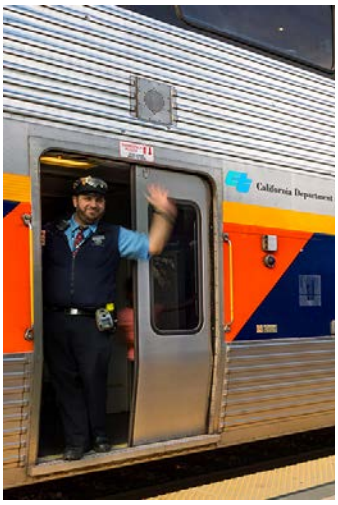
FINAL REPORT



June 2022

Solano Rail Hub Advanced Planning Study Phase I

Solano Transportation Authority
. . . working for you!

ARUP

A summary of project benefits and design options to provide increased passenger convenience and safety at the Suisun-Fairfield Amtrak/Capitol Corridor Station and deliver an accessible pedestrian connection between the two cities, this Final Report summarizes the available data and information.

SOLANO TRANSPORTATION AUTHORITY
SOLANO RAIL HUB ADVANCED PLANNING STUDY PHASE I
JUNE 2022

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SOLANO RAIL HUB ADVANCED PLANNING STUDY PHASE I

INTRODUCTION

Summary

The Solano Rail Hub Project — located at the site of the current Suisun-Fairfield Amtrak/Capitol Corridor Station — seeks to upgrade and expand the current station and create seamless connections between the two cities. The project will enhance train passenger safety and comfort, unify the two downtowns by reestablishing a viable and accessible pedestrian and bicycle connection between downtown Fairfield and downtown Suisun City, and support and enable each city's vision for downtown development.

The Solano Rail Hub was first identified in the 2018 *California State Rail Plan* (2018 CSRP) that would:

- Support expanded Capitol Corridor intercity rail service – potentially including direct trains to downtown San Francisco;
- Connect with future Sonoma-Marin Area Rail Transit (SMART) rail service from Napa and Marin;
- Host express buses to Contra Costa County; and
- Serve connections to local transit in mid-Solano County;

providing passengers with seamless and reliable connections throughout the region.

Various designs have been considered that can deliver this vision — alternatives include relocation of the platform to the north of State Route 12 (SR 12) and a realignment of the platform to be fully south of SR 12, as well as below- and above-grade connections that cross the Union Pacific Railroad (UPRR) tracks. These alternatives would all provide a pedestrian and bicycle link from Suisun City's Main Street to Fairfield's Union Avenue or Jefferson Street.

The purpose of the current study is to define design options to advance into further study and participate in the state's grant and funding process.

Project Study Sponsor

The Solano Transportation Authority (STA) is the sponsor of the Solano Rail Hub Study. Project partners include Capitol Corridor Joint Powers Authority, the City of Fairfield, City of Suisun City, the County of Solano, Caltrans, and the California State Transportation Agency. Arup US, Inc. (Arup) developed the project's conceptual sketches. Noakro Consult provided guidance on required environmental studies and compliance. DBK Advisory Services reviewed the project elements and the conceptual sketches.

Existing Conditions

This section outlines the existing services and usage in the study area.

Location — The current Suisun-Fairfield Station is located on Main Street at SR 12 in Suisun City. The station is a small structure, and the rail infrastructure consists of a side platform on the eastbound track and a narrow (approximately 8ft wide) center platform used for trains on the westbound track. Opposite the station building on Main Street is a 306-space station parking lot, with a pre-pandemic typical weekday occupancy of about 65% to 75%.

The current station bisects (along with Highway 12 and the UPRR tracks) downtown Fairfield and downtown Suisun City. The area north of Highway 12 is designated by MTC as an "Equity Priority Communities (EPC). EPCs are identified based on eight demographic characteristics. If a location exceeds both threshold values for Low-Income and People of Color shares (20% and 70%) or exceeds the threshold value for Low-Income and also exceeds the threshold values for three or more variables it is an Equity Priority Community. Figure 1 identifies the relationship of the EPC to the Suisun-Fairfield Station.

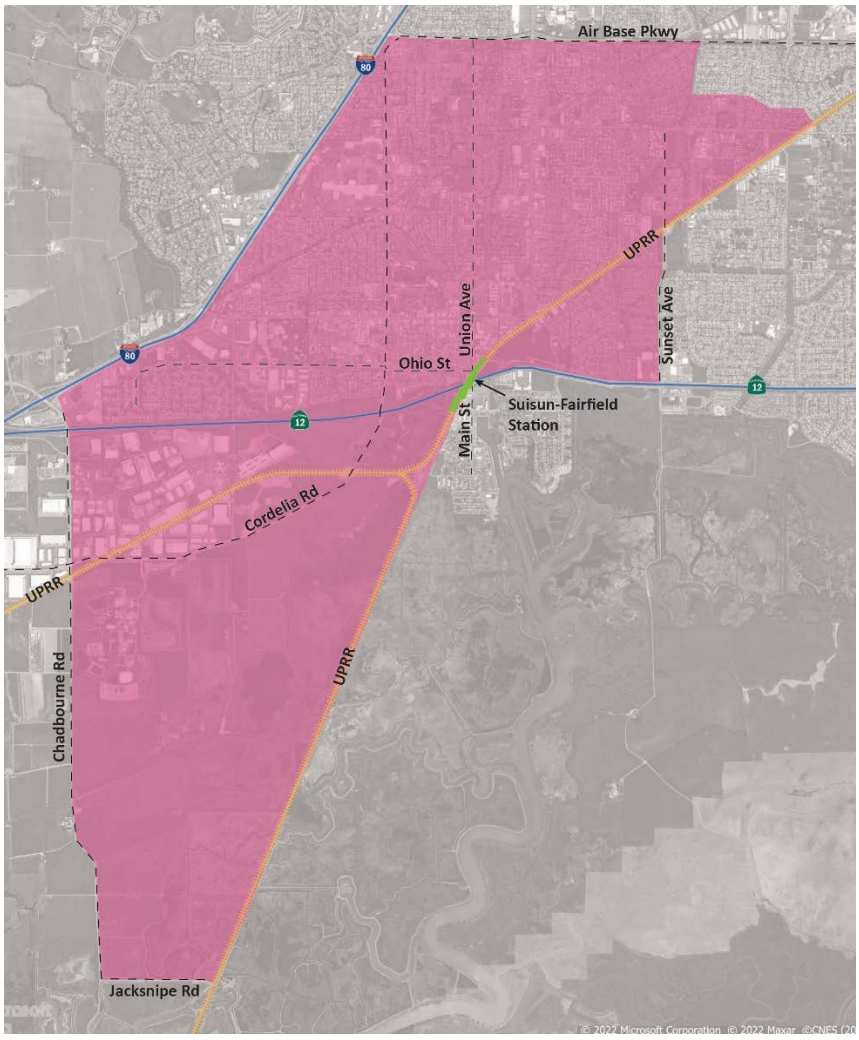

FIGURE 1 - FAIRFIELD EQUITY PRIORITY COMMUNITY (SHADED) (SOURCE: MTC)

Transportation and Utility Infrastructure — The station area includes highways, streets, bicycle lanes and dedicated bicycle facilities and several utilities. Major infrastructure (in addition to the UPRR right-of-way, which is a minimum 100ft wide) includes SR 12 (which bridges over the site), city streets, municipal water and sewer services, and stormwater facilities. Especially important to note are Pacific Gas and Electric Company (PG&E) natural gas transmission lines, which cross Union Avenue north of the UPRR and run parallel to Main Street in Suisun City, and the Kinder-Morgan Petroleum pipeline, which is buried along the west side of and crosses under the UPRR right-of-way. This pipeline transports gasoline, jet fuel, and diesel fuel from a hub in the East Bay via a 20-inch pipeline that extends to Sacramento and serves Travis Air Force Base. Almost all of the transportation, utility and railroad infrastructure is built based on designs and standards stretching back more than 25 years.

UPRR Facilities – The UPRR rail infrastructure consists of two tracks, non-contiguous fencing, and two (2) passenger platforms (a side platform adjacent to the Depot building and a smaller, narrow eight-foot wide platform between the two mainline tracks). The existing speed limit for trains at the station is 70 miles per hour (mph) for passenger trains and 60 mph for freight trains. On each approach to the station, the speed limit is 79 mph for passenger trains and 60 mph for freight trains. Within the UPRR right-of-way, existing bridge columns supporting the SR 12 grade separation are placed about 90ft–100ft apart.

Disabled Access – Amtrak, as the operator for the CCJPA Capitol Corridor passenger trains, requires that platforms must be "readily accessible to and usable by individuals with disabilities, including individuals who use wheelchairs." The current narrow center platform requires all passengers – including those with disabilities – to cross an active track and board into a train on a slope. In addition, an existing pedestrian bridge with a grade of more than 9% -- non-compliant under the Americans with Disabilities Act (ADA) – spans the UPRR right-of-way connecting Main Street in Suisun City and Union Avenue.

Railroad Operational Considerations – The current "grandfathered" design of the station and platforms results in constraints on railroad operations. As passengers must cross active tracks, UPRR – as host railroad owner and train dispatcher – enforces the "hold-out" rule that requires if a train is stopped for passengers, an approaching train on another track must wait outside the station. This results in delay for passenger trains, and a more significant delay for freight trains. The freight trains must dwell outside the station and as a result, contribute to additional diesel exhaust in communities of concern.

Ownership and Easements – The rights-of-way ownership is spread among Caltrans (SR 12), UPRR (most of the rail alignment), the City of Fairfield, and City of Suisun City and includes easements and other uses by various utilities. The property documents reviewed indicate that UPRR ownership is not contiguous, and it appears that the City of Fairfield retains ownership of the historic north-south alignment of Union Avenue (turning into Main Street in Suisun City), along with another crossing of the UPRR right-of-way that extends from the current Main Street (near the westbound SR 12 on-ramp) extending into Fairfield on the north side of the PG&E gas facility. Figure 1 identifies the current right-of-way ownership.

Several years after Caltrans delivered the SR 12 grade separation, Fairfield and Suisun City studied a street crossing in the Main Street/Union Avenue alignment. It is likely this alignment was studied because it was indicated as public right-of-way; the concept was dropped due to cost considerations.

The four-mile long Class 1 Central County Bikeway starts in downtown Suisun City, connects to the existing rail station, and extends to the eastern edge of Suisun City limits providing active transportation connections throughout Suisun City to the train station.

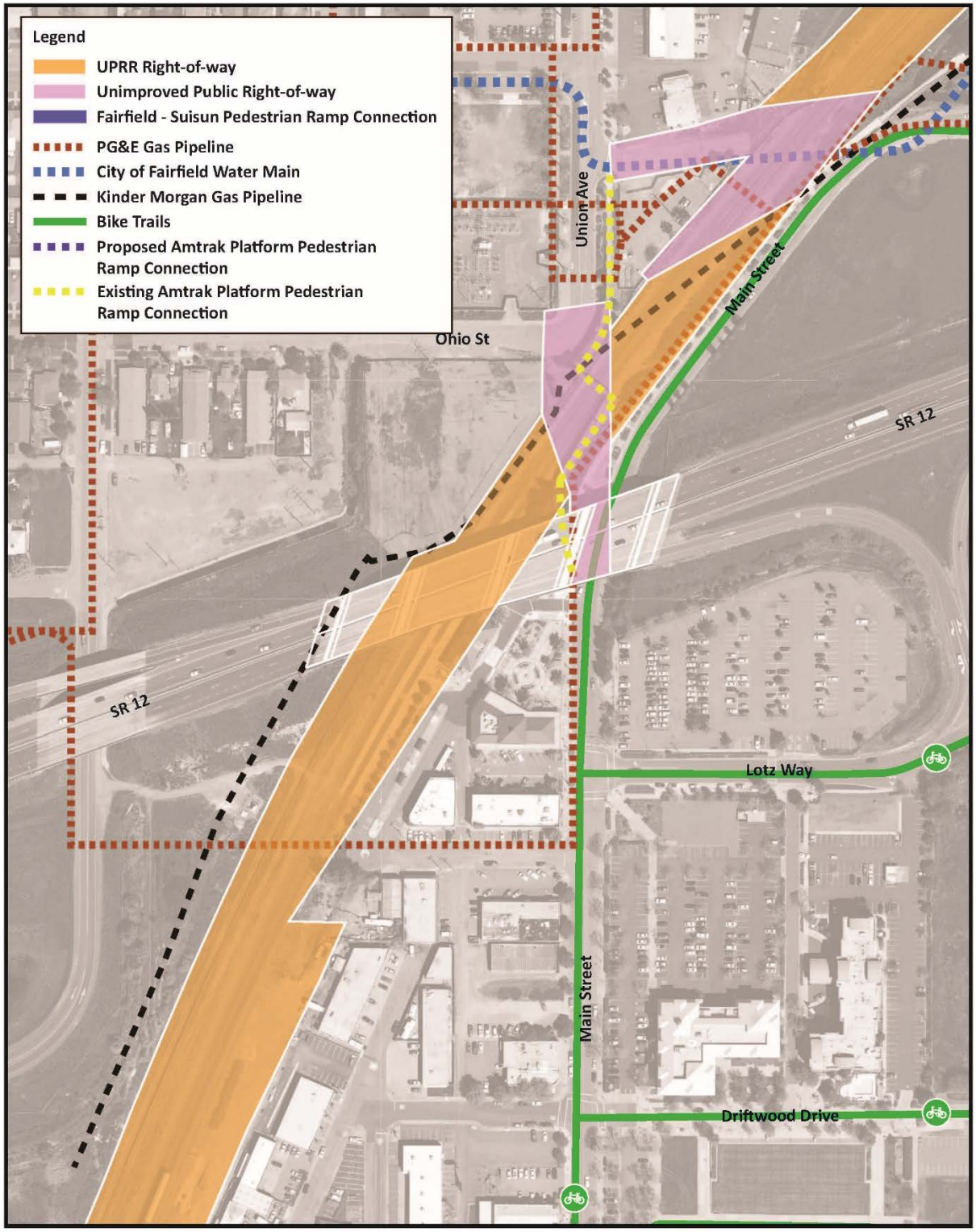

FIGURE 2 - RIGHT OF WAY AND KEY UTILITIES

Intercity/Regional Rail Service — While Amtrak long-distance trains (California Zephyr and Coast Starlight) operate on the UPRR tracks through Solano County, Capitol Corridor is the sole passenger rail service serving Solano County with Suisun-Fairfield as the county's historic predominate station. Pre-pandemic, 30 trains per weekday (15 in each direction) served both the Suisun-Fairfield and Fairfield-Vacaville/Hannigan stations, providing connections to Sacramento, San Jose and Oakland, with 22 Capitol Corridor trains served these Solano County stations on weekends and holidays. The greatest frequency of trains occurs in the westbound direction during the three-hour (5:30AM- 8:30AM) morning peak period (five trains in peak direction) and in the eastbound direction during the three-hour (4:00PM-7:00PM) evening peak period (four trains in peak direction).

Pre-pandemic, average daily ridership (boardings and alightings) at Suisun-Fairfield Station was about 400 passengers.

Regional Bus Services — At the Suisun-Fairfield Station, two SolanoExpress routes operate:

- Green Line operates between El Cerrito del Norte Bay Area Rapid Transit (BART) and the Suisun-Fairfield Station via I-80 and serves the Fairfield Transportation Center; about 20 trips in each direction are provided Monday through Friday.
- Red Line operates between El Cerrito del Norte BART and the Suisun-Fairfield Station via I-80 and downtown Vallejo (including the ferry terminal) and serves Six Flags Discovery Kingdom, Solano College, and Fairfield Transportation Center. About 30 trips in each direction are provided weekdays; about 15 trips are provided Saturdays and Sundays.

In addition, Napa VINE operates Route 21 from the Suisun-Fairfield Station to Napa Valley College and downtown Napa throughout the week. From Suisun-Fairfield, 13 trips in each direction are provided weekdays, operating hourly.

Greyhound operates intercity bus service with a limited number of departures at the Suisun-Fairfield Station. These buses operate daily in interstate service, with destinations in the Bay Area as well as to Reno and eastern and northern locations via Sacramento.

Travel Market —The previous *SMART and SolanoExpress Station Feasibility Study (January 2021)* documented a "big data" analysis of travel patterns using primarily mobile phone data. Based on this information, about 250,000 daily trips are made from Solano County to other counties, while another 150,000 trips originate in other counties destined for Solano destinations. Of the 250,000 trips originating in Solano County, about half are from Fairfield and Suisun City.

Policy Actions

The *2018 CSRP* identifies a need for a "Solano County Hub" where intensive rail service to the Bay Area core is focused and the hub is supplemented with feeder and connecting services. The STA Board in January 2021 designated the Suisun-Fairfield Station as the *2018 CSRP's* "Solano County Hub" and planning will assume the site is the primary link to other regional destinations both to the west and the east of the county.

Problem Statement

The *2018 CSRP* identifies a location in mid-Solano County (the "Solano County Hub") that will link expanded Capitol Corridor intercity rail service with future Sonoma-Marin Area Rail Transit (SMART) rail service to Napa and Marin (project to be developed by others), and express buses to Contra Costa County, as well as connections to local transit systems.

The previous *SMART and SolanoExpress Station Feasibility Study* concluded that the current Suisun-Fairfield Station is well placed to serve as the Solano County Hub because the preponderance of out-of-county travel originates in the Fairfield and Suisun areas.

However, the legacy configuration at the Suisun-Fairfield Station currently does not conform to prevailing design guidance and passenger safety and passenger amenities best practices, nor have the capacity to accommodate future demands:

- The station design requires upgrades to improve, enhance and deliver a safe and comfortable passenger experience. The platforms and tracks are curved to a greater degree than current design criteria allow, resulting in gaps between the platform and the rail cars, and the tracks are sloped, making boarding and alighting uncomfortable.
- To board on the northernmost track, passengers must cross an active rail line where trains can operate at up to 70 mph.
- The current narrow center platform subjects disabled passengers to uncomfortable and inconvenient access to the trains.
- The existing pedestrian connection between the station in Suisun City and Fairfield does not comply with ADA standards for changes in slope and elevation.
- The current station impacts railroad operations requiring approaching trains "hold-out" when passenger trains are in the station
- The "hold-out" trains dwell and emit diesel emissions into communities of concern.
- The two-track infrastructure does not physically allow for other trains to pass when a train occupies the platform.

Potential Future Conditions

Demographics and Growth Strategies — The 2020 Census recorded 7.8 million residents in the nine-county Bay Area, an 8.6% increase from 2010. Solano County population increased to 453,000, almost a 10% increase from 2010.

Plan Bay Area 2050, the region's long-range regional transportation and sustainable communities strategy, forecasts 10.3 million residents by 2050. Solano County population increases from about 450,000 residents in 2020 to more than 510,000 by 2050. Most of the county's population increase is forecast in Fairfield, Suisun City, and Vacaville, where the number of households increases by 34%, or about 30,000 units.

Both Fairfield and Suisun City adopted downtown-specific plans that detail significant development envelopes. In Fairfield, the *Heart of Fairfield Plan* identifies about 110 acres of downtown land (south of West Texas Street and east of Pennsylvania Avenue) currently used for residential and forecast a year 2040 moderate residential growth scenario of about 500 units, increasing to almost 3,000 units under an

aggressive growth scenario. The *Suisun City Waterfront District Specific Plan* plans for as many as 2,600 residential units. It is important to note that both the *Heart of Fairfield Plan* and the *Suisun City Waterfront Plan* were written prior to the large forecast household increase in *Plan Bay Area 2050* or the *California State Rail Plan* that details large increases in rail service, creating additional market opportunity and demand within downtown Fairfield and Suisun City.

Transportation Plans — The *2018 CSRP* identifies a series of phased improvements to the statewide rail network. These improvements include both service and rail infrastructure.

For Solano County, Capitol Corridor service increases in the first phase to about 30 minute peak period service. By 2040, *2018 CSRP* suggests six trains per hour into the Bay Area and two trains hourly to and from Sacramento. In addition, the Solano County Hub is identified as the location where Bay Area-Sacramento services connect with bus or rail services to Napa and Marin, along with bus services to Contra Costa County and two BART stations. In the midterm scenario (2027), Capitol Corridor service will operate every 30 minutes between Sacramento and the Bay Area in the peak periods and hourly at other times.

The *2018 CSRP* vision — only 18 years distant — suggests the Solano Rail Hub is a vital link in the state and regional network. By this time, Capitol Corridor service will operate between Roseville and Sacramento and directly to San Francisco (via a new transbay crossing) every 30 minutes, with supplemental service from the Solano County Hub operating every 30 minutes to San Francisco and to San Jose via the East Bay every 30 minutes – or a train every 10 minutes to the Bay Area (see Figure 3)

Every westbound train delivers passengers to downtown Oakland in about 50 minutes and four of the trains deliver passengers to downtown San Francisco in about one hour. The total capacity of these trains will be about 4,000 passengers an hour in the westbound direction, about the same capacity as two freeway lanes. In addition, SMART rail service to Marin and Napa could also be accommodated in the station complex.

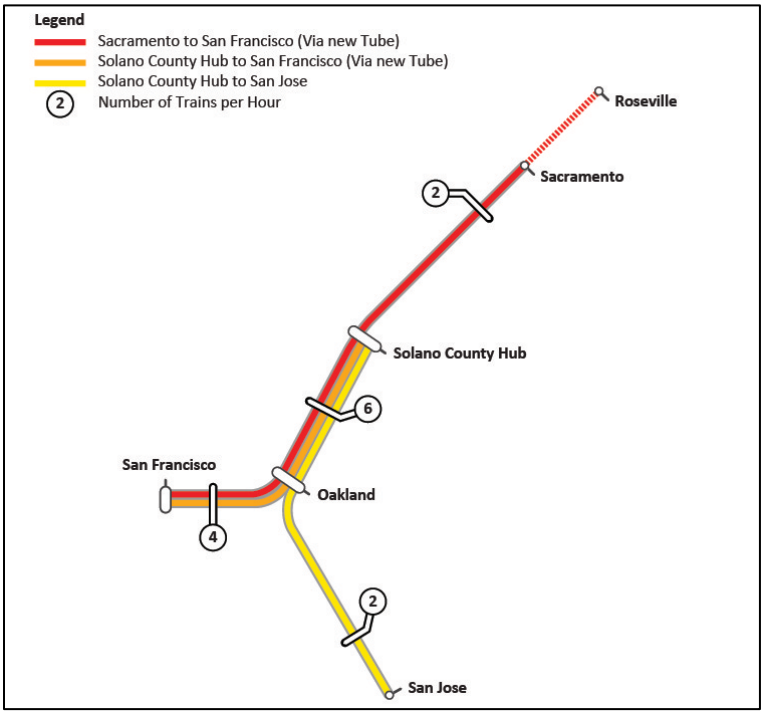

FIGURE 3 - 2040 CSRP TRAIN SERVICE

The Solano County Hub location will be the most connected place in Solano County, and its access will enable the local governments to consider the station location for significant adjacent land use density with housing and jobs in the two downtown Priority Development Areas.

TABLE 1 — 2018 CSRP INITIATIVES: CAPITOL CORRIDOR OPERATIONS AT SOLANO HUB

Year Delivered	Service	Document
In Operation (Pre-pandemic)	15 trains each direction, per day	N/A
2027	30-minute peak service; 60-minute off peak Trains extend to Roseville	2018 CSRP
2040	30-minute service to/from Bay Area to Sacramento via Solano County Hub 30-minute service to Oakland and San Francisco (starting at Solano County Hub) 30-minute service to Oakland and San Jose (starting at Solano County Hub) Direct Capitol Corridor service to downtown San Francisco via new tube	2018 CSRP

DESIGN PRINCIPLES AND CRITERIA

Purpose of Proposed Improvements and Design Objectives

This project aims to address Suisun-Fairfield Station design deficiencies, allow for future expansion of the station, reestablish a viable and accessible pedestrian and bicycle connection between downtown Fairfield and downtown Suisun City, and support and enable each city's vision for downtown development.

The new station will be safe, comfortable, inviting, and a community asset for both cities.

The design addresses and seeks to achieve these goals:

- Provide passenger and railroad facilities encompassing the following:
  - Comfortable waiting areas
  - Elimination of conflicts with moving trains
  - Safe, effective and comfortable vertical and pedestrian circulation
  - Sensible passenger lighting and shelter
  - Tracks, signals, and related railroad infrastructure conforming to prevailing design standards, passenger expectations, and industry best practices
- Design station infrastructure that allows for additional passenger rail service without substantially affecting UPRR freight operations.
- Improve pedestrian connection and create an attractive and accessible link between downtown Fairfield and Suisun City, effectively unifying the two downtowns.
- Encourage adjacent, high-density land uses in conformance with local and regional plans.

Additionally, the following design principles are incorporated into the project requirements:

- Infrastructure improvements will substantially adhere to the relevant codes and design criteria of Amtrak, California Public Utilities Commission, Capitol Corridor, SMART, UPRR, Caltrans, and the cities of Fairfield and Suisun City.
- Caltrans SR 12 structures will not be relocated, moved, or significantly affected.
- Stairs and ADA-compliant ramps are preferred over mechanically operated elevators or escalators for vertical circulation to reduce one-time capital and recurring operating/maintenance costs.
- A "program of projects" that allows for phased implementation of improvements is desired, if feasible.

In addition to confining the station and pedestrian improvements within the current or public right-of-way, adhering to the various agency and railroad standards results in the following:

- Grade-separated access by passengers to station platforms, prohibiting passengers from crossing mainline tracks
- Realignment and addition of tracks and platforms as required to meet prevailing design criteria and regulatory requirements
- Passenger waiting and circulation on a center platform or platforms
- Provision for a separate SMART rail terminal within the station (future project by others)

- Additional third mainline track allowing trains to safely bypass the station tracks and facilities within the UPRR corridor
- Additional passing track for use by queuing Capitol Corridor Solano-Bay Area trains
- Extension of the grade separation facilities to enable ADA-compliant pedestrian and bicycle use between the Suisun City and Fairfield central business districts
- Improvement and potential relocation of automobile parking facilities
- Improvement of bus connection areas and bus facilities in both Suisun and Fairfield
- Contiguous criteria-consistent security fencing and infrastructure hardening to prevent unauthorized access onto the UPRR corridor

The Appendix includes the adopted Guiding Principles.

Design Criteria

A set of design criteria was developed specifically for the study. The criteria combine passenger comfort with agency/railroad standards (some of which conflict) to allow for reasonable guidance to further project development.

Important criteria include vertical clearances between tracks and structures: 25ft minimum for an above-grade structure (required by railroad clearance needs) and 14ft (preferred) for below-grade structures (primarily driven by pedestrian and passenger comfort and safety). The track bed (top of rail to top of structure) is assumed to be 2.5ft. The structure carrying the track is assumed to be between 3.75ft for a 30ft span and 5ft for a 40ft span. The structure for the pedestrian bridge is assumed to be a minimum of 3ft. (See Figure 3 for representative sketches.)

Elevators are assumed to be required for where ramps would exceed 400ft (due to long walk times).

The acceptable width of either the bridge or the below-grade concourse is 25ft, but a minimum of 20ft is allowable at certain pinch-points (such as connections to platforms and stairs). This may decrease where stairs/elevators are provided in addition to ramps. To provide a more comfortable pedestrian experience, a 30ft–40ft width is preferred for below-grade options.

The platform length is a minimum of 800ft and not less than 24ft wide.

Note that in further design phases, design exceptions could be considered where the impact on safety is negligible, the impact on passengers and users is within an acceptable range, and the impact on budget and finances is positive.

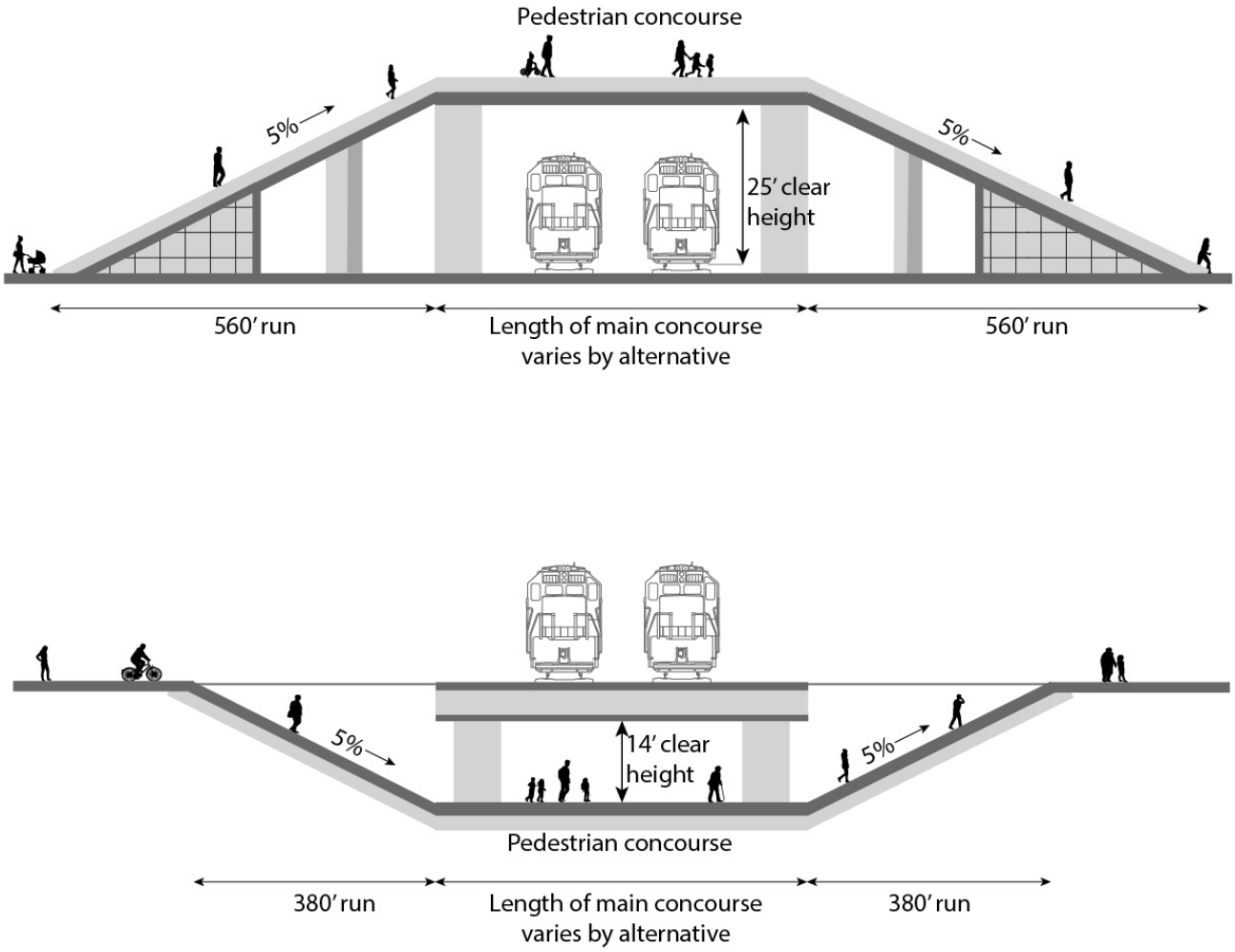

FIGURE 4 - CLEARANCE FOR PEDESTRIAN WALKWAY ABOVE/BELOW RAIL (NOTE: SECTION NOT TO SCALE).

Policy Considerations

Large infrastructure projects adhere to technical requirements and standards but also work toward overall policy goals.

Engineering Considerations

- ***Relocation of Underground Utilities*** — Underground utilities can be either relocated or avoided. The benefit of utility relocation is delivering less constrained designs, but at higher cost and increased risk.

- ***Station Platform Location*** — The UPRR-required third track results in significant changes to track geometry, which, in turn, requires the station platform either moving south of the current location or north of the SR 12 columns. The platform cannot encroach on the highway columns due to required column setbacks. The placement of the station platform is a policy issue that should be

considered because it may either improve or diminish the perception of "closeness" to residents of Fairfield or Suisun City.

Design Considerations

- ***Fairfield Gateway*** — The station site can be accessed from downtown Fairfield via either Union Avenue (consistent with the *Heart of Fairfield Plan*) or Jefferson Street (closer to the commercial part of downtown Fairfield). Pedestrians are about 250ft closer to Texas Street via Jefferson, but high school students walking to Armijo High School have an indirect route that adds about 600ft to their journey.

- ***California Environmental Quality Act (CEQA) Exemption/National Environmental Policy Act (NEPA) Exclusions*** — The project can be designed to meet the constraints of CEQA statutory exemptions and NEPA categorical exclusions. The primary requirement under either the state or federal requirements is confining the improvements to within the existing railroad or public rights-of-way (i.e., streets). This requirement appears feasible at the current level of design. The main advantage of using the CEQA/NEPA exemptions/exclusions is reducing project schedule and avoiding potential legal conflicts. In addition, staying within the rights-of-way reduces impacts and avoids land acquisitions. The downside of adhering to the rights-of-way requirement to meet the CEQA/NEPA exemptions/exclusions is the limit on design flexibility, which may limit project benefits to the communities and project partners.

Institutional Considerations

- ***Designation of Station Owner and Stakeholders*** — The station facilities outside the UPRR right-of-way will be owned and operated by a public entity, and that entity becomes the owner and the final point of design decisions. UPRR continues to own the right-of-way and lease the platforms and other connecting structures to the public agencies. Other stakeholders will include Capitol Corridor as the transportation tenant, and UPRR and Caltrans as entities that must approve encroachments and improvements.

- ***UPRR Engagement*** — The process to engage UPRR and understand the envelope of design flexibility will be important to the delivery of the project. It is noted that UPRR guidance prefers — but does not mandate — above-grade separations.

DESIGN CHOICES

The consulting team developed conceptual designs and analyzed costs and benefits for two prototypical designs — a below-grade option that could parallel Main Street and Union Avenue and a bridge option south of SR 12 crossing UPRR at a right angle.

In addition, platforms could be placed north or south of SR 12. The below-grade option can work with either platform location. The studied bridge option assumes a south platform. However, it is likely that a northern platform could be served by a bridge in approximately the same location as the current pedestrian bridge.

The user experience for the below-grade and bridge options can be considerably different. These differences include walking distance, quality of the experience, and the need for mechanical assistance. In addition, the platform locations can also affect the passenger experience. The studied bridge option assumes the bridge width over the tracks is 20ft, although the ramps and stairs may be narrower. The below-grade option is primarily open air, with structure limited to a 20ft-wide single-track bridge for the eastbound tracks and a 40ft bridge at the north end of the pathway for the westbound and passing track.

While the project is driven by the need to provide safety improvements and better passenger facilities for Capitol Corridor passengers, the design aspirations also prioritize reconnecting the Fairfield and Suisun downtowns to enable in-fill downtown development, create circulation synergies, and provide an improved downtown experience. Improving access from Fairfield to Crystal Middle School in Suisun and Suisun City neighborhoods to Armijo High School in Fairfield was also identified as a high priority. The current non-ADA-compliant grade separation, which can be used for these travels, is unwelcoming, poorly designed, and narrow.

Northern vs. Southern Platform Options

The primary differences between a northern versus southern platform location are users' perception of distances between Suisun City or downtown Fairfield and actual walking time to the platform:

- Fairfield users may perceive the northern platform to be closer than the current platform or the future southern platform, primarily because their sightline of the platform will improve.
- Conversely, Suisun City users may perceive that the northern platform is more distant, although the current platform is not easily viewed from Suisun City.
- The actual walking distance and walking time for Suisun City residents increases by about one minute (the southern platform requires reverse pedestrian movements, adding to walking distance). For Fairfield users, accessing the northern platform is about two minutes faster than the new southern platform.

Above-Grade Option (Bridge Option)

The study team considered several above-grade design enhancements, as follows:

- ***Simple Above-Grade Crossing*** — In this option, ramps are the sole means of ADA-accessible vertical circulation. The vertical clearance is 25 feet over the tracks, requiring a walkway at about 28 feet

above the tracks. The ramps switchback from its Suisun City landings, resulting in distances exceeding 600ft to reach the required bridge height. The bridge then has another set of ramps to the Capitol Corridor platform (which is about 100ft wide at that point). However, the bridge continues to the west side of the UPRR right-of-way, ramping adjacent to the western abutment of the SR 12 grade separation and then transitioning into downtown Fairfield. Because this sub-option results in distances of more than 400 feet, it would require a design exception.

- ***Simple Above-Grade Crossing* with Stairs** — Similar to the ramp design, stairs are an additional enhancement to provide a quicker means of vertical circulation for those who do not require ramps. Stairs will reduce the travel distance – compared to ramps – by about 35% to 50%.
- ***Mechanical Above-Grade Crossing*** — Elevators become the primary means of vertical circulation with this enhancement. At the terminus of the bridge, a tower structure incorporates two elevators (required for redundancy), wrapped with a staircase. As in the prior sub-option, the bridge continues to the west side of the UPRR right-of-way, with a tower and elevators continuing to an extended SMART platform and providing access downtown between the future SMART tracks onto the future SMART platform, and then transitioning into downtown Fairfield.

Below-Grade Option (Tunnel Option)

Similar to the above-grade options, the below-grade option can include sub-options including stairs, but elevators and mechanical systems are not anticipated. Two enhancements were considered:

- ***Below Grade with Ramps*** — Ramps are provided in the current station plaza in Suisun City, crossing below the tracks with about 12ft–14ft of vertical clearance (and resulting in a passenger grade change of about 15ft–20ft). On the Fairfield side, Union Avenue is closed at the PG&E substation and the street becomes a pedestrian way into Suisun City. Additional ramps to the Capitol Corridor platform are included.
- ***Below Grade with Ramps and Stairs*** — This enhancement provides stairs as a faster means of vertical circulation, in addition to the ramps in the previous sub-option.

A key concern with the below-grade option is potential conflicts with existing utilities. The primary concerns include a PG&E gas transmission line and the Kinder-Morgan petroleum pipeline. Arup identified these potential conflicts based on the available documentation:

- The pedestrian tunnel may impact the PG&E gas transmission line south of the dead-end street; however, the available right-of-way information does not identify the depth of this utility.
- The pedestrian tunnel route could impact the Kinder-Morgan petroleum pipeline depending on tunnel alignment. Based on available archive information, the Kinder-Morgan facility drops from about 10ft to 40ft within the Union Avenue right-of-way.

Design Precedents

The following images provide examples of similar grade separation projects. Figures 5-8 are examples of above-grade projects. Figures 9-10 are examples of below-grade projects.

FIGURE 5 – COLISUEM CAPITOL CORRIDOR PEDESTRIAN BRIDGE

FIGURE 6 - COLISEUM CAPITOL CORRIDOR PEDESTRIAN BRIDGE (USERS' VIEW)

FIGURE 7 - COLISEUM CAPTORL CORRIDOR PEDESTRIAN RAMP

FIGURE 8 - EMERYVILLE AMTRAK PEDESTRIAN BRIDGE

FIGURE 9 - RICHMOND BART/AMTRAK BELOW GRADE CONCOURSE

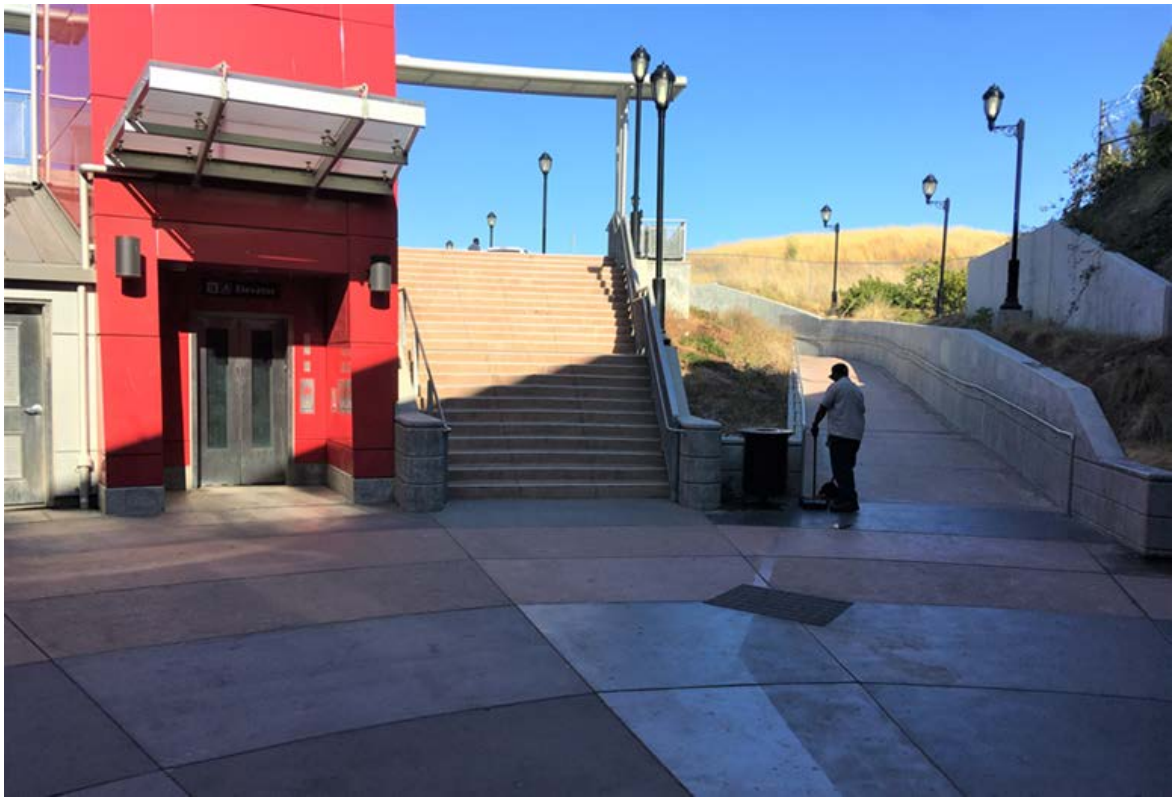

FIGURE 10 - RICHMOND BART/AMTRAK BELOW-GRADE RAMP AND STAIR ACCESS

Initial Walking Time Comparisons Between Suisun & Fairfield

Comparison of Characteristics of Vertical Circulation Options:

Journey Time:

Table 2 reports total Journey Time for different horizontal paths (Bridge Option and Below-Grade Option) and different vertical conveyance options (ramps, stairs, and elevators).

TABLE 2 — WALKING TIME COMPARISONS: MAIN STREET AND LOTZ IN SUISUN CITY TO UNION AVENUE AND BROADWAY IN FAIRFIELD

Alignment	Journey Time		
	Ramps Only	**With Stairs**	**With Elevators**
	Main Street and Lotz in Suisun City to Union Avenue and Broadway in Fairfield		
Bridge Option	13 minutes	10 minutes	11 minutes
Below-Grade Option	7 minutes	6 minutes	7 minutes
	Main Street and Lotz in Suisun City to Amtrak Platform		
Bridge Option	8 minutes	3 minutes	4 minutes
Below-Grade Option	4 minutes	4 minutes	4 minutes
	Union Avenue and Broadway in Fairfield to Amtrak Platform		
Bridge Option	13 minutes	7 minutes	7 minutes
Below-Grade Option	8 minutes	8 minutes	8 minutes
	Main Street and Lotz in Suisun City to Future SMART Platform		
Bridge Option	8 minutes	4 minutes	4 minutes
Below-Grade Option	7 minutes	6 minutes	6 minutes
	Union Avenue and Broadway in Fairfield to SMART Platform		
Bridge Option	5 minutes	6 minutes	6 minutes
Below-Grade Option	6 minutes	6 minutes	6 minutes

Notes: All paths and travel times assume a path of travel from Main Street and Lotz Way in Suisun City to Union Avenue and Broadway in Fairfield. Walking speed is assumed to be 3ft/sec. Walking speed up stairs is assumed to be 1.9ft/sec. Elevator speed is assumed to be 100ft/min. Elevator wait time is assumed to be 20 seconds.

The bridge option with ramps traverses about 2,300ft, or about a 13-minute walk. Introducing stairs reduces the walking time by about three minutes.

The below-grade option provides a shorter and more direct path of travel, with about a 1,300ft distance, resulting in a journey six minutes faster. Introducing stairs reduces the walking time by about one minute.

In both cases, elevators increase journey time. This is because although the horizontal walking distance/time is the same as for the “with stairs” options, elevator travel times are assumed to require a 20 second wait time.

Times to the alternative northern platform could add one minute to Suisun City access and reduce time from Fairfield by about two minutes.

Operations and Maintenance (O&M) Cost:

The proposed Suisun-Fairfield Station ramps for the bridge option features a relatively significant vertical change of about 28 feet, resulting in very long ramps required to keep the angle manageable for mobility impaired individuals. This increases the length and scope of the facility.

The bridge encompasses almost 40,000 square feet of surface area (more than six times the area of the below-grade option), however, maintenance costs are typically low. Upkeep on ramps and stairs, such as cleaning, painting, and minor concrete repair does not require specialize staff. Conversely, elevator maintenance requires servicing and attention on a regular basis performed by certified service personnel.

Annual cost for elevator operation and maintenance is predictable. Appendix XYZ identifies an annual per elevator maintenance cost of about $31,000, or almost $200,000 annually for all six elevators identified. (Note that the bridge option would require 2 elevators on the SMART platform, 2 elevators on the Amtrak platform, and 2 elevators in Suisun City. The below grade option could be designed to provide two elevators in Suisun City.)

Although the study's design principles state "Stairs and ADA compliant ramps are preferred over mechanically operated elevators or escalators for vertical circulation to reduce one time capital and recurring operating/maintenance costs," project stakeholders may decide that overriding considerations of comfort favor incorporating elevators into the final design.

User experience:

Ramps, stairs, and elevators can provide effective and comfortable vertical circulation to some users, and concerns to others. Long ramps, typically used as an option to elevators, can become eyesores and, if the only option, can be frustrating to ambulatory users and difficult for the mobility challenged. Long runs of inclined grades can be difficult for user propelling themselves in a wheelchair or pushing a stroller or heavy cart. The long incline could also be difficult for those with respiratory problems. Ramps and stairs can be used by skateboarders, potentially creating hazards for other users. Elevators can create perceived and real security problems, as well as cleaning and sanitation concerns.

Reliability:

Ramps and stairs are reliable. Elevators, while generally reliable, are vulnerable to mechanical and electrical difficulties. Modern standards suggest two elevators at each location so that if one is out of service, the station is accessible to mobility-impaired passengers.

Adherence to Design Principles:

Using stairs alone without ramps and without elevators would not be ADA-compliant. If needed, both stairs and elevators could feasibly be added after the ramp solution is in place, allowing for phased implementation of improvements.

Cost Estimates

The overall cost of this project will likely range from about $88 million to about $150 million, depending on whether a bridge or below-grade option is chosen. These are total costs and include design, project and construction management, contingency, and construction costs.

Under either crossing scenario, the relocation and addition of UPRR tracks costs about $48 million (total costs including design, project management and construction administration, etc.).

The bridge/above-grade options could range from $62 million to $132 million, with a likely cost of about $88 million. The below-grade/tunnel options could range from about $105 million to $225 million, with a likely cost of about $150 million.

The full cost estimate is included in the Appendix C and includes the cost analysis assumptions and data points.

Summary Pros/Cons

TABLE 3 — SUMMARY COMPARISON

Table 3 identifies and summarizes the metrics and qualitative aspects of each design option.

	Design Option	
Evaluation Category	**Above Grade**	**Below Grade**
Vertical Change/Require Ramp Lengths	About 30ft — requires longer runs/ramps	About 20ft —shorter runs/ramps than above grade.
Elevator Requirement	Runs/ramps are greater than 400ft; therefore, elevators are required per the design criteria	Runs/ramps are less than 400ft; therefore, no elevator is required
Drainage	Little consideration needed	High water table, requiring more complex and/or expensive design. Stormwater also requires detailed design, however, space is available to incorporate drainage elements, including drains and pumps
Geotechnical Concerns	Less consideration needed	Will require soil stability analysis and proper engineering of retaining walls. Mitigation: option as conceived is actually a pedestrian trench with 2 rail bridges for 3 tracks largely using retaining walls and likely not a large engineering concern
Utility Conflicts	Likely minor and mainly related to electrical infrastructure	Depending on alignment, could affect Kinder-Morgan pipeline and other below-ground utilities
Flexibility of Design	Less flexible because the change in elevation requires long ramps Few ways to mitigate the required length of ramp in the right-of-way	More flexible due to reduced elevation change: Less length is required, so the route is more flexible Different structural designs could be used, leading to different structural depths A deeper ballasted track, or shallower direct fixation could be incorporated into the design
User Comfort — Suisun to Fairfield Walking Time	About 11- to 14-minute walk via ramps	About 7-minute walk via ramps
User Comfort — Enclosed Spaces	Bridge will be fenced on each side for safety and security reasons.	Tunnel will feature solid walls, but most of the tunnel will not have cover/ roof/ceiling
User Comfort — Width	20ft wide	30-35ft wide
User Comfort — Perception of Safety	The above-grade option has good visibility, although more switchbacks	Tunnels have more negative connotations, specifically visibility and line-of-sight concerns. These can be

	Design Option	
Evaluation Category	**Above Grade**	**Below Grade**
	(to allow the requirement ramp length), results in more tight turns	addressed through proper designs that open air (not enclosed/covered tunnel) and wide concourses with no sharp turns The tunnel can also be designed with tangents, reducing blind spots and tight turns
Urban Design and Aesthetics	Large impactful structure	Smaller impact and easier to integrate into urban design
Cost (Range)	$62–$132 million	$105–$225 million

DESIGN OPTIONS

Based on discussion with STA, six additional design concepts were identified for future consideration. Only the Lotz/Jefferson bridge option and the Main-Union below-grade option were studied at a conceptual level, with both assuming a southern platform. The six design concepts include two northern and four southern platform options.

TABLE 4 — DESIGN OPTIONS STUDIED

	Platform Location		Vertical Change	
Alignment	**North**	**South**	**Below Grade**	**Above Grade**
Union/Main Street — Tangent	✓	✓	✓	
Union/Main Street — Right Angle	✓		✓	✓
Lotz/Jefferson		✓	✓	✓
Lotz/Union		✓	✓	
Lotz/Union — Rounded		✓	✓	✓

Several of the options can accommodate either below- or above-grade crossings. Figures 11 and 12 identify the ***northern platform*** alignments. The right-angle option can be either above or below grade, while the tangent option must be below grade due to clearances related to UPRR and the SR 12 grade separation.

The study identified four potential ***southern platform*** options, as shown in Figures 13-16.

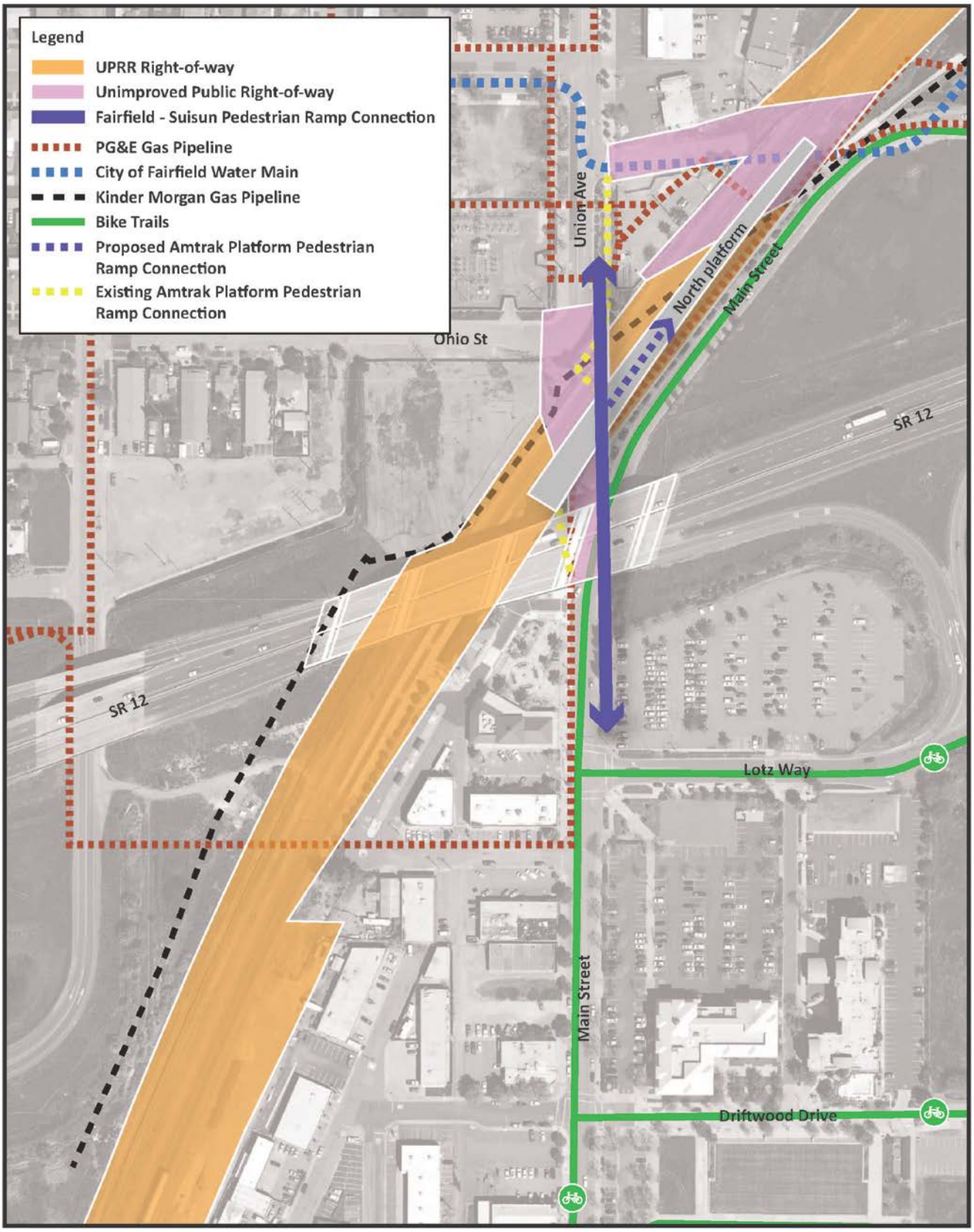

FIGURE 11- NORTHERN PLATFORM – UNION-MAIN TANGENT OPTION - BELOW GRADE

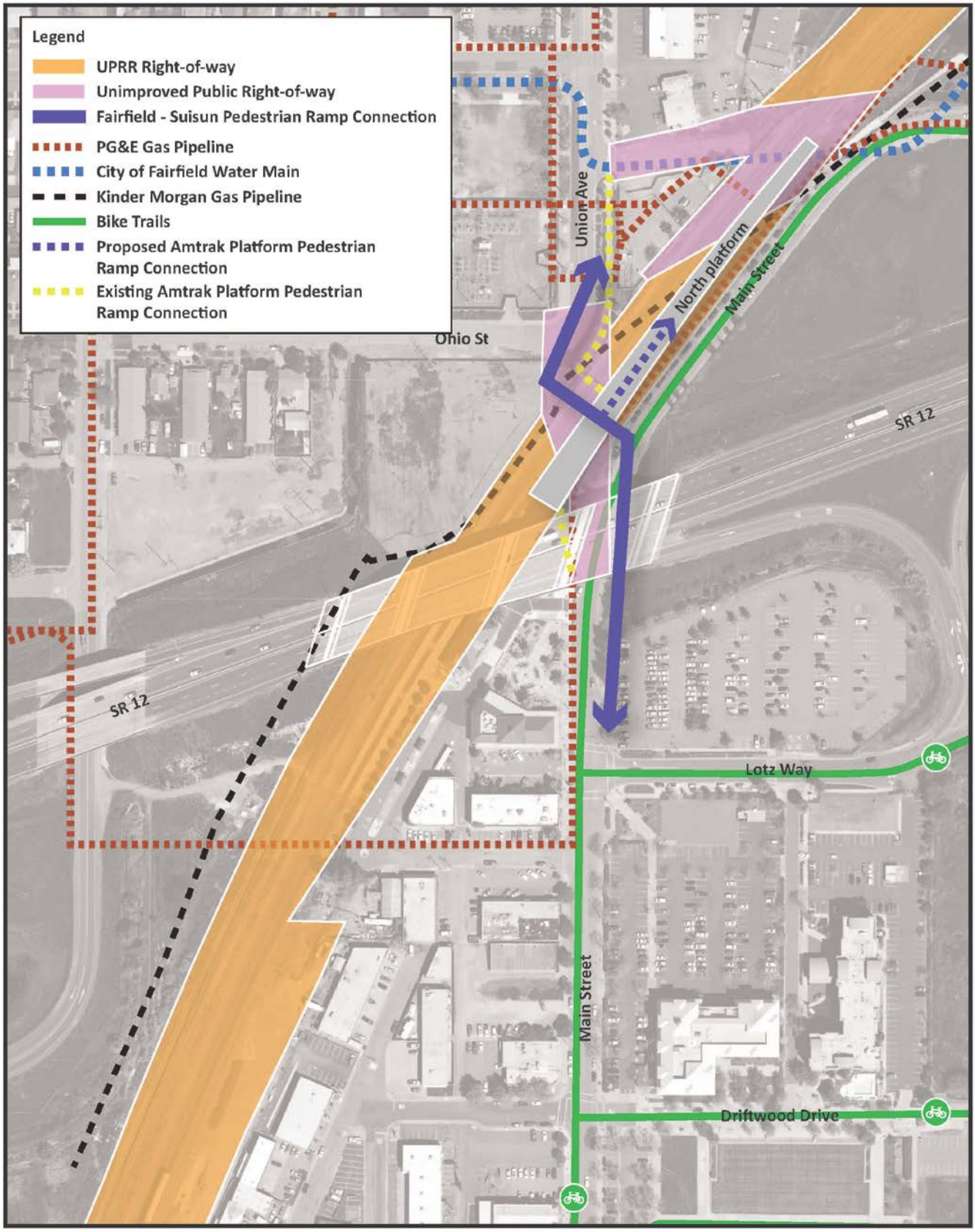

FIGURE 12 - NORTHERN PLATFORM - 90 DEGREE OPTION - ABOVE OR BELOW GRADE

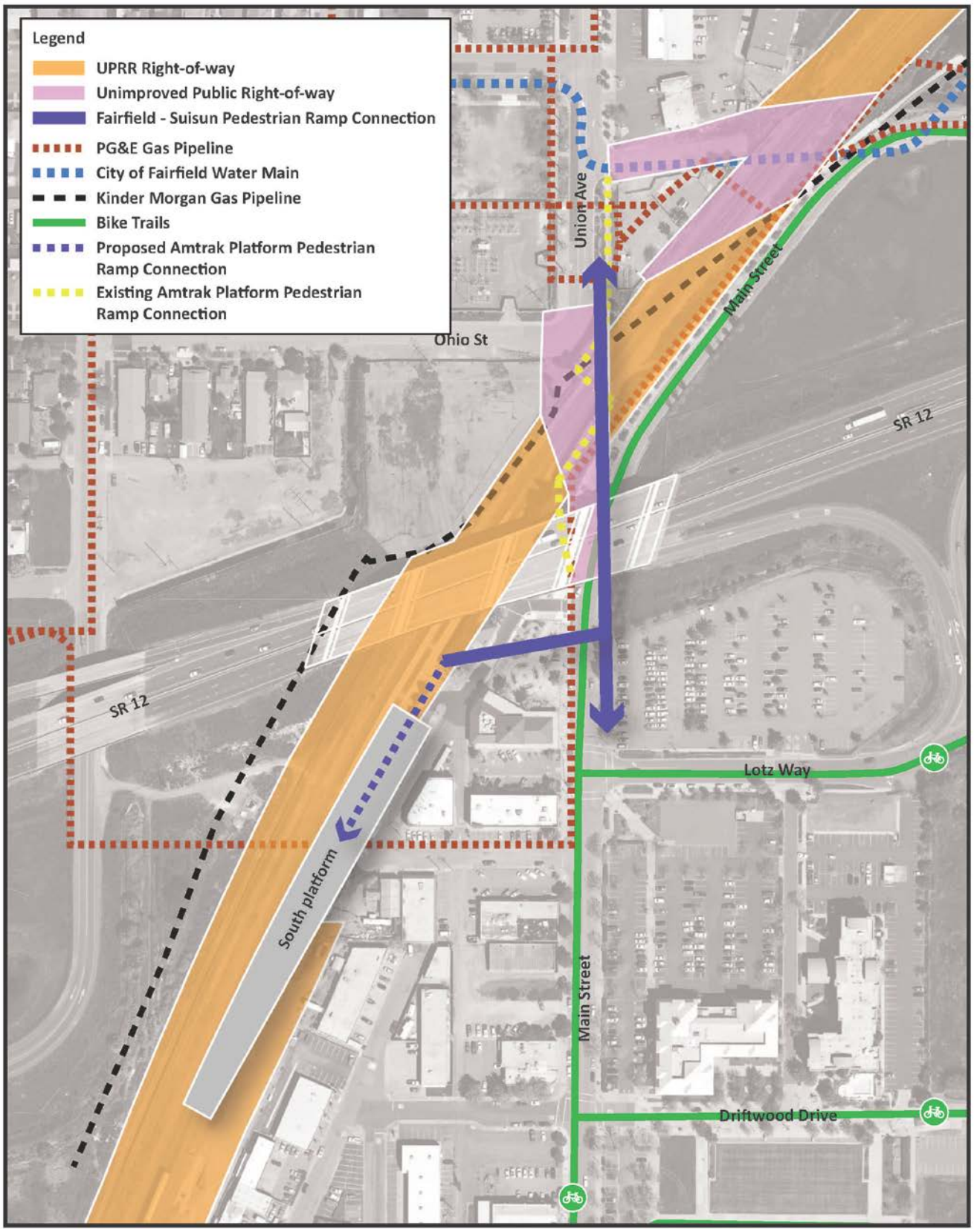

FIGURE 13 - SOUTHERN PLATFORM – UNION-MAIN TANGENT OPTION - BELOW GRADE

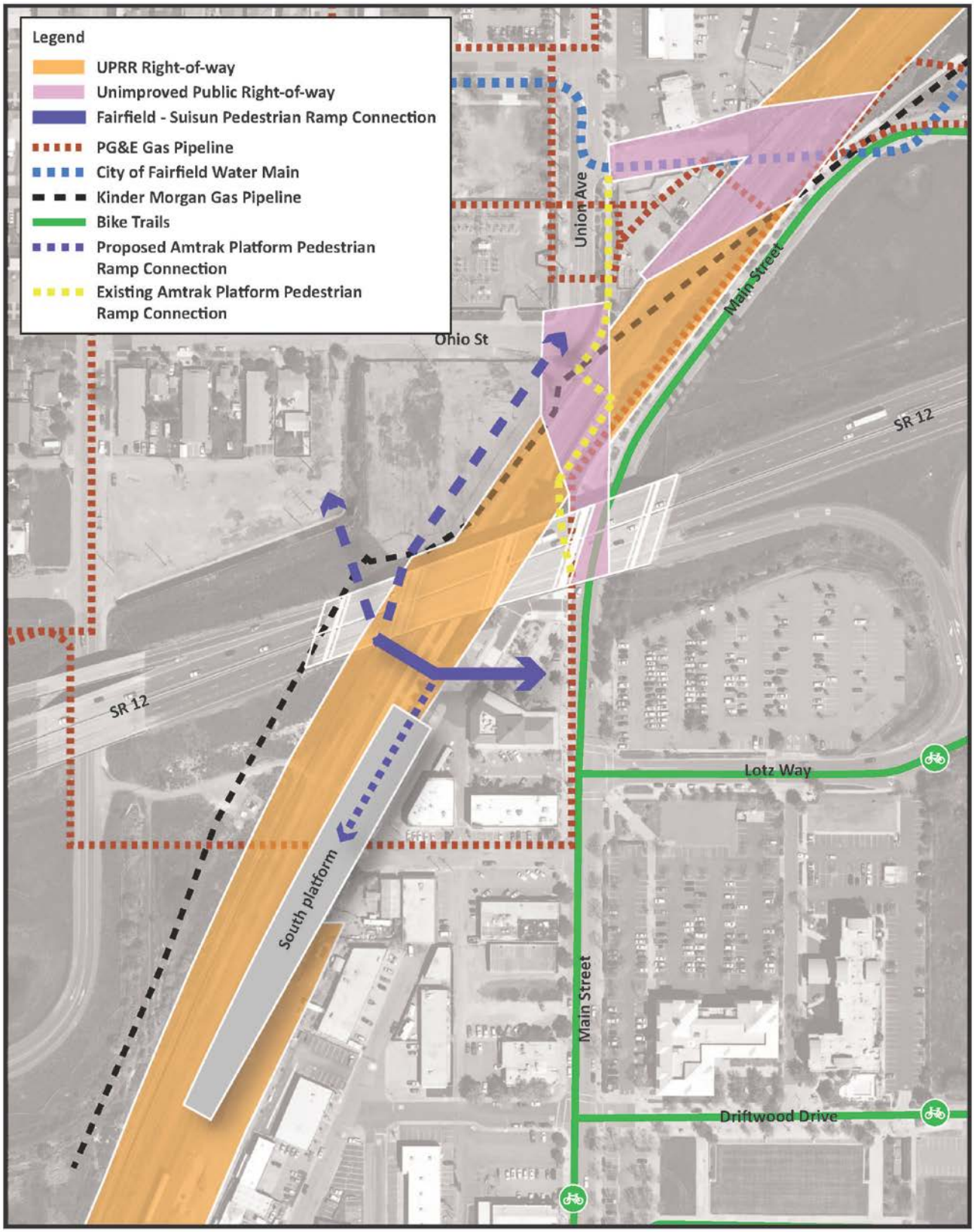

FIGURE 14 - SOUTHERN PLATFORM - LOTZ/JEFFERSON OPTION - ABOVE OR BELOW GRADE

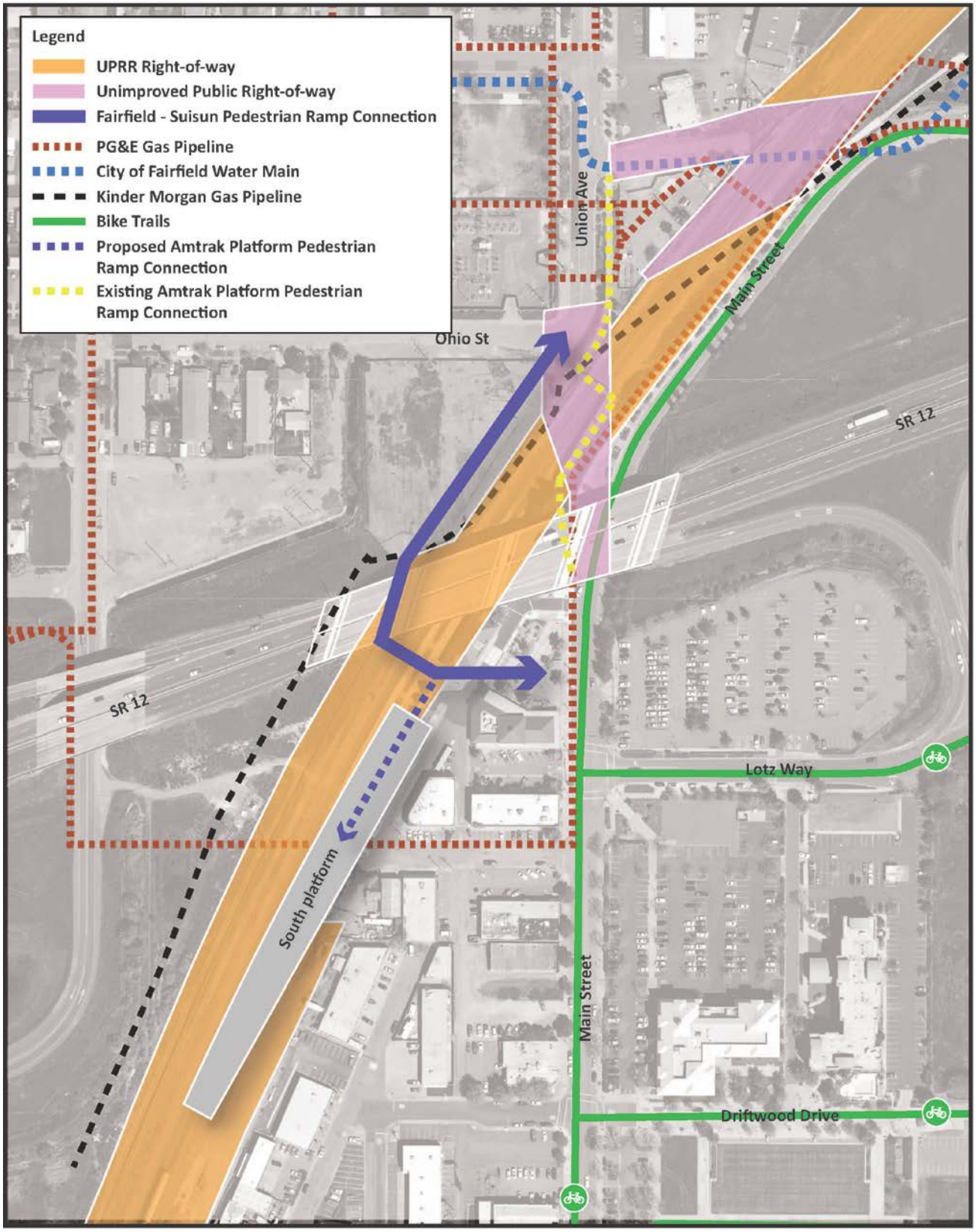

FIGURE 15 - SOUTHERN PLATFORM - LOTZ-UNION ROUNDED OPTION - ABOVE OR BELOW GRADE

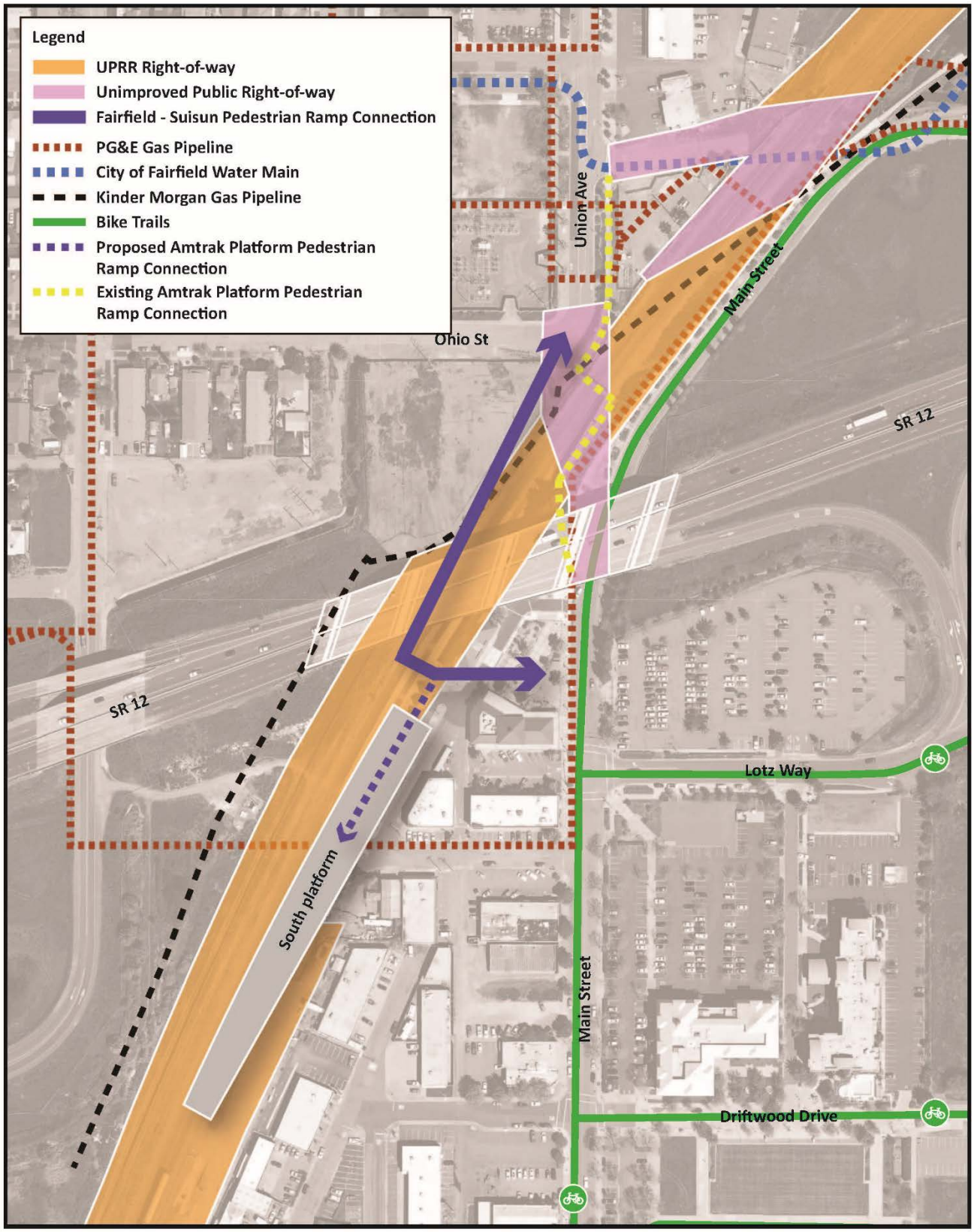

FIGURE 16 - SOUTHERN PLATFORM - LOTZ-UNION OPTION - BELOW GRADE

NEXT STEPS

Initial Project Development

This study identifies several options to deliver the goals of the Solano Rail Hub. These options — potentially along with other concepts — require additional design and engineering analysis and additional vetting with stakeholders in a process leading to a preferred alternative.

The development and screening process — including refinement of the initial conceptual designs — could take between 12 and 18 months and would lead into preliminary engineering of two alternatives (one below grade and an above-grade option that will require stakeholder input and support and UPRR review and consideration). Preliminary engineering could start at about the midpoint of the longer 18-month schedule and could extend into and be part of the NEPA/CEQA process.

Environmental Review and Future Project Approval

Environmental Review Process

For the environmental review, the location of the project facilities — the Solano Rail Hub — would be generally located on the UPRR at about the site of the current Suisun-Fairfield Amtrak/Capitol Corridor Station, in the cities of Suisun City and Fairfield, in Solano County. The station location borders on the central business districts of the City of Fairfield to the north and City of Suisun City to the south. This site currently includes tracks, platforms, adjacent station buildings, bus transfer areas, automobile parking facilities, and city streets. (See Figure 2)

The primary purpose of the project is to enhance passenger and pedestrian safety and provide access improvements in compliance with the ADA. These improvements trigger additional railroad-required upgrades, which would consist of the relocation and addition of tracks and platforms as required to meet prevailing design and train passenger safety criteria and various regulatory requirements. The Solano Rail Hub would include passenger waiting and circulation on a center platform or platforms and would be designed to not preclude future transportation corridor connections to the North Bay. The proposed project would add a third mainline track, which would allow trains to safely bypass the station tracks and facilities within the UPRR corridor. A layover/passing track for Capitol Corridor Solano-Bay Area trains would also be added.

In addition to these tracks, in order to maintain passenger safety, the proposed project would provide full grade separation of passengers from the active railroad, and the grade separation facilities would be extended to enable pedestrian and bicycle use between the Suisun City and Fairfield central business districts. The proposed project would also expand automobile parking facilities and bus connection areas to serve the station.

Applicability of the CEQA and NEPA Processes — The proposed improvements can be designed to meet CEQA statutory exemptions related to passenger rail improvements that are confined within the existing station and parking areas, and railroad and public rights-of-way. In addition, the project may qualify for a categorical exclusion under NEPA, which would be similar to the CEQA exemption. The Solano Rail Hub involves the “maintenance, rehabilitation, and reconstruction of facilities that occupy substantially the

same geographic footprint," as well as the project being "within areas of the right-of-way occupied by the physical footprint of the existing facility."

The benefits of using the CEQA exemption and NEPA exclusion include reduced costs associated with the preparation of an environmental impact report (EIR)/environmental impact statement, the associated time savings, and a reduction in project risk related to potential legal actions contesting adoption of an environmental document. The time savings are likely about two years, although some of that time would be spent on preliminary engineering in any project development scenario.

However, in discussions with the project stakeholders during this study, the consensus was to not preclude additional designs and improvements that could provide additional benefit, even if that meant engaging in additional environmental studies. These studies would be conducted under CEQA and NEPA and would require a lead agency for the state level document and a federal lead agency, likely the Federal Railroad Administration.

Environmental Review Process: CEQA — CEQA applies to projects that may result in a change in the environment; a full environmental review is only required where the project could result in a significant adverse impact. The CEQA process would begin with an initial study checklist, which would assess the potential environmental impacts of the project and a reasonable range of alternatives. If there are significant adverse impacts, further analysis and an EIR would be required. For example, more detailed analysis would be necessary to determine whether the project would create a significant hazard due to its proximity to a gas pipeline. Table 5 represents a typical CEQA full EIR timeline.

TABLE 5 — CEQA EIR MILESTONES AND DURATION

Task/Milestone	Timing
Task 0: Development of conceptual design, initial concept screening, and initiation of preliminary engineering on preferred concepts	12–18 months (some overlap with NEPA/CEQA process)
Task 1: Start-Up/Document Review/Issue Notice of Preparation (NOP)/Optional Scoping Meeting	Within two weeks from formal authorization to proceed (*NOP has a 30-day review period that runs concurrent with Task 2 work; STA may also choose to hold a formal scoping meeting during the 30-day NOP review period.*)
Task 2: Prepare Administrative Draft EIR (ADEIR) for STA Review	10–12 weeks from completion of Task 1 (*starts* on *receipt of necessary background information; this period can vary depending on the responsiveness of technical experts/studies required*)
STA Review of ADEIR	2 weeks
Task 3: Prepare Public Draft EIR (DEIR)	2 weeks from receipt of comments on ADEIR
Public Review Period (per CEQA statute)	45 calendar days (*A public hearing on the DEIR is typically held about 30 days into the 45-day public review period.)*
Task 4: Prepare Draft Responses to Comments (Administrative Final EIR)	4 weeks from receipt of all public and agency comments on DEIR
Task 5: STA Review of AFEIR	1 week

Task 6: Prepare Final EIR (comments and responses document plus revisions to DEIR)/Mitigation Monitoring and Reporting Program	2 weeks from receipt of all STA comments on AFEIR
Task 7: Certify Final EIR and Project Approval	As scheduled
Task 8: File Notice of Determination	Within five days after project approval

NEPA Review — NEPA would be triggered if the project involves effects that may be major and which are potentially subject to federal control and responsibility, such as a federal approval, permit, decision, funding, or control. The Solano Rail Hub could trigger NEPA with the use of federal transportation funding.

A full environmental analysis under NEPA would be similar in scope and duration as the CEQA process. Depending upon the approving federal lead agency, the six- to seven-month CEQA process may need to be completed prior to NEPA approval (e.g., Federal Transit Administration). If done sequentially, the impact to the overall project development process could lengthen the schedule. If done concurrently, a joint CEQA/NEPA document could take a minimum of 18 to 24 months to complete.

Other Project-Related Coordination

UPRR — Given that the project is located within the UPRR right-of-way, coordination with the railroad would be required. Generally, the UPRR requires that project proposals be at the preliminary engineering stage with 30% of the design ready for their consideration. Coordination with UPRR and securing its review and approvals of the railroad-related project elements will be time-consuming and should ideally be conducted concurrently with the environmental review process so that any requested modifications can be considered and analyzed during the CEQA and NEPA phase.

The next stage of project development, Final Design, involves similar consultation efforts with the railroad, legal review, and then some time afterward to get to an agreement.

Regional and State Funding Coordination — STA will also need to coordinate with the Metropolitan Transportation Commission to ensure that the project is included in the regional transportation plan, *Plan Bay Area*, and the accompanying Transportation Improvement Program if federal funds are sought for the project. Similar coordination should occur with Caltrans DRMT and CCJPA for any requests to obtain state transportation funds, including developing a DRMT Project Study Report.

Project Authorization

During the analysis period, STA (if leading the design and environmental review process) should identify the eventual owner of the station. While UPRR owns (most) of the right-of-way, the above- or below-ground facilities will need to become the responsibility of a public agency. This responsibility could include project management and eventually ownership and operation of the station and its pedestrian circulation areas.

Once the environmental review process is complete, the owner's policy board will need to adopt the project and authorize its construction and delivery.

Project Tasks

Advancing this project will require a series of discussions, studies, decisions and approvals, all leading to construction and ultimately delivery of the project.

These include:

- Concept Study (this document)
- Project Study Report (Division of Rail and Mass Transportation Template), identifying
    - Additional Design Options
    - Station Area Plan
- Inclusion in the CCJPA Business Plan
- Environmental Review
    - Notice of Preparation (CEQA/NEPA)
    - Scoping
    - Environmental Review
        - Stakeholder outreach (railroads, utilities, governments and focused on operations);
        - Community outreach (includes public and adjacent property owners and focused on design),
        - Development of alternatives/conceptual and preliminary engineering;
        - Analysis of consistency with local plans;
        - Funding and Financing strategy;
        - Adoption of Locally Preferred Alternative
- CEQA Certification/Federal Record of Decision/Project Approval
- Final Design and Construction
- Project Delivery

Summary

The STA, in consultation with the project leadership team, has indicated that the limitations of the CEQA exemptions reduce its desired design flexibility. As a result, the design concepts include several that would trigger both CEQA and NEPA review processes. It is assumed that the project plan will include full CEQA/NEPA review, requiring about two to three years from pre-environmental studies through certification and record of decision. Construction is expected to take about 24 months, plus procurement and acceptance time.

In total, the project — from the initiation of design to its delivery, and assuming a full CEQA/NEPA document — will require a minimum of five years.

APPENDIX

A. Guiding Principles

B. Design Criteria

C. Cost Estimate

APPENDIX A – GUIDING PRINCIPLES

Memorandum

ARUP

To	Kathrina Gregana, STA	Date	April 22, 2021
Copies	Arup Team	Reference number	272032
From	Anthony Bruzzone, Arup	File reference	03
Subject	Solano Rail Hub: Project Definition & Guiding Principles REV 1		

Purpose of Memorandum

This memorandum documents the need for a Solano Rail Hub, the design and service functions that will be provided at the facility, and the Guiding Principles to be used in the development of design options for the Solano Rail Hub.

Location of Solano Rail Hub

The Solano Rail Hub would be generally located on the Union Pacific Railroad (UPRR) at about the site of the current Suisun-Fairfield Amtrak/Capitol Corridor Station. This location currently includes tracks, platforms, adjacent station buildings, bus transfer areas, automobile parking facilities and city streets. The location can link the downtowns of Suisun City and Farifield and prior to the 1980s was a key gateway between the downtowns. The platforms of the existing station are partially below the Highway 12 grade separation.

Need for the Solano Rail Hub and Related Improvements

The California State Rail Plan (2018) identifies a location in mid-Solano County that will link the Capitol Corridor intercity rail service with express buses to Contra Costa County, as well as connections to local transit systems. The Plan proposes future rail service to the northern San Francisco Bay Area counties of Marin, Sonoma and Napa (with interim bus service) provided by the Sonoma Marin Area Rail Transit District (SMART). Capitol Corridor service levels increase significantly with up to two trains per peak hour per direction between Suisun/Fairfield and San Jose and four trains per hour per direction between Suisun/Fairfield and San Francisco (via a proposed conventional railroad tube connecting Oakland and downtown San Francisco). Eastbound, up to two trains peak hour per direction continue to Sacramento and Roseville. In its current configuration, the station is limited in its ability to reasonably meet either increased passenger demand or the additional operational requirements of the future Capitol Corridor service plan. The track infrastructure has no provisions for either reversing trains bound for the southernmost end of the Capitol Corridor (San Francisco/Peninsula/San Jose), as envisioned in the State Rail Plan, or as a terminal for extended SMART rail service from Novato.

The current station infrastructure also does not conform to prevailing safety standards or passenger capacity requirements to accommodate the greatly expanded train service levels. The platforms are curved, resulting in gaps between the platform and the rail cars. The tracks are also curved, as well as sloped, limiting the optimal ease to board and alight passengers from trains. Although the center platform is the minimum width required for compliance with the Americans with Disabilities Act (ADA), which is about eight feet wide, passengers are required to cross active tracks to access the platform. Therefore, improvements to enhance passenger safety are necessary.

In addition, with the planned frequent and fast service to both the Bay Area and the Sacramento region, adjacent higher-density residential development is anticipated. Both Fairfield and Suisun City's downtowns are regionally designated Priority Development Areas and Plan Bay Area 2050 encourages new housing near transit. Substantial government and commercial land uses are also within the PDA boundaries.

The station location borders on the central business districts of the cities of Fairfield to the north and Suisun City to the south. The "Heart of Fairfield Specific Plan" calls for a HTD (Transit-Oriented Development) District. The HTD district is located near the southeastern sector of Downtown near the Suisun-Fairfield Train Station. The vision for this area is to create a new high density residential neighborhood, with densities up to 80 units per acre, accessible to both Downtown and the Suisun City-Fairfield Train Station south of Highway 12. In 2016, Suisun City adopted the Waterfront District Specific Plan, covering the area along the Suisun waterfront to the Suisun-Fairfield Amtrak Station. Within this area, the plan anticipates a range of uses including mixed retail and commercial; low-, medium-, and higher-density dwelling units; and other compatible uses. Densities range up to 3.0 floor-area ratios and up to 45 units per acre.

Pedestrian and bicycle access between the two downtowns is limited to a six foot wide, non-ADA compliant grade separation. This is a key concern, as middle and high school students typically travel between the two cities to attend classes, along with potential rail passengers accessing jobs in downtown Fairfield.

In conclusion, the Solano Rail Hub and its related improvements are needed to support planned rail and bus transportation improvements, improve passenger safety, support planned land use development, unify the downtowns, and enhance pedestrian and bicycle access.

Purpose of the Solano Rail Hub and Related Improvements

The purpose of the Solano Rail Hub is to enable expansion of passenger rail service in northern California, as defined in the State Rail Plan. The goal of the project is to deliver a central rail station between the Bay Area and Sacramento that concentrates transportation services, links these areas to communities in the northern end of the Bay Area, encourages rail and bus ridership, and supports and enables adjacent in-fill development. The project objectives are to:

- Deliver station infrastructure that allows for additional passenger rail service without substantially impacting UPRR freight operations;
- Provide passenger and railroad facilities encompassing

  - Comfortable waiting areas,
  - Grade separation between passengers and trains,
  - Effective and comfortable vertical and pedestrian circulation, and
  - Sensible passenger lighting and shelter,
  - Tracks, signals and related railroad infrastructure

  conforming to prevailing design standards, passenger expectations and industry best-practices;

- Improve the pedestrian connection and create an attractive and usable link between downtown Fairfield and Suisun City; and
- Encourage adjacent, high-density land uses in conformance with local and regional plans.

Project Description

The project is currently in the concept development stage and will consider alternative designs. The final design will substantially upgrade, improve, reuse and redevelop the existing Suisun-Fairfield Amtrak/Capitol Corridor Station and include the following elements:

- Relocation and addition of tracks and platforms as required to meet prevailing design criteria and regulatory requirements
- Passenger waiting and circulation on a center platform or platforms
- Provision for a separate SMART rail terminal within the station
- Additional third mainline track allowing trains to safely bypass the station tracks and facilities within the UPRR corridor
- Layover track for Capitol Corridor Solano-Bay Area trains
- Full grade separation of passengers from the active railroad
- Extension of the grade separation facilities to enable Americans with Disabilities Act (ADA) compliant pedestrian and bicycle use between the Suisun City and Fairfield central business districts.
- Expansion of automobile parking facilities
- Expansion of bus connection areas and bus facilities in both Suisun and Fairfield

Memorandum

Project Guiding Principles

- The Solano County Hub will accommodate the existing and planned Capitol Corridor services, future SMART services, and local and regional feeder and express bus services.
- Infrastructure improvements will be provided to meet the anticipated needs of existing and future services and users in a safe, comfortable, effective and attractive manner.
- Improvements and facility designs will strive to stay within the boundaries of the current site. The site includes the current station, the UPRR right-of-way, and the adjacent Caltrans and city rights-of-way.
- Infrastructure improvements will substantially adhere to the relevant codes and design criteria of Amtrak, CPUC, Capitol Corridor, SMART, UPRR, Caltrans and the cities of Fairfield and Suisun City. Any design exceptions must still allow the facilities to meet the intent of the design criteria.
- Caltrans Highway 12 structures will not be relocated, moved or impacted.
- Stairs and ADA-compliant ramps for vertical circulation are preferred over mechanically-operated elevators or escalators as a means to reduce one-time capital and recurring operating/maintenance costs.
- A “program of projects” that allows for phased implementation of improvements is desired, if feasible.

APPENDIX B – DESIGN CRITERIA

File Note

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Project title	SMART-Solano Express Station Study/Solano Rail Hub Project Study Report	Job number	272032
cc		File reference	
Prepared by	Emma Burkhardt	Date	April 22, 2021
Subject	Task 3: Design Criteria		

1 Summary & Assumptions

This document summarizes the relevant design criteria from the three rail operators that will operate in the project area: Amtrak, Union Pacific, and SMART. Additionally, the document provides prescriptive project-specific guidance that considers previous study and stakeholder input. The following general assumptions apply:

- The project will work around the existing Caltrans Hwy 12 bridge and assume no columns or abutments will be adjusted or relocated.
- Based on the current nominal height of the Caltrans Highway 12 bridge measured at the site, 25’ of vertical clearance will be used for pedestrian bridge alternatives. This does not include potential encroachment of falsework in construction.
- A shoofly track will be built to continue rail operations throughout construction. This track will be designed and built to become a permanent UPRR passing siding track upon the completion of construction.
- In addition to the passing siding track, a new turnaround track will be provided to the north of the station.
- Watertight construction and support of excavation methods will be selected to have negligible impact to groundwater level and negligible long-term groundwater ingress management.

2 Definitions

Centerline (CL): The direct center of the rail alignment between the two rails.

Crest: A vertical curve that connects ascending grades, creating a crest shape.

Degree of curvature (D_c): The angle subtended by the horizontal curve radii at both ends of a 100-ft long chord. $D_c = 2$ Arcsine (50 / R).

Horizontal curve (HC): A horizontal geometry component with a constant radius to transition from one tangent direction to another.

Horizontal tangent: A horizontal geometry component with a constant direction and no horizontal curvature.

Last long tie (LLT): The final tie connecting the two diverging rail lines on a turnout, before the two lines are completely separate. Ties between two diverging rail alignments become sequentially longer as the two alignments diverge further from one another.

Point of Switch (PS): The point at which the two tracks of a turnout diverge.

Radius (R): A measurement of the sharpness of a horizontal curve. R = 50 / (Sine (D_c / 2)).

Rate of change (A/L): The average change in gradient in a vertical curve per 100’ station, calculated as the difference in grades between the two vertical tangents (A) divided by the length of the vertical curve (L).

Reverse curves: Two sequential horizontal curves of opposing directions with minimal or zero tangent between them.

Sag: A vertical curve that connects descending grades, creating a bowl or sag shape.

Shoofly: A temporary track built during construction to continue rail operations.

Spiral: A horizontal geometry component with changing radius to transition from tangent (no curvature) to horizontal curve (constant radius).

Structural depth: The vertical depth/clearance required for structural components of a bridge or tunnel structure.

Summit: Synonymous with crest.

Superelevation – applied/actual (E_a): The vertical offset measured in inches from the low rail to the high rail applied on curves to counteract centripetal forces.

Superelevation – equilibrium (E_e): The calculated amount of superelevation that would exactly offset opposing centripetal forces.

Superelevation – underbalance (E_u): The difference between applied superelevation and equilibrium superelevation.

Tie: Rectangular support pieces made of wood or concrete that support the rails and transfer loads onto the ballast and subgrade.

Top-of-rail (TOR): The elevation of the top of the steel rail. Vertical clearances are typically measured as an offset from this elevation.

Track centers: Horizontal clearance measured between the centerlines of two adjacent rail alignments.

Turnout (TO): A mechanical installation enabling railway trains to be guided from one track to another, such as at a railway junction or where a spur or siding branches off.

Velocity (V): The speed of the rail alignment in mph.

Vertical Curve: A vertical geometry component connecting two vertical tangents of different grades. They are typically parabolic.

Vertical Tangent: A vertical geometry component with a constant grade and no vertical curvature.

3 Design Criteria

3.1 Rail Geometry

3.1.1 Horizontal

UPRR (7)			
Superelevation (in)	E_a	Max	5
		Pref max	4
		Min	0.25
	E_u	Max	3
		Pref max	1
		Min	0
Minimum Horizontal Tangent Length (ft)	Main Line (Preferred)	60 mph and above	500
		40 mph thru 59 mph	300
		39 mph and below	150
	Yards and Tracks (Min)	7D30'0" or less	36
		Greater than 7D30'0"	60
Minimum Spiral Length (ft)			$44*E_a$

Amtrak (5)			
Superelevation (in)	E_a	Max	5.5
		Pref max	4
		Min	0.5
	E_u	Max	4
	Curves that have less than ¼ inch of balanced elevation (E_e) should have no superelevation (E_a)		
Minimum Horizontal Tangent Length (ft)	Greater of		3*V
			100
Minimum Spiral Length (ft)			$1.63*E_u*V$
		Not less than	62
Minimum Horizontal Curve Length (ft)	Greater of		3*V
			100

SMART (8)			
Superelevation (in)	E_a	Max	5
Minimum Horizontal Tangent Length (ft)	Between reverse curves	Preferred	3V
		Abs min	100
	Between PS & TO	Preferred	50
		Abs min	20
	Between PS & curve	Preferred	100
		Abs min	15
	Between PS & platform	Preferred	100
		Abs min	60
	Between PS & LLT	Preferred	60
		Abs min	15
	Between curve & platform	Preferred	60
		Abs min	30
Minimum Spiral Length (ft)	The longest of		$1.63*E_u*V$
			$1.2*E_a*V$
			$62*E_a$
Minimum Horizontal Curve Length (ft)	Mainline Tracks		100
	Yard and Industry Tracks		50

3.1.2 Vertical

UPRR (7)			
Max grade			1%
Max rate of change	Sag	All main track	0.06
		branch track >40mph	0.06
		branch track <40mph	0.12
		yard track	0.4
		Industrial leads	0.6
		Industry track	1.2
	Summit	All main track	0.1
		branch track >40mph	0.1
		branch track <40mph	0.2
		yard track	0.8
		Industrial leads	1
		Industry track	2

Amtrak (5)		
Max grade		1.5%
Minimum vertical curve length (ft)		$(2.15*D*V^2)/A$
Minimum vertical tangent (ft)	Longer of	3*V
		100
Max rate of change		0.4

SMART (8)		
Max grade		2%
Minimum vertical curve length (ft)	Longer of	$(2.15*D*V^2)/A$
		100
Minimum vertical tangent (ft)	Longer of	3*V
		100

3.2 Rail Clearances

3.2.1 Horizontal

	Track centers		Side clearance for tangent rail (from track CL)*	
	To same rail agency	To different rail agency	To platform edge	To permanent structures
UPRR	15’ (7)	20’ (7)	5’-6” (7)	9’ (7)
Amtrak	14’ (5)	14’ (5)	5’-1” (3)	9’ (3)
SMART	15’ (8)	15’ (8)	5’-7” (8)	8’-6” (8)

*Side clearance values may increase on horizontal curves

3.2.2 Vertical

The following table lists overhead clearance values from the three rail agencies that will use the station. The project team used a Bosch distance measurer to measure the clearance provided below the existing Highway 12 bridge. Values measured varied from 24.8’-25.5’ from TOR to bottom of structure. Hence, the project team will assume a clearance of 25’ for all pedestrian bridge alternatives. This does not include potential encroachment of falsework in construction.

	Vertical clearance	Description
UPRR (7)	23'-4"	Measured from the top of the highest rail to the lowest obstruction under the structure
Amtrak (3)	23'-0"	Overhead bridges and other structures in non-electrified territory
	24'-3"	Overhead bridges and other structures in electrified territory for 22’-0” trolley wire
	26'-9"	Overhead bridges and other structures in electrified territory for 24’-6” trolley wire height
SMART (CPUC) (6)	22'-6"	Freight cars
	14'-0"	Non-freight cars
Current nominal	25’-0”	Average existing clearance measured from TOR to bottom of Hwy 12 bridge structure

3.3 Station

3.3.1 Platforms

The following assumptions will be used for the platform design:

- Center platforms
- Platforms and tracks at the station will not be superelevated

	Length (ft)	Width (ft)		Height (in)	Max degree of curvature
	Minimum	Minimum	Preferred		
SMART (8)	270	17	-	48	0
Amtrak (4)	700	20	24	8	1°40”

3.3.2 Pedestrian Access

Sections 3.3.2.1-3.3.2.3 are informed by ADA (9) requirements.

3.3.2.1 Stairs

Min rise height	Max rise height	Min tread	Min width	Min landing width	Min landings requirement
4"	7"	11"	4'	4'	Every 12' of vertical rise

3.3.2.2 Ramps

Max slope	Max slope with landings	Min width	Min landing width	Min landings requirement
1:20 (5%)	1:12 (8.33%)	4'	5'	Every 5' of vertical rise

3.3.2.3 Elevators

Elevators will be provided when accessible travel paths (i.e., ramps) exceed a run (length) of 400 feet from the passenger concourse (either below or above grade) to grade. When elevators are required, two will be provided for each path of travel.

Min elevator width (in)	Min elevator depth (in)
68	51

3.4 Pedestrian Crossing

Values in sections 3.4.1 and 3.4.2 may be modified upon further analysis and design throughout the course of the project.

3.4.1 Underpass

It is envisioned that the pedestrian underpass would be constructed using watertight support of excavation walls and an excavation sequence that allows continuity of rail service for the duration of construction. Support of excavation methods such as slurry or secant pile walls would extend below excavation level to provide a groundwater cutoff and prevent base heave during base slab construction. Construction joints will include hydrophilic waterstops to prevent long term groundwater ingress issues.

The rail bridge will be designed with a structural depth to support the loads of the freight and passenger trains that will pass through the station. Acceptable and preferred clear heights are per architectural recommendation. It is assumed that:

- The underpass will be just below the railroad ballast
- The tunnel wall and roof will be monolithic

	Clear height (ft)
Minimum	10 (1)
Acceptable	12
Preferred	14

3.4.2 Bridge

The pedestrian bridge widths are recommended per pedestrian circulation demand calculations to maintain a pedestrian LOS C at peak demand. The following assumptions will be used for the bridge design:

- Clear span over entire track ROW
- Preferred construction type: Precast concrete or steel girder

	Steel Girder or Precast Girder	Cast-in-Place
Structural depth (ft) (2)	0.04 * span	0.033 * span + falsework depth

	Width (ft)
Minimum	20
Acceptable	25
Preferred	30

4 Recommended Values

UPRR/Amtrak Tracks			
Superelevation (in)	E_a	Max	5
		Min	0.5
	E_u	Max	3
		Min	0
Minimum Horizontal Tangent Length (ft)	Main Line (Preferred)	60 mph and above	500
		40 mph thru 59 mph	300
		39 mph and below	150
	Yards and Tracks (Min)	7D30'0" or less	36
		Greater than 7D30'0"	60

Minimum Spiral Length (ft)	Greater of	$44*E_a$	
		$1.63*E_u*V$	
		62	
Minimum Horizontal Curve Length (ft)	Greater of	$3*V$	
		100	
Max Grade		1%	
Minimum vertical curve length (ft)		$(2.15*D*V^2)/A$	
Max rate of change	Sag	All main track	0.06
		Branch track >40mph	0.06
		Branch track <40mph	0.12
	Summit	All main track	0.1
		branch track >40mph	0.1
		branch track <40mph	0.2

Vertical clearance (ft)		25
Track centers (ft)	Between UPRR/Amtrak and SMART	20
	Between UPRR/Amtrak and UPRR/Amtrak	15
Side clearance (from track CL) (ft)	To platform edge	5.5
	To permanent structures	9
Platform	Length (ft)	700
	Width (ft)	24
	Degree of curvature	1º40”

File Note

272032 April 22, 2021

SMART Tracks			
Superelevation (in)	E_a	Max	5
Minimum Horizontal Tangent Length (ft)		Between reverse curves	100
		Between PS & platform	60
		Between curve & platform	30
Minimum Spiral Length (ft)		The longest of	$1.63*E_u*V$
			$1.2*E_a*V$
			$62*E_a$
Minimum Horizontal Curve Length (ft)		Mainline Tracks	100
		Yard and Industry Tracks	50
Max grade			2%
Minimum vertical curve length (ft)		Longer of	$(2.15*D*V^2)/A$
			100
Minimum vertical tangent (ft)		Longer of	3V
			100
Vertical clearance (ft)			25
		To platform edge	5.5
Side clearance (from track CL) (ft)		To permanent structures	8.5
Platform		Length (ft)	270
		Width (ft)	17
		Degree of curvature	0

5 Sources

1) American Association of State Highway and Transportation Officials. *Guide for the Development of Bicycle Facilities.* 2012.
2) American Association of State Highway and Transportation Officials. *LRFD Guide Specifications for the Design of Pedestrian Bridges*. 2009.
3) Amtrak. Standard Track Plan 70050.001.08 Minimum Roadway Clearances. 2016.
4) Amtrak. *Station Program and Planning Guidelines*. 2013.
5) Amtrak. *Track Design Specification No. 63*. 2015.
6) Public Utilities Commission of the State of California. *General Order No. 26-D*. 1981.
7) Union Pacific Railroad. *Track Standard Drawings*. 2005.
8) Sonoma Marin Area Rail Transit District. *Design Criteria Manual.* 2019.
9) U.S. Access Board. *Technical Guide. Chapter 4: Accessible Routes*. 2015.

DOCUMENT CHECKING (not mandatory for File Note)

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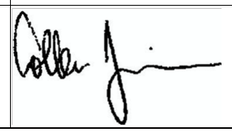
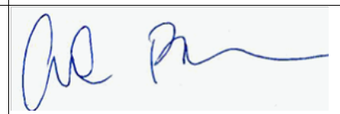
Signature			

APPENDIX C – CAPITAL COST ANALYSIS

3/28/2022

Solano Rail Hub Project

Level 5 Estimate

ARUP

Estimate Classification Matrix

Estimate Level	Estimate Description	Design Phase	Level of Completion	Methodology	Accuracy Range
5	Rough Order of Magnitude	Planning Schematic Design	0% to 5%	Parametric Models Capacity Factored Historical Costs	L: -20% to - 50% H: +30% to +100%
4	Concept Feasibility	Planning Schematic Design	1% to 15%	Equipment Factored Parametric Models	L: -15% to - 30% H: +20% to +50%
3	Budget Authorization	Planning Schematic Design Design Documents	10% to 40%	Unit Costs Assembles	L: -10% to - 20% H: +10% to +40%
2	Budget Control Estimate	Preliminary Design Engineering Design Documents Construction Documents	30% to 70%	Detailed Unit Cost Detailed Take-Off	L: -5% to - 15% H: +5% to +30%
1	Bid	Detailed Design Engineering Construction Documents	50% to 100%	Detailed Unit Cost Detailed Take-Off Productivities Subcontractor Quotes	L: -2% to - 5% H: +3% to + 15%

ARUP	Job No: **272032-00**	Sheet No:
JobTitle: **Solano-Rail-Hub** Cost Plan: Rough Order Of Magnitude - Level 5	Element: ***Notes & Assumptions***	Base Date of Estimate ***Q3 2021***
	Prepared by / Checked by **NS / JD**	Date: **September 24, 2021**

1.0 Assumptions

General Information

This document has been prepared by Arup to provide an indication of expected Bid Costs for Solano rail hub development project. The estimate within this document is not intended to set the budget for the potential works, the budget can only be established once the Client's brief has been finalized, a design solution and program developed by the Project Team, and the Forecasted Costs subsequently approved by the Client

Pricing is based on current rates provided from Arup's internal sources of cost data, Pricing Books such as RS Means or Caltrans cost database. All costs are adjusted to reflect Sacramento area prices and shown in 3rd Quarter 2021 dollars.

The cost estimate for each project was developed independently.

Arup prepared two independent estimates, one for Suisun-Fairfield Station and other for I680 Freeway Bus Station. For I680 Freeway Bus Station, Arup is providing the cost estimate for two bus platform options: central platform and lateral platforms.

Below the list of the main components included in each estimate.

Suisun-Fairfield Station

Above and below grade options.

Both options include: excavation, tunnel/bridge structure, and finishes
Additional track for storage area and new sidings, includes required track relocation, turnouts and crossovers
SMART and Capital Corridor Platforms
Relocation of existing station building, including utilities relocation allowance
Sinking plaza included only for the below grade option. It includes: excavation, concrete, lighting and landscaping
Parking at grade, including 265 parking spaces.
Demolition of the existing pedestrian bridge structure, excluding any deep foundations.

Capital Cost

The values are in US dollars from the third quarter of the year 2021.
Direct unit costs include material, equipment and labor. Such costs are obtained from benchmarks from industry projects, Arup past projects and data bases such as RS Means and Caltrans.

Other Costs

Besides the Direct Construction Costs, the estimate includes the following costs:
General Condition / Indirect, includes construction staff, site conditions, and temporary power. This cost is allocated to the contractor and corresponds to 10% of the direct costs.
A Maintenance of Traffic (MOT) allowance of 3% from the direct cost.
A mobilization and demobilization allowance of 2% from the direct cost.
Contractor Fees allowance of 10% from the direct and indirect costs.
Contractor's contingency is allocated as 15% from the direct and indirect costs.

Soft Costs

A design fees allowance of 7% from the construction price is considered.
Environmental fees, including EIR/EIS are assumed as 1% of the construction price
Project Management and Construction Management fees, including safety and QA/QC are allocated as 5% of the construction price
Legal fees, including but not limited to permits, licenses and Fees are allocated as 2% of the construction price.

Owner's Reserve

Due to the level of design, Arup proposes an owner’s contingency of 15% from the total soft cost and construction price.

ARUP	Job No:	Sheet No:
JobTitle:	**272032-00**	
Solano-Rail-Hub	Element:	Base Date of Estimate
Cost Plan: Rough Order Of Magnitude - Level 5	***Notes & Assumptions***	***Q3 2021***
	Prepared by / Checked by	Date:
	NS / JD	**September 24, 2021**

2.0 Exclusions

The following items are excluded from the estimate:
Other owner's costs, which include consultant fees, liability, surveys and site investigation fees
The costs or impacts of latent environmental issues that result in litigations or development delays
Right of way and or land acquisition costs
Risk-based contingency analysis
Local taxes and duties
Removal and disposal of hazardous materials, unless stated in the estimate
Pedestrian only tunnel for Suisun-Fairfield Station

3.0 Items that might affect the Estimate

The following items may affect the estimate:
Modifications to the scope of work included in the estimate
Restrictive technical specifications or excessive contract conditions
Any other non-competitive projects schedule
Additional loss of productivity
Future market conditions

4.0 Statement of Probable Cost

ARUP has no control over the cost of labor and materials, general contractor's or any subcontractor's method of determining prices, or competitive bidding and market conditions. This opinion of probable cost of construction is made on the basis of the experience, qualifications, and best judgment of the professional consultant familiar with the construction industry. ARUP cannot and does not guarantee that proposals, bids, or actual construction costs will not vary from this or subsequent cost estimates.

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Capital Cost Estimate			
		Bridge	Tunnel
Scope of Work	Unit	Total Cost	Total Cost
Rail Hub		$ 46,300,000	$ 78,200,000
Structure	LS	$ 19,320,000	$ 47,630,000
Bridge Structure	LS	$ 17,447,000	$ 44,518,000
Other works	LS	$ 1,873,000	$ 3,112,000
Rail	LS	$ 25,020,000	$ 25,020,000
Track & Rail Accessories	LS	$ 21,918,000	$ 21,918,000
Platforms	LS	$ 3,100,000	$ 3,100,000
Existing Building Station	LS	$ 241,000	$ 241,000
Relocate existing station	LS	$ 241,000	$ 241,000
Rail Hub	LS	$ 1,700,000	$ 1,330,000
Conveying	LS	$ 368,000	$ -
Parking	LS	$ 1,325,000	$ 1,325,000
Sinking Plaza for Tunnel	LS	$ -	$ 3,961,000.00
Sinking Plaza for Tunnel	LS	$ -	$ 3,961,000.00
Total Direct Cost	LS	$ 46,300,000	$ 78,200,000
Total Construction Price		$ 66,200,000	$ 112,800,000
Total Construction Price + Soft Costs		$ 76,200,000	$ 129,800,000
Owner's Reserve	%	$ 11,430,000	$ 19,470,000
TOTAL PROJECT PRICE		$ 88,000,000	$ 150,000,000
Expected Low Range - Estimate Level 5	-30%	$ 62,000,000	$ 105,000,000
Expected High Range - Estimate Level 5	50%	$ 132,000,000	$ 225,000,000
Bid Factor		190.06%	191.82%

No escalation
2021 USD

ARUP

Above grade - Capital Cost Estimate

		Top Down Approach		
Scope of Work	Unit	Quantity	Unit Cost	Total Cost
Rail Hub				**$ 46,300,000**
Structure	**LS**			**$ 19,320,000**
Bridge Structure	**LS**			**$ 17,447,000**
Demolition	LS			$ 500,000
Pavement Demolition	SF	28,070	$ 5	$ 140,000
Pedestrian Bridge demolition	AL	1	$ 360,000	$ 360,000
Utility Relocation	AL	1	$ 1	$ -
Petroleum Pipe relocation	LF	-	$ 2,200	$ -
Excavation	LS			$ -
Dewatering	AL	-	$ 300,000	$ -
Excavation	CY	-	$ 250	$ -
Backfill	LS			$ -
CLSM backfill	CY	-	$ 200	$ -
Retaining Walls for ramps	LS			$ -
Retaining wall	SF	-	$ 75	$ -
Base Concrete Slab	LS			$ -
Concrete	CY	-	$ 2,000	$ -
Reinforcement	LBS	-	$ 6	$ -
Wall Concrete Slab	LS			$ -
Concrete	CY	-	$ 2,000	$ -
Reinforcement	LBS	-	$ 6	$ -
Ceiling Concrete Slab	LS			$ -
Concrete slab	SF	-	$ 25	$ -
Reinforcement	LBS	-	$ 6	$ -
Invert Slab Concrete	LS			$ -
Concrete	CY	-	$ 2,000	$ -
Reinforcement	LBS	-	$ 6	$ -
Pedestrian Bridge	LS			$ 16,947,000
Pedestrian Bridge Structure	SF	37,659	$ 450	$ 16,947,000
Other works	**LS**			**$ 1,873,000**
At grade pavement	LS			$ 185,000
Concrete pavement - sidewalk	SF	9,240	$ 20	$ 185,000
Stairs	LS			$ 465,000
Stairs	CY	166	$ 2,797	$ 465,000
Interiors	LS			$ -
Paint for tunnel walls	SF	-	$ 4	$ -
Acrylic Sealer for floor	SF	-	$ 1	$ -
Ceiling finishes	SF	-	$ 2	$ -
Waterproofing	SF	-	$ 20	$ -
Drainage	SF			
Lighting	LS			$ 103,000
Pedestrian Lighting	LF	5,170	$ 20	$ 103,000
Fencing	LS			$ 1,120,000
Security fencing	LF	20,000	$ 56	$ 1,120,000
Rail	**LS**			**$ 25,020,000**
Track & Rail Accessories	**LS**			**$ 21,918,000**
Capital Corridor	LS			$ 21,918,000
Relocate Existing Tracks (Single Track)	TF	710	$ 456	$ 324,000
Relocate Existing Tracks (Double Track)	TF	3,930	$ 1,060	$ 4,167,000
New Track	TF	4,120	$ 2,570	$ 10,590,000
Additional Storage Track (No. 10)	TF	1,800	$ 2,570	$ 4,627,000
Double Crossover (No. 10)	TF	2	$ 750,000	$ 1,500,000
Turnout (No. 10)	TF	2	$ 150,000	$ 300,000
Turnout (No. 20)	TF	1	$ 410,000	$ 410,000
Platforms	**LS**			**$ 3,100,000**
Capital Corridor Platform	LS			$ 3,100,000
Rail Platform	CY	1,300	$ 1,250	$ 1,625,000
Platform Canopy	SF	5,000	$ 45	$ 225,000
Platform amenities	SF	50,000	$ 25	$ 1,250,000
Existing Building Station	**LS**			**$ 241,000**
Relocate existing station	**LS**			**$ 241,000**
Relocate existing station	LS			$ 241,000
Moving existing station	SF	5,400	$ 40	$ 216,000
Utilities reconnection	AL	1	$ 25,000	$ 25,000

Rail Hub	**LS**				**$**	**1,700,000**
Conveying	**LS**				**$**	**368,000**
Elevators	LS				$	368,000
Hydraulic Elevator, 2-stops	EA	6	$	61,380	$	368,000
Parking	**LS**				**$**	**1,325,000**
Parking	LS				$	1,325,000
Parking	Space	265	$	5,000	$	1,325,000
Sinking Plaza for Tunnel	**LS**				**$**	**-**
Sinking Plaza for Tunnel	**LS**				**$**	**-**
Sinking Plaza for Tunnel	LS				$	-
Excavation	CY	-	$	250	$	-
Compaction	SF	-	$	2	$	-
Concrete for plaza	SF	-	$	40	$	-
Retaining wall	SF	-	$	75	$	-
Ramp	SF	-	$	410	$	-
Stairs	CY	-	$	2,797	$	-
Lighting	AL	-	$	80,000	$	-
Landscaping	AL	-	$	60,000	$	-
Total Direct Cost	**LS**	**1**			**$**	**46,300,000**
General Conditions/Indirect	%	10%			$	4,630,000
MOT	%	1%			$	463,000
Mobilization/Demobilization	%	2%			$	926,000
Subtotal					*$*	*52,319,000*
Contractor Fees (Overhead and profit)	%	10%			$	5,231,900
Subtotal					*$*	*57,550,900*
Contractor's Contingency	%	15%			$	8,632,635
Total Construction Price					**$**	**66,200,000**
Design Fees	%	7%			$	4,634,000
Environmental Fees	%	1%			$	662,000
Project Management, Construction Management, Safety/QA/QC	%	5%			$	3,310,000
Legal Fees	%	2%			$	1,324,000
Total Construction Price + Soft Costs					**$**	**76,200,000**
Owner's Reserve	%	15%			$	11,430,000
TOTAL PROJECT PRICE					**$**	**88,000,000**
Expected Low Range - Estimate Level 5	-30%	-30%			$	62,000,000
Expected High Range - Estimate Level 5	50%	50%			$	132,000,000
Bid Factor						190.06%

No escalation
2021 USD

ARUP

Below grade - Capital Cost Estimate

		Top Down Approach		
Scope of Work	Unit	Quantity	Unit Cost	Total Cost
Rail Hub				**$ 78,200,000**
Structure	**LS**			**$ 47,630,000**
Tunnel Structure	**LS**			**$ 44,518,000**
Demolition	LS			$ 1,309,000
Pavement Demolition	SF	53,310	$ 5	$ 267,000
Pedestrian Bridge demolition	AL	1	$ 360,000	$ 360,000
Utility Relocation	AL	1	$ 1	$ -
Petroleum Pipe relocation	LF	310	$ 2,200	$ 682,000
Excavation	LS			$ 6,571,000
Dewatering	AL	1	$ 300,000	$ 300,000
Excavation	CY	25,083	$ 250	$ 6,271,000
Backfill	LS			$ 180,000
CLSM backfill	CY	902	$ 200	$ 180,000
Retaining Walls for ramps	LS			$ 3,386,000
Retaining wall	SF	45,150	$ 75	$ 3,386,000
Base Concrete Slab	LS			$ 20,732,000
Concrete	CY	5,923	$ 2,000	$ 11,847,000
Reinforcement	LBS	1,480,833	$ 6	$ 8,885,000
Wall Concrete Slab	LS			$ 2,970,000
Concrete	CY	752	$ 2,000	$ 1,504,000
Reinforcement	LBS	244,352	$ 6	$ 1,466,000
Ceiling Concrete Slab	LS			$ 1,472,000
Concrete slab	SF	6,090	$ 25	$ 152,000
Reinforcement	LBS	219,917	$ 6	$ 1,320,000
Invert Slab Concrete	LS			$ 7,898,000
Concrete	CY	3,949	$ 2,000	$ 7,898,000
Reinforcement	LBS	-	$ 6	$ -
Pedestrian Bridge	LS			$ -
Pedestrian Bridge Structure		-	$ 450	$ -
Other works	**LS**			**$ 3,112,000**
At grade pavement	LS			$ -
Concrete pavement - sidewalk	SF	-	$ 20	$ -
Stairs	LS			$ 310,000
Stairs	CY	111	$ 2,797	$ 310,000
Interiors	LS			$ 1,611,000
Paint for tunnel walls	SF	55,300	$ 4	$ 194,000
Acrylic Sealer for floor	SF	6,090	$ 1	$ 7,000
Ceiling finishes	SF	6,090	$ 2	$ 12,000
Waterproofing	SF	67,480	$ 20	$ 1,350,000
Drainage	SF	6,090	$ 8	$ 48,000
Lighting	LS			$ 71,000
Pedestrian lighting	LF	3,554	$ 20	$ 71,000
Fencing	LS			$ 1,120,000
Security fencing	LF	20,000	$ 56	$ 1,120,000
Rail	**LS**			**$ 25,020,000**
Track & Rail Accessories	**LS**			**$ 21,918,000**
Capital Corridor	LS			$ 21,918,000
Relocate Existing Tracks (Single Track)	TF	710	$ 456	$ 324,000
Relocate Existing Tracks (Double Track)	TF	3,930	$ 1,060	$ 4,167,000
New Track	TF	4,120	$ 2,570	$ 10,590,000
Additional Storage Track (No. 10)	TF	1,800	$ 2,570	$ 4,627,000
Double Crossover (No. 10)	TF	2	$ 750,000	$ 1,500,000
Turnout (No. 10)	TF	2	$ 150,000	$ 300,000
Turnout (No. 20)	TF	1	$ 410,000	$ 410,000
Platforms	**LS**			**$ 3,100,000**
Capital Corridor Platform	LS			$ 3,100,000
Rail Platform	CY	1,300	$ 1,250	$ 1,625,000
Platform Canopy	SF	5,000	$ 45	$ 225,000
Platform amenities	SF	50,000	$ 25	$ 1,250,000
Existing Building Station	**LS**			**$ 241,000**
Relocate existing station	**LS**			**$ 241,000**
Relocate existing station	LS			$ 241,000
Moving existing station	SF	5,400	$ 40	$ 216,000
Utilities reconnection	AL	1	$ 25,000	$ 25,000

Rail Hub	**LS**				**$**	**1,330,000**
Conveying	**LS**				**$**	**-**
Elevators	LS				$	-
Hydraulic Elevator, 2-stops	EA	-	$	61,380	$	-
Parking	**LS**				**$**	**1,325,000**
Parking	LS				$	1,325,000
Parking	Space	265	$	5,000	$	1,325,000
Sinking Plaza for Tunnel	**LS**				**$**	**3,961,000.00**
Sinking Plaza for Tunnel	**LS**				**$**	**3,961,000.00**
Sinking Plaza for Tunnel	LS				$	3,961,000.00
Excavation	CY	11,900	$	250	$	2,975,000
Compaction	SF	13,300	$	2	$	27,000
Concrete for plaza	SF	9,000	$	40	$	360,000
Retaining wall	SF	6,120	$	75	$	459,000
Ramp	SF	-	$	410	$	-
Stairs	CY	-	$	2,797	$	-
Lighting	AL	1	$	80,000	$	80,000
Landscaping	AL	1	$	60,000	$	60,000
Total Direct Cost	**LS**	**1**			**$**	**78,200,000**
General Conditions/Indirect	%	10%			$	7,820,000
MOT	%	2%			$	1,564,000
Mobilization/Demobilization	%	2%			$	1,564,000
Subtotal					*$*	*89,148,000*
Contractor Fees (Overhead and profit)	%	10%			$	8,914,800
Subtotal					*$*	*98,062,800*
Contractor's Contingency	%	15%			$	14,709,420
Total Construction Price					**$**	**112,800,000**
Design Fees	%	7%			$	7,896,000
Environmental Fees	%	1%			$	1,128,000
Project Management, Construction Management, Safety/QA/QC	%	5%			$	5,640,000
Legal Fees	%	2%			$	2,256,000
Total Construction Price + Soft Costs					**$**	**129,800,000**
Owner's Reserve	%	15%			$	19,470,000
TOTAL PROJECT PRICE					**$**	**150,000,000**
Expected Low Range - Estimate Level 5	-30%	-30%			$	105,000,000
Expected High Range - Estimate Level 5	50%	50%			$	225,000,000
Bid Factor						191.82%