.38	50,586	15,176	65,762	$175,099			0
10.07 Guideway: Underground tunnel	0.00	0	0	0				0
10.08 Guideway: Retained cut or fill	0.25	10,405	3,122	13,527	$54,229			0
10.09 Track: Direct fixation	0.63	3,201	960	4,161	$6,658			0
10.10 Track: Embedded	0.00	0	0	0				0
10.11 Track: Ballasted	0.00	0	0	0				0
10.12 Track: Special (switches, turnouts)		0	0	0				0
10.13 Track: Vibration and noise dampening		0	0	0				0
20 STATIONS, STOPS, TERMINALS, INTERMODAL (number)	**1**	230,261	69,078	**299,339**	**$299,339**	**58%**	**37%**	**0**
20.01 At-grade station, stop, shelter, mall, terminal, platform	0	0	0	0				0
20.02 Aerial station, stop, shelter, mall, terminal, platform	0	0	0	0				0
20.03 Underground station, stop, shelter, mall, terminal, platform	1	213,299	63,990	277,289	$277,289			0
20.04 Other stations, landings, terminals: Intermodal, ferry, trolley, etc.	0	0	0	0				0
20.05 Joint development	0	0	0	0				0
20.06 Automobile parking multi-story structure	0	0	0	0				0
20.07 Elevators, escalators	14	16,962	5,089	22,051	$1,575			0
30 SUPPORT FACILITIES: YARDS, SHOPS, ADMIN. BLDGS	0.63	0	0	**0**	$0	**0%**	**0%**	**0**
30.01 Administration Building: Office, sales, storage, revenue counting		0	0	0				0
30.02 Light Maintenance Facility		0	0	0				0
30.03 Heavy Maintenance Facility		0	0	0				0
30.04 Storage or Maintenance of Way Building		0	0	0				0
30.05 Yard and Yard Track		0	0	0				0
40 SITEWORK & SPECIAL CONDITIONS	0.63	63,919	26,619	**90,538**	$144,861	**18%**	**11%**	**0**
40.01 Demolition, Clearing, Earthwork		2,819	846	3,665				0
40.02 Site Utilities, Utility Relocation		37,216	18,608	55,824				0
40.03 Haz. mat'l, contam'd soil removal/mitigation, ground water treatments		627	188	815				0
40.04 Environmental mitigation, e.g. wetlands, historic/archeologic, parks		264	79	343				0
40.05 Site structures including retaining walls, sound walls		0	0	0				0
40.06 Pedestrian / bike access and accommodation, landscaping		14,733	4,420	19,153				0
40.07 Automobile, bus, van accessways including roads, parking lots		8,260	2,478	10,738				0
40.08 Temporary Facilities and other indirect costs during construction		0	0	0				0
50 SYSTEMS	0.63	33,182	9,955	**43,137**	$69,019	**8%**	**5%**	**0**
50.01 Train control and signals		5,610	1,683	7,293				0
50.02 Traffic signals and crossing protection		1,296	389	1,685				0
50.03 Traction power supply: substations		11,391	3,417	14,808				0
50.04 Traction power distribution: catenary and third rail		3,003	901	3,904				0
50.05 Communications		9,802	2,941	12,743				0
50.06 Fare collection system and equipment		2,080	624	2,704				0
50.07 Central Control		0	0	0				0
Construction Subtotal (10 - 50)	0.63	391,554	124,909	**516,463**	$826,341	**100%**	**64%**	**0**
60 ROW, LAND, EXISTING IMPROVEMENTS	0.63	0	0	**0**	$0		**0%**	**0**
60.01 Purchase or lease of real estate		0	0	0				0
60.02 Relocation of existing households and businesses		0	0	0				0
70 VEHICLES (number)	**0**	0	0	**0**			**0%**	**0**
70.01 Light Rail	0	0	0	0				0
70.02 Heavy Rail	0	0	0	0				0
70.03 Commuter Rail	0	0	0	0				0
70.04 Bus	0	0	0	0				0
70.05 Other	0	0	0	0				0
70.06 Non-revenue vehicles	0	0	0	0				0
70.07 Spare parts	0	0	0	0				0
80 PROFESSIONAL SERVICES (applies to Cats. 10-50)	0.63	183,859	0	**183,859**	**$294,174**	**36%**	**23%**	**0**
80.01 Project Development		36,152		36,152				0
80.02 Engineering		41,317		41,317				0
80.03 Project Management for Design and Construction		51,646		51,646				0
80.04 Construction Administration & Management		25,823		25,823				0
80.05 Professional Liability and other Non-Construction Insurance		516		516				0
80.06 Legal; Permits; Review Fees by other agencies, cities, etc.		19,109		19,109				0
80.07 Surveys, Testing, Investigation, Inspection		1,033		1,033				0
80.08 Start up		8,263		8,263				0
Subtotal (10 - 80)	0.63	575,413	124,909	**700,322**	**$1,120,516**		**87%**	**0**
90 UNALLOCATED CONTINGENCY				**105,048**			**13%**	**0**
Subtotal (10 - 90)	0.63			**805,371**	**$1,288,593**		**100%**	**0**
100 FINANCE CHARGES				**0**			**0%**	**0**
Total Project Cost (10 - 100)	0.63			**805,371**	**$1,288,593**		**100%**	**0**

Allocated Contingency as % of Base Yr Dollars w/o Contingency	21.71%
Unallocated Contingency as % of Base Yr Dollars w/o Contingency	18.26%
Total Contingency as % of Base Yr Dollars w/o Contingency	39.96%
Unallocated Contingency as % of Subtotal (10 - 80)	15.00%

YOE Construction Cost per Mile (X000)	$0
YOE Total Project Cost per Mile Not Including Vehicles (X000)	$0
YOE Total Project Cost per Mile (X000)	$0