FEASIBILITY STUDY

Lower Eastside Community Connectivity Active Transportation Plan

Canada Street Pedestrian and Bicycle Overcrossing

Prepared for:

City of Santa Barbara
Department of Public Works

Prepared by:

consor

September 2023

This Feasibility Report has been prepared under the direction of the following registered civil engineers. The registered civil engineer attests to the technical information contained herein and the engineering data upon which recommendations, conclusions, and decisions are based.

Prepared by:

Gavin Keating, Consor Project Engineer

Reviewed by:

Greg Young, Consor Project Manager

Approved by:

Chelsey Swanson, City of Santa Barbara Project Manager

Table of Contents

EXECUTIVE SUMMARY 4
GENERAL DESCRIPTION 5
DESIGN CRITERIA 6
TYPICAL SECTION WIDTH 7
VERTICAL ALIGNMENT 7
HORIZONTAL ALIGNMENT 8
STRUCTURAL ALTERNATIVES 10
RIGHT OF WAY 16
UTILITIES 17
ENVIRONMENTAL STUDIES 18
BRIDGE RAILING 20
AESTHETIC REQUIREMENTS 21
STORMWATER QUALITY 22
GEOTECHNICAL/FOUNDATIONS 23
SEISMIC LOADING 25
HYDRAULICS 26
OTHER PROJECT CONSTRAINTS 28
PROJECT COST ESTIMATES 31
CONCLUSIONS 31

APPENDIX
A. Project Constraints Map
B. Alignment Plan and Profile
C. Bridge Advance Planning Studies
D. Construction Cost Estimates
E. Topographic Mapping
F. Environmental Studies
G. Hydraulic Memorandum
H. Preliminary Geotechnical Report
I. Renderings

EXECUTIVE SUMMARY

The City of Santa Barbara Public Works Department (City) secured a Cycle 4, Active Transportation (ATP) grant to develop alternatives and cost estimates for a pedestrian/bicycle bridge connecting the Lower Eastside neighborhood over US 101 to the Waterfront. US 101 acts as a barrier for pedestrian/bicycle travel, and an overcrossing would allow pedestrians/bicyclists to safely cross US 101 and satisfy policy goals set forth in the City's Pedestrian and Bicycle Master Plans. The objectives of this study are as follows:

- Analyze feasibility of constructing a structure to span US 101 and the Union Pacific Railroad (UPRR) tracks without placing infrastructure within Caltrans or UPRR right of way;
- Study three structure design and alignment alternatives;
- Identify site constraints, including consideration of Sycamore Creek, UPRR railroad, US 101 highway and Santa Barbara Zoo (Zoo) parking lot;
- Study the hydraulic impacts of a pedestrian/bicycle bridge over Sycamore Creek while also presenting an alternative that is compatible with future Santa Barbara County Flood Control improvements;
- Maximize structural efficiency while minimizing parking losses in the Zoo parking lot;
- Minimize right of way acquisition;
- Assess how potential bridge and roadway options affect the access to the Sunrise RV park and Santa Barbara Green Mobile Home Park from Pitos Street; and
- Develop cost estimates that can be used to program the final design and construction phases.

Santa Barbara is a city that has been developed to maximize the use of the beautiful waterfront, and this project has the potential to improve pedestrian/bicycle access. The crossing location presents many challenges but provides significant benefits to the surrounding community.

Three different alignment and structure alternatives have been studied and are presented as part of this Feasibility Study. The alignment alternatives focused on the feasible Sycamore Creek crossing locations. The structure alternatives focused on different bridge types and span configurations to cross US 101 and the railroad. The railroad does not permit falsework to be constructed above an active track, so precast concrete and steel truss structure types were determined to provide structural efficiency and proper constructability while working over the railroad.

The south side approach was developed to reduce impacts to parking at the Zoo while maintaining structural efficiency. Multiple alternatives were reviewed but due to falsework requirements with Cast-in-place concrete, it was determined that precast girders would be effective alternatives to consider at this approach.

The north side approach is constrained at the cul-de-sac on Canada Street. Due to the need for curved geometry, a cast in place slab stacked ramp concept was noted to be the best alternative at this location. It provides a less constricting layout, as compared to a typical corkscrew alignment, and fits within the narrow right of way constraints at the approach location.

The purpose of the Feasibility Study is to identify existing constraints within the study area and propose viable bridge structure types for the crossing. Cost for the alternatives have been generated to assist the city in programming the final design and construction phases.

GENERAL DESCRIPTION

The purpose of the ATP is to encourage active modes of transportation, such as biking and walking, while increasing safety. It aims to ensure that the benefits of the program are distributed to disadvantaged communities, while providing a broad spectrum of projects to benefit active transportation users.

The proposed pedestrian/bicycle bridge would provide multimodal access to the zoo, parks and Waterfront from the Lower Eastside neighborhood that is currently impacted by US 101, which acts as a barrier. The proposed bridge would span over the highway, and adjacent railroad, to provide safe pedestrian/ bicycle crossing. This would serve to provide a significant improvement in access, with current alternate crossing points located approximately 1.25 miles away.

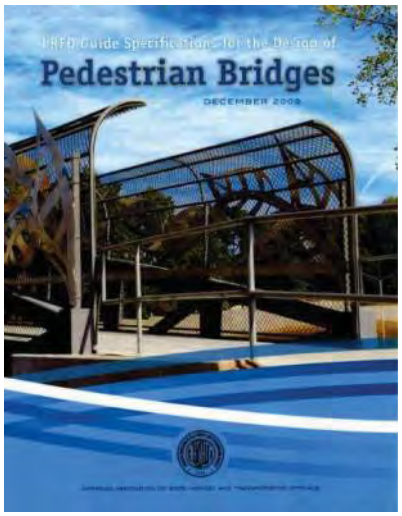
Three horizontal alignment alternatives were studied which focused on the most feasible Sycamore Creek crossing location. Three structure alternatives were considered in this study, all along the preferred horizontal alignment. This alignment connects Canada Street on the north side of US 101 to Dwight Murphy Field on the south side of US 101.

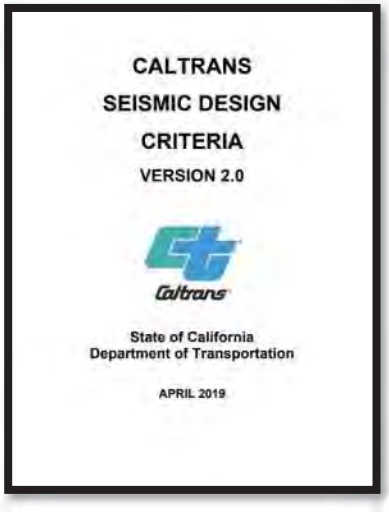
Minimizing impacts to parking at the Santa Barbara Zoo, encroachments into Union Pacific right of way, encroachments into Caltrans right of way and compatibility with future flood control projects planned for Sycamore Creek were some of the primary study considerations.

DESIGN CRITERIA

The following criteria will be used for final design and are based on the following standards:

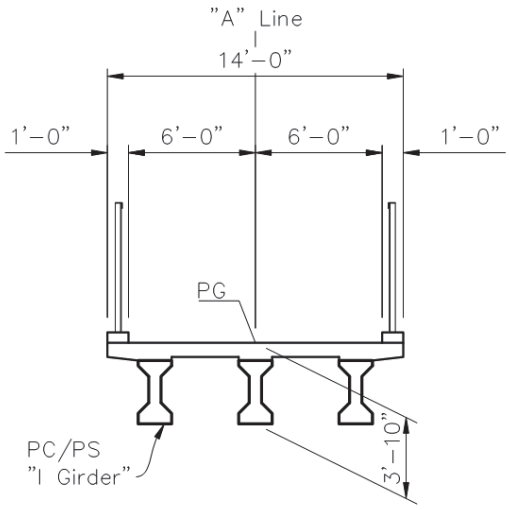
- Bike Path Design – Bike Path design will be based on Caltrans **"The 7th Edition Highway Design Manual (HDM)**" (Chapter 1000: Bicycle Transportation Design)
- Bridge Design - Final bridge design will be performed in accordance with "**AASHTO LRFD Bridge Design Specifications (8th Edition), "AASHTO LRFD Guide Specification for the Design of Pedestrian Bridges (2nd Edition)", and the Caltrans Amendments (AASHTO-CA BDS-8)**". The latest updated versions of Caltrans bridge design manuals will also be utilized when applicable.
- Seismic Design - Seismic design will be performed in accordance with the Caltrans "**Seismic Design Criteria Version 2.0 April 2019**"and the latest information available from Caltrans Earthquake Research.
- Hydraulic Freeboard -The Caltrans "**Local Program Manual**" requires the bridge soffit to be a minimum of 2' above the 50-year flood elevation, or the flood of record, and that the bridge is capable of conveying the 100-year flood (i.e., no freeboard). A design exception is anticipated to be required for freeboard as this project is located within a floodplain and it is not feasible to raise the profile any higher due to ADA grade constraints.





TYPICAL SECTION WIDTH

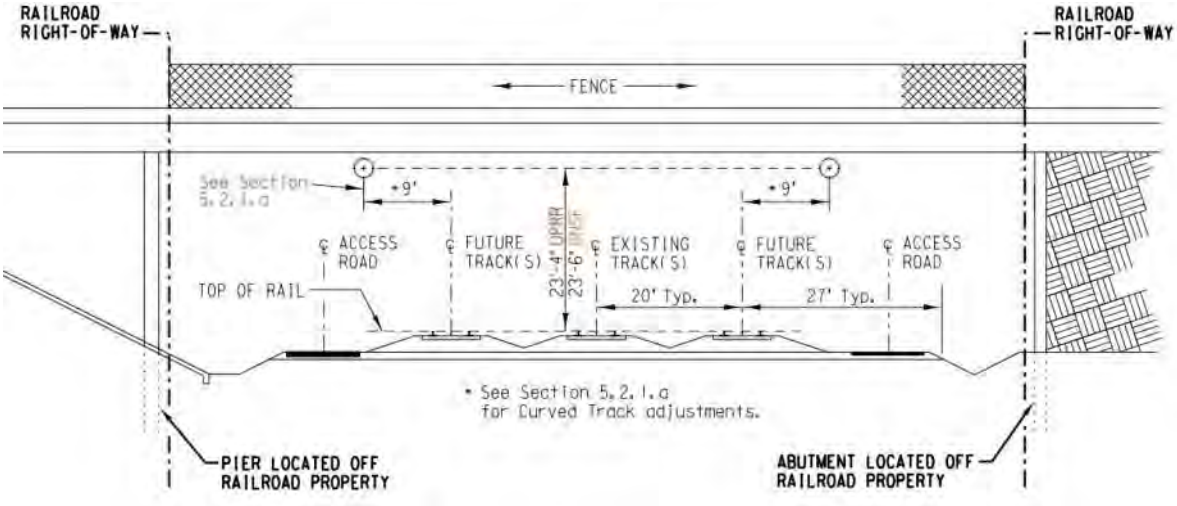
The criteria that govern Class I Bikeway width comes from section 1003.1 of the Caltrans Highway design manual. Class I facilities must be at least 8 feet wide, but the criterion proposes a preferred width of 10 feet. Bikeway shoulders must be a minimum of 2 feet on each side composed of the same pavement material as the bike path (3 feet shoulders are preferred where feasible). The clear width of a bike path on structures is 10 feet between the railing. It is desirable that the clear width of the structures be equal to the minimum clear width of the path plus shoulders.



A clear width of 12 feet (8 feet plus 2 feet shoulders on each side) is proposed. This satisfies the minimum path and shoulder width off the structure and exceeds the 10 feet minimum between rails on structures. A narrower 10 feet width was considered but rejected due to the desire to have some additional "shy" distance between the path and bridge railing. Wider sections we also considered but in discussions with City parks, wider widths can sometimes lead to misuse of the facility. A wider facility would also have higher right of way impacts and have a higher cost. 1 feet wide railings are proposed on each side so the total proposed bridge width is 14 feet.

VERTICAL ALIGNMENT

The vertical profile is constrained by the Americans with Disabilities Act (ADA) grade standards, vertical clearance requirement per the Union Pacific Railroad (UPRR) guidelines for railroad grade separations, the Caltrans Highway Design Manual, and vertical hydraulic clearance requirements over Sycamore Creek. ADA standards limit approaches to a maximum sustained grade of 5% or less. Steeper grades of up to 8.33% are also allowed, however a flat rest landing is required every 30 ft when grades exceed 5%. These relatively low gradients translate into the need for a longer horizontal distance to provide the necessary vertical clearances over various project features. The minimum vertical clearance required per UPRR standards is 23'-4". This location controlled the project profile high point. In addition to the UPRR standards, the bridge soffit must also be above the Caltrans right of way vertical clearance requirements of 18'-6", and the Sycamore Creek high water flows. Each vertical profile was analyzed to sufficiently pass the constraints listed. Structure alternatives consider ways to minimize the structure depth to help mitigate the need for higher profiles with longer horizontal approaches.



HORIZONTAL ALIGNMENT

Considerations of alignment constraints included cost, right of way, visual impacts, structural constraints, short- and long-term loss of Santa Barbara Zoo parking, changes to circulation and/or the Zoo kiosk location, increased development adjacent to the creek, security for the Zoo, necessity for improving the existing zoo access bridge, and creating longer and possibly less user-friendly routes for peds/cyclists.

Since the northern project conform at Canada Street and US101 crossing locations were highly constrained by existing right of way limits, the horizontal alignment alternatives were focused on the south side of the project in order to select the most feasible Sycamore Creek crossing location. In addition to the preferred alignment for the Sycamore Creek frame, two alternative alignments were studied that would not create a new creek crossing and would use the existing bridge at the Santa Barbara Zoo entrance that would be widened.

Since the project would be located within the designated Coastal Zone and adjacent to Sycamore Creek, project alignments were studied for conformance with the City's Coastal Land Use Plan (LUP). Biological Resources policies within the LUP that could be applicable to the project include policies:

- 4.1-6 Allowed Uses in Terrestrial ESHAs
- 4.1-11 Creek Crossings
- 4.1-15 ESHA, Wetland, and Creek Habitat Buffers
- 4.1-17 Development within Habitat Buffers
- 4.1-18 Reduction of ESHA, Wetland, and Creek Habitat Buffers

These policies generally limit development within 50' of the top of bank of Sycamore Creek and limit new creek crossings unless there are no other feasible alternatives and/or certain findings can be made.

The Team looked into the feasibility of three alternatives:

- Alignment 1 – New bridge crossing parallel to Union Pacific Right of Way (preferred alignment)
- Alignment 2 – Use existing bridge crossing at Zoo Entrance (outside 50' creek buffer)
- Alignment 3 – Use existing bridge crossing at Zoo Entrance (within 50' creek buffer)

Alignment 1 (Preferred) – This alignment runs parallel to the UPRR right of way along the north edge of the Zoo parking lot. The design team elected to place the north edge of deck 1'-0" south of the UPRR right of way line for a construction tolerance buffer. While this alignment does result in the need for a new 14 feet wide bridge crossing Sycamore Creek, the other alignment alternatives would require widening of the existing zoo entrance bridge crossing which results in similar Creek impacts. Primary advantages of this alternative are the benefits to both the Zoo parking operations and active transportation users. This alignment keeps users separated from the Zoo parcel and ties in at the ideal location of Dwight Murphy Field.

This alternative also results in the fewest loss of parking places to the Zoo Parcel (5 total) and maximizes Zoo security since the pedestrian path would have no direct access to the Zoo parcel. Since the south UPRR right of way line is located near the north edge of the Zoo parking lot pavement, the structure will need to be located above the existing parking spaces. Structure alternatives were developed to provide enough vertical clearance below the structure to still accommodate parking. The structure alternatives also looked at column placement and span lengths to retain as many parking spaces below the new structure as possible.

Alignment 2 – This Alignment was proposed outside the 50' Creek buffer and would be expected to satisfy LUP policies associated with Sycamore Creek. This comes at great costs both in terms of dollars and impacts to the Zoo parking lot. This alignment requires bisecting the existing parking lot with an elevated retaining wall and bridge structure. Since the alignment must conform to the existing grade by the Zoo entrance it would prevent vehicle traffic flow in the first two southern parking aisles. Limited vertical clearance could be provided for the two northern aisles to maintain circulation, but it would not be feasible to provide standard truck clearance. Reduced vertical clearance is a result of the fact that the profile can only climb at a maximum grade of 8.33% to satisfy ADA requirements. Many Zoo parking spaces would be affected as the current angled one-way parking aisles would need to be converted to two-way which would eliminate the entire southernmost parking row consisting of 11 parking spaces. An additional 6 parking spaces would also be lost in the adjacent rows based on conflict with the alignment itself. This alignment would also require the relocation of the Zoo kiosk and associated structures (walls, trellis). Our Team feels this alignment is not feasible due to increased structure costs, unreasonable impacts to Zoo parking lot circulation and functionality. This alternative would also require modifications and possible widening of the existing Zoo bridge which further increase impacts and cost.

Alignment 3 – This Alignment was proposed within the 50' Creek buffer along the western edge of the Zoo parking lot. This alignment was studied because although it is within the 50' buffer, the area of the alignment has already been developed with asphalt for use of the Zoo parking lot and would also not create a new crossing over Sycamore Creek. The proposed alignment does not represent new development within an existing undeveloped area. The advantage of this alignment is that it would reduce parking lot circulation impacts and would also be less expensive than Alternative 2 due to a shorter bridge structure. Disadvantages of this alternative is that it would require modifications and possible widening of the existing Zoo bridge as the existing pedestrian and bicycle access on the Zoo bridge does not meet current standards. It also results in significant impacts to the Zoo parking and operations relative to the preferred alignment, resulting in a permanent loss of 24 parking spaces versus 5 spaces. Zoo security would need to be maintained with the use of at grade fencing which will diminish the pedestrian experience. Further, because the Zoo gates the parking lot after hours, the parking lot exit would need to be reconfigured to accommodate the new pedestrian path.

US 101 Crossing - In order to reduce the bridge length (and therefore cost) across US 101, the alignment was selected to be perpendicular to the right of way resulting in the shortest path possible. It was best for the alignment to cross US 101 on the far east side of the City owned northern parcel. Crossing on the east side of the parcel was most feasible because it provided additional horizontal distance from the Dwight Murphy Field conform to elevate the profile over the UPRR tracks and still satisfy the ADA maximum grade requirements.

North Approach - On the north approach structure, the same ADA requirements applied. This location was more constrained at the end of the Canada Street cul-de-sac, adjacent to a residential neighborhood. A stacked ramp structure was most feasible to touch down to the original grade within the right of way constraints.

Detailed horizontal and vertical alignments are located in Appendix B.

STRUCTURAL ALTERNATIVES

The bridge will have three distinct frames. The south approach will be called the Sycamore Creek frame and will extend from Dwight Murphy Field west of Sycamore Creek to the 90 degree bend to cross UPRR over the Zoo parking lot. The second frame will be the US 101 frame which will span from the south side of the UPRR right of way to the north side of the Caltrans US 101 right of way. The third frame will be the northern stacked ramp structure. An expansion joint will be necessary between each frame. All girders within each frame have been assumed to be simple span for deadloads and continuous for live loads. In addition to increased structure efficiency associated with continuous live loads, reducing the number of bridge joints is desirable for reduce joint seal maintenance, and less tripping hazards due to eliminating ADA compliant expansion joint cover plates.

Since the geometry and span configuration of both the Sycamore Creek and Stacked Ramp frames are highly constrained (which limit feasible alternatives), the alternatives analysis in this study will focus on the US 101 frame. The main span, crossing over US 101 and the railroad, was considered to have 3 feasible span configurations: a single clear span, a 2-span, and a 3-span configuration. Each of these alternatives result in minor changes to the vertical alignment. Changes in vertical alignment between alternatives are due to changes in structure depth and locations where vertical grade breaks can be incorporated.

Detailed bridge structure advanced planning studies are located in Appendix C.

Sycamore Creek Frame – 7 Span Structure

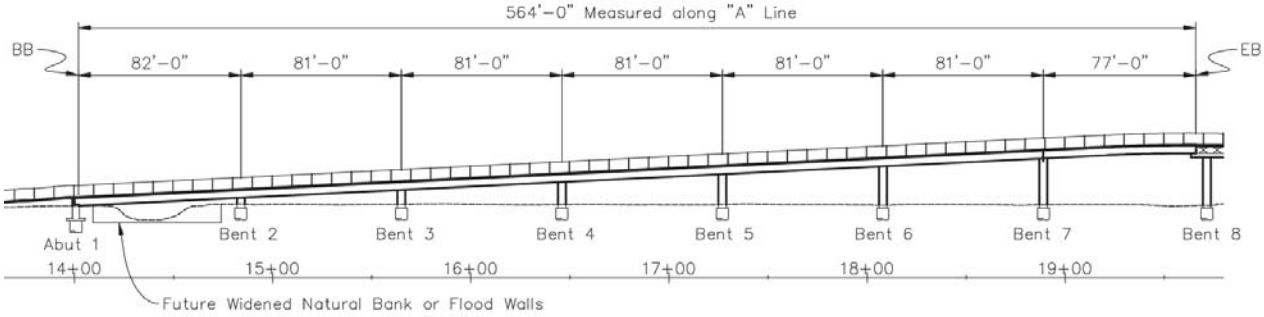
Abutment 1 is located just west of Sycamore Creek within the floodplain but outside the creek channel. It is desirable to elevate the bridge profile as quickly as possible to reduce adverse backwater impacts to the floodplain and maximize clearance under the structure for additional Zoo parking. The vertical profile begins at the conform with Dwight Murphy Field and then climbs as quickly as ADA requirements allow on earthen fill just prior to Abutment 1. 8% grades with 1.5% rest landings every 30 feet are proposed for the earthen bridge approach ramp. Culverts through the fill could also be proposed to improve flow.

The length of span 1 is constrained by hydraulic opening requirements and future flood control projects along Sycamore Creek. The design team met with representatives from Santa Barbara County Flood Control to better understand what work may occur in the future. One study has proposed flood walls on both the west and east banks below the structure. The City Creeks Division is also proposing a widening in the project vicinity but with naturalized creek banks. It is imperative that Abutment 1 and Bent 2 are located outside these limits to allow the flood walls or widened banks to be installed below the bridge later without resulting in future structure conflicts. While the exact limits of the future channel improvements are not yet known, conversations with Santa Barbara County Flood Control staff resulted in concurrence that an 82’-0” span length would be a reasonable assumption for span 1 to avoid conflicts. To best balance structure efficiency and minimize construction costs, similar span lengths were selected for the remaining spans of the Sycamore Creek frame. Cost is lowered if a similar span lengths are selected because precast elements can be mass produced at the same length and depth.

In addition to flood walls, future hydraulic improvements are planned for bridges both upstream and downstream of the project site. The US 101 bridge upstream has been designed for a future flow criteria. Currently Spans 1 and 3 have been blocked off but will have the ability to be opened to convey more flow through the US 101 bridge after future flood control projects come online. There are currently no plans to replace or increase the hydraulic capacity of the UPRR bridge located just upstream of the project, however this structure is nearing the end of its service life so it will be replaced at some point in the future.

There are also plans to increase the hydraulic capacity of several bridges downstream. The design Team set the proposed Sycamore Creek Span 1 length to convey the future planned US 101 hydraulic capacity of 3000 cfs. The proposed pedestrian/bicycle bridge will have a higher soffit elevation and no intermediate piers, relative to the US 101 bridge resulting in better hydraulic performance relative to any of the adjacent structures.

Profile grade breaks (required for ADA rest platforms if the profile exceeds a 5% sustained grade) within a span are less feasible because the precast girders would be fabricated flat without grade breaks. Grade breaks required at the deck level would result in the need of a highly variable deck fillet which would complicate bridge constructability. The best approach would be to place profile grade breaks for rest landings at the support locations so that girders could remain flat. Unfortunately, this would require columns to be located approximately every 30 ft to meet ADA requirements. Adding this many columns would have a significant impact on zoo parking, and therefore was not pursued. Fortunately, a profile just under 5% allows for a constant grade so flat rest landings can be eliminated. This grade requires approximately 660' (85' earthen ramp, 564' Sycamore Frame Shown below, and 11' on the US 101 Frame) from the Dwight Murphy touch down to the required UPRR clearance elevation. Since the conform elevation at Dwight Murphy is set, the ADA max grade and UPRR clearance criteria dictated how far East the US 101 crossing needed to be. Fortunately, this distance fits just within the eastern right of way boundary of the City owned parcel on the north side of US 101.



US 101 Frame – 1, 2, or 3 Span Structure

The railroad with the UPRR right of way creates a constraint for construction methods and materials used for the structure. Per section 5.5 of the UPRR "Guidelines for Railroad and Grade Separation Projects" the *Railroad discourages the use of cast-in-place superstructures and every effort shall be made to utilize a structure type that will not require interruption to Railroad operation during construction. The use of cast-in-place beams is not permitted. The use of stay in place deck forms for falsework between precast concrete beams or steel girders is encouraged.* This requirement eliminates consideration of cast-in-place concrete superstructures over UPRR right of way. Due to these constraints, precast concrete girders or prefabricated steel trusses were considered most feasible structure types. Since the US 101 span is just a continuation of the UPRR span, the same structure types were selected for the US 101 span because it would be undesirable to change structure types for an adjacent span. Regardless of the structure type selected, a UPRR flagman would be required during active construction over or adjacent to the track. This cost must be considered in the overall construction cost.

Construction over Caltrans right of way would require an encroachment permit from Caltrans. Discussions with Caltrans staff has indicated they are open to lane closures during girder or truss erection. Caltrans desires to keep a minimum of two lanes open during the day and one lane open at night. Specific impacts to Caltrans right of way depend on the alternative selected. In general, the clear span has the lowest permanent impact followed by the two span and then the three-span alternative.

US 101 Frame Structure Alternative 1: Single Span

The main span consists of a single ~225' prefabricated steel truss that spans across US 101 and the railroad without intermediate supports. This option would not permanently impact the Caltrans right of way along the highway, or UPRR right of way along the railroad. The railroad clearance requirements control the profile grade of the structure, and this option does not allow for a grade break within the US 101 span. This results in a higher overall profile for the bridge. This alternative may be considered the most aesthetically pleasing, with the most adaptability to the City's design preferences.

It should be noted that utilizing a steel truss relative to concrete structures would result in a higher long term maintenance burden for the City due to painting requirements. Weathering steel which does not require painting was considered to help reduce future maintenance costs, however this treatment is not recommended so close to the corrosive marine atmosphere. Due to the proximity of the ocean, the design team recommends two layers of protection by both galvanizing and painting the structural steel. Painting this structure approximately every 20 years will be costly and also require coordination with Caltrans and UPRR to obtain access for painting over their right of way. This is the single largest drawback to this alternative.

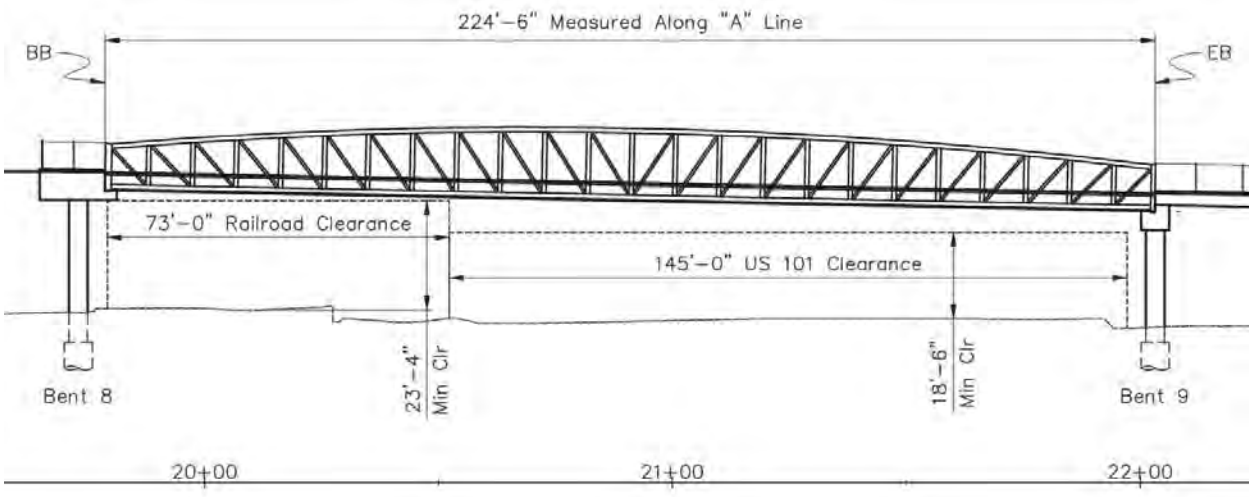
The contractor could choose between two primary erection methods. For the single span truss they could assemble the entire 225 foot truss in the Zoo parking lot parallel to US 101 and then swing it 90 degrees over US 101 into place during a night closure. A second approach would be to utilize one or more splice towers. The first tower could be between the UPRR and Caltrans right of way in the shoulder and the second could be within the NB/SB median. This could allow the truss to be picked in two or more pieces and then spliced together before the temporary towers are removed.

Pros:

- No supports required outside of City right of way
- Reduced number of columns and piles result in lower foundation costs
- Lowest traffic control requirement on US 101 out of all alternatives
- Most aesthetic flexibility
- Reduced schedule due to removal of additional intermediate supports

Cons:

- Maintenance requirements for steel are typically higher than concrete
- Challenging crane lift to place truss elements
- Taller profile to accommodate vertical clearance requirements without main span grade break



US 101 Frame Structure Alternative 2: Two Span Main Crossing

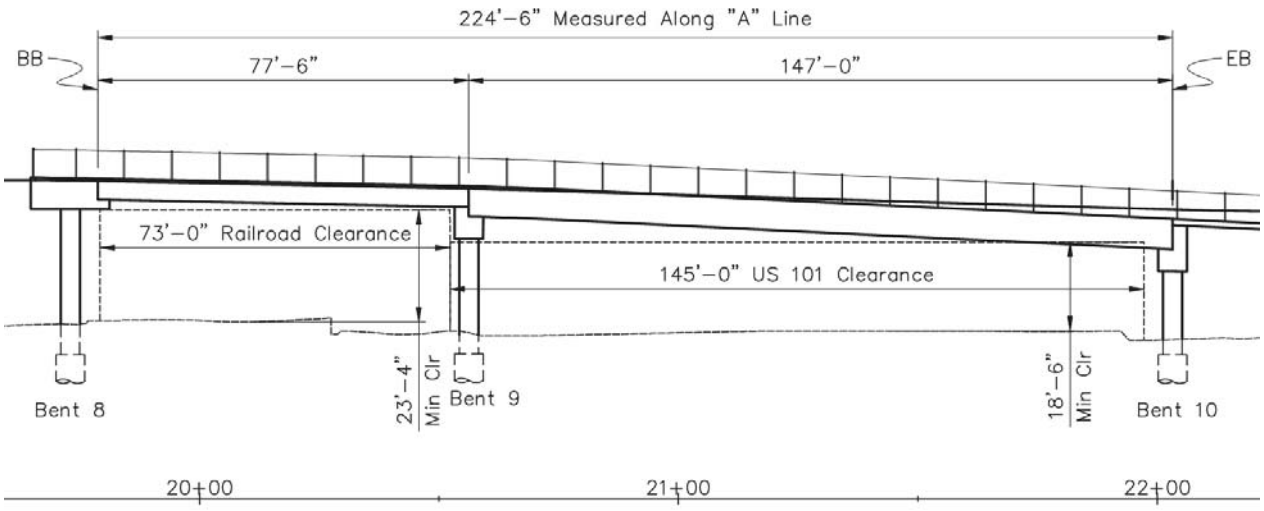
This option consists of 2 spans across US 101 and UPRR. A single-column support would be located outside of the south shoulder of US 101, within Caltrans right of way. The structure could be either a precast concrete girder or a prefabricated steel truss. The design Team recommends precast concrete girders given the lower span length and desire to reduce future maintenance costs. Precast concrete girders would consist of 2 different superstructure elements for each span, one with a 4' depth over UPRR, and one with a 6'-6" depth over US 101. This discontinuous structure is required to meet clearance requirements over UPRR, and span length requirements over US 101 while minimizing the profile of the bridge and associated construction cost. This does result in the least aesthetically pleasing design out the 3 US 101 alternatives due to a variable depth but provides a feasible 2-span configuration with minimal impacts to Caltrans right of way.

Pros:

- Precast concrete girders minimize falsework requirements
- Precast concrete girders minimize maintenance requirements of the structure
- Support column on main span can be located outside of Caltrans shoulder, minimizing impacts to traffic
- Reduced number of supports in comparison to Alternative 3

Cons:

- Aesthetically discontinuous main span
- Required column support in Caltrans right of way
- Required additional bridge joint and cover plate at Bent 9
- Different structural depths and members reduce efficiency of similar precast elements



US 101 Frame Structure Alternative 3: Three Span Main Crossing

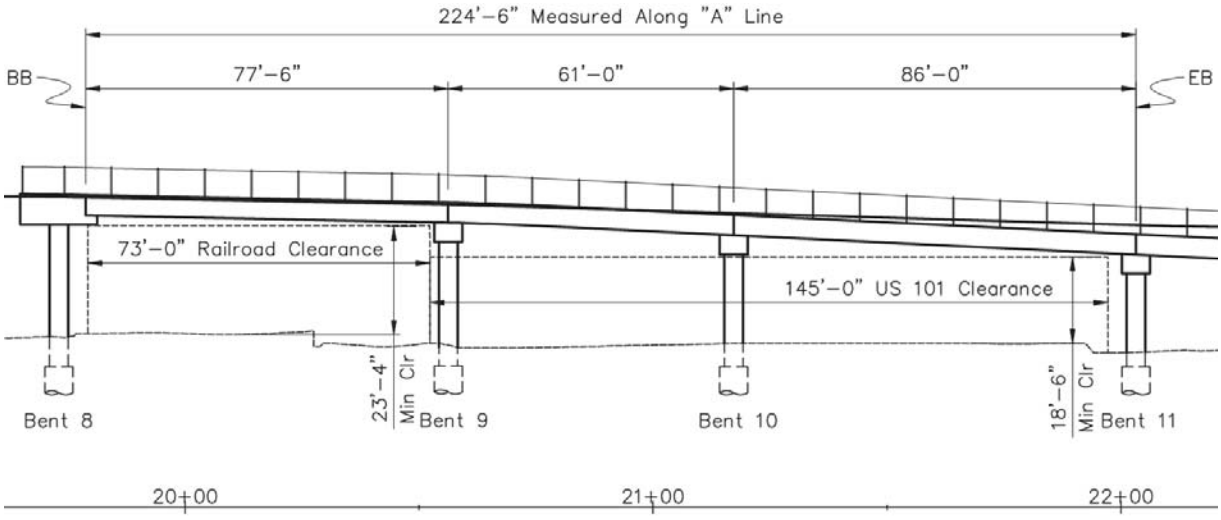
This option consists of 2 intermediate supports along the main span. One of the supports would be located outside of the south shoulder on US 101, with the other support would be located within the median of US 101. The structure depth would be consistent across all three spans, making for a more pleasing aesthetic design. The three-span main crossing would consist of precast concrete girders, continuous across the supports. The structure depth would be 4'-0" on all spans, while the supports would allow for grade breaks across the main structure. Grade breaks allow for the structure to maintain vertical clearance requirements across the UPRR right of way, then break to a lower elevation across US 101. This results in a lower elevation profile across the main span, especially at the northern end of bridge.

Pros:

- Reduced span lengths allow for flexible superstructure design
- Reduced substructure loading from reduced span lengths
- Continuous aesthetic

Cons:

- Additional supports within Caltrans right of way
- Additional foundation construction and supports increase costs



North Stacked Ramp Frame

This structure alternative was driven by right of way constraints and the need for a minimum horizontal alignment footprint while not exceeding the maximum ADA grades. A stacked ramp structure that ramps up/downward with several levels located vertically over the top of each other was the only way to achieve the required grades within the horizontal space constraints of the available parcel. Since the span lengths are relatively short, and there are no schedule or vertical clearance requirements that preclude use of falsework, cast-in-place construction is the most economical structure type at this location.

The City did not want to pursue a "corkscrew" configuration similar to the City US 101 pedestrian/bicycle overcrossing at Anapamu and Walnut Avenue. This configuration was not desired due to limited sight distance, steeper non-compliant ADA grades, and an overall dark/confined feeling.

While the stacked ramp structure is a similar concept it will feel much different than the Anapamu/Walnut structure. The proposed stacked ramp will have more gradual grades with frequent level landings for resting. Given the longer ramps and side by side configuration sight distance will be much improved. Last the vertical clearance between ramps will be at least 10 feet. This will let in much more natural light. A similar structure is shown in the photos below.

A more direct staircase option from ground level to the upper flight was also studied for users that want to reduce their travel distance and time. The Team determined that a staircase option was feasible within the space constraints and is shown as an option on the planning study layout. The Team selected California Code of Regulations Title 8 Section 3231 and ADA chapter 5 for the stair design criteria. Approximately 48 steps assuming a standard 7" rise to 11" run tread pattern along with two required intermediate landings were necessary to elevate facility users approximately 28 feet vertically.

RIGHT OF WAY

The project has the potential to affect three primary right of way owners. The City of Santa Barbara own the majority of the property which includes Dwight Murphy Field, Santa Barbara Zoo, and northern parcel adjacent to the Canada/Pitos Street cul-de-sac. Caltrans owns the US 101 right of way that is approximately 145 feet wide at the proposed crossing. Union Pacific Railroad (UPRR) owns the rail line right of way that is approximately 73 feet wide at the proposed crossing location. Coordination with Santa Barbara County Flood Control will also be necessary for the crossing location over Sycamore Creek.

Right of way is a primary project constraint and greatly influenced project alignments and structure types. After extensive right of way research, it was determined that the northern zoo parcel chain link fence and many of the trees/landscaping are located within the UPRR right of way. The existing UPRR right of way is located just north of the existing asphalt limits. This condition requires that the elevated structure be located further to the south, and entirely over the top of the existing zoo parking lot.

Structure alternatives were developed to avoid any supports within the 73 feet wide UPRR right of way. Depending on the structure alternative selected, there could be zero, one or two column support within the Caltrans right of way. If a clear span is not selected, one column supports is proposed just north of the UPRR right of way but south of the US 101 edge of pavement, and potentially one additional column support could be placed in the median between northbound and southbound traffic. All remaining supports would be within City right of way.

On the north side of the project there is a triangular Caltrans parcel (portion of block 367) that extends into the City right of way on the north side of the soundwall. There is also a 1’ Caltrans sound wall easement. It is anticipated that Caltrans would relinquish this triangular parcel to the City as part of the project. Other than transfer of this parcel, no other permanent right of way takes are anticipated to be required.

See Appendix E for additional Right of Way limits.

UTILITIES

The following utilities are located within the Study Area and may be affected by the project:

Utility	Utility Owner	In Conflict?
Overhead Electric	Southern California Edison	Conflict along southern UPRR right of way and adjacent to the Sunrise RV Park.
Overhead Telecommunications	Frontier/Cox Cable	Conflict along southern UPRR right of way and adjacent to the Sunrise RV Park.
Sewer	City of Santa Barbara	Possible conflict within Zoo parking lot. It may be possible for support to miss the existing line after location of Sewer is confirmed.
Storm Drain	City of Santa Barbara	Possible conflict just north of soundwall to the connection point at the cul-de-sac of Pitos/Canada street.
Reclaimed Water	City of Santa Barbara	Possible conflict near the southern project conform adjacent to Sycamore Creek. It may be possible for support to miss the existing line after location of Sewer is confirmed.

Potholing to positively locate the depths and horizontal limits of the existing underground utilities should be conducted within the next project phase. Relocation of overhead utilities will be required. Adjustments to manholes, valves, and storm drain inlets maybe required depending on structure support locations. The proposed structure could also support utilities, however this may require both a temporary and permanent relocation.

ENVIRONMENTAL STUDIES

The environmental study area generally encompasses the alignment of the proposed project. Environmental Specialists from SWCA used the Study Area as the general boundary for their work. Below is a brief synopsis of the results of the existing conditions and environmental research that have been performed to date.

Prior to conducting on-site survey, SWCA performed a literature and database review to determine which sensitive species have been documented within the vicinity of the project. This included a 5-mile search radius using the California Natural Diversity Database (CNDDB), CNPS Electronic Inventory, and review of environmental documents that have been prepared for others in the general area. SWCA also received an unofficial species list from the United States Fish and Wildlife Service (USFWS), which reaffirmed the CNDDB records and segmented the number of species for consideration.

Existing tree data was collected by the survey team and location and species was verified by SWCA. Because all the landscape trees within the alignment will be removed, with no neighboring trees that would be affected, an analysis of projected damage of the crucial root zone was not necessary.

No protocol-level surveys for wildlife were conducted as part of the survey, nor were any focused botanical surveys conducted. Regardless, it is very unlikely that any of the regional plant species of concern would occur within the project site due to the very urban and disturbed nature of the project area.

A formal aquatic resources delineation was not conducted; however, the boundaries of the state jurisdiction were mapped since the structure would cross over Sycamore Creek and result in the removal of some riparian vegetation. The pier structures are anticipated to be outside of the channel. No permanent impacts would occur below the Ordinary High-Water Mark.

For a more detailed Environmental information see Appendix F. A Preliminary Environmental Study (PES) form has been completed to help scope the studies required for the final design phase.

Plant Species of Concern

The USFWS, CNDDB, and CRPR species lists indicate 14 special-status plant taxa (federally listed, state listed, and/or CRPR List 1B, 2, or 4) as occurring within a 5-mile radius of the project site. An analysis of the range and habitat preferences were conducted to identify which special-status plant species have the potential to occur within the BSA. The analysis considered existing habitat, elevation, results of previous surveys conducted for other projects, and soils within the BSA. As a result, SWCA determined it is unlikely that the BSA supports suitable habitat for any of the 14 special-status plant species.

While no sensitive plant species are expected to occur within the BSA; it is recommended for the purposes of CEQA that a spring focused botanical survey be conducted to ensure the presence/absence determination of sensitive species. Should a focused sensitive botanical survey not be feasible prior to CEQA, appropriate mitigation measures should be included within the environmental document that provide specific measures to conduct a focused botanical survey at a later date and include specific measures to mitigation the impact should one be identified, that cannot be avoided.

Wildlife of Concern

The USFWS, CNDDB species lists indicate 24 special-status wildlife taxa (federally listed and/or state listed) as occurring within a 5-mile radius of the project site. This list of species is considered regional; therefore, an analysis of the range and habitat preferences was conducted to identify which special-status wildlife species have the potential to occur within the BSA. This list is not intended to be inclusive of all nesting

migratory species that may occur in the area, since numerous species of birds with potential for occurrence in the BSA that are protected by the MBTA and CFG Code Sections 3503 and 3503.5.

It is anticipated that the required permits and approvals from CDFW and RWQCB would not allow for construction of the proposed project over Sycamore Creek during the rainy season (October 16 to May 31); however, should there be a significant rainy season which results in water being present within the channel during the months of June 1 to October 15, there is a potential for Southern California steelhead or tidewater goby to occur within the channel. While this is unlikely, the avoidance of any activity below the Ordinary High-Water Mark or along the banks of the channel would result in no effect to these aquatic species. Final project plans would have appropriate measures included to further reduce the potential for any inadvertent impacts from construction of the structure, piers, or abutments.

Nesting birds are anticipated within Sycamore Creek, and along the landscaped trees planted between the Santa Barbara Zoo and UPRR. The proposed project would remove vegetation along the alignment to construct the proposed project. It is recommended that the removal of this vegetation occur outside of the typical nesting season which is recognized as February 1 to September 1. Removal outside of the typical nesting season will reduce the probability of any nesting impacts. However, it is recommended that even tree removal outside of the nesting season should be surveyed by a qualified biologist prior to removal to ensure no late, or early, nesting activities are present.

Lastly, based on the reconnaissance-level survey, eucalyptus within the BSA do not provide sufficient density to provide overwintering habitat for monarch butterfly. This observation was further supported by the absence of any overwintering habitat documented by the Xerces Society, Map of Overwintering Sites (www.westernmonarchcount.org). Therefore, it is anticipated there would be no effect to this species.

Cultural Resources Review

Records from a search of the Central Coast Information Center (CCIC) of the California Historical Resources Information System (CHRIS) included all resource and prior study records within the project area. The records search revealed that 21 prior cultural resources studies overlap with the project area. These include archaeological (survey and Extended Phase I) and historic resource studies. Although none addressed the entirety of the proposed project area, the combined coverage of the 21 studies encompasses 100 percent of the project area. The records search revealed that portions of the site are known to have archaeological sensitivity. The most recent studies included in the records search were associated with various projects at the Santa Barbara Zoological Gardens.

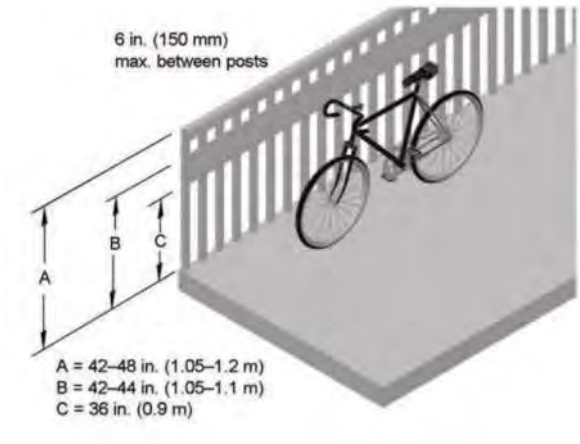
If federal funds are utilized for the project, then the full suite of National Historic Preservation Act Section 106 cultural resources studies would be required for the project. Additional or supplemental studies may be required due to the City's review of the project as it relates to their obligations under the California Environmental Quality Act. For planning purposes, a Historic Property Survey Report (HPSR), Archaeological Survey Report (ASR), and Historic Resources Evaluation Report (HRER) technical studies are anticipated to be required. Extended Phase I study is possible given the number of previously identified cultural resources, but unlikely given that the project area is largely within previously disturbed and developed areas.

Hazardous Materials

An Initial Site Assessment should be conducted to determine if any Recognized Environmental Conditions (REC) were observed at/near the project site. Treated wood waste, naturally occurring asbestos, aerial deposited lead, and other lead based paints are common potential REC that may exist at the site.

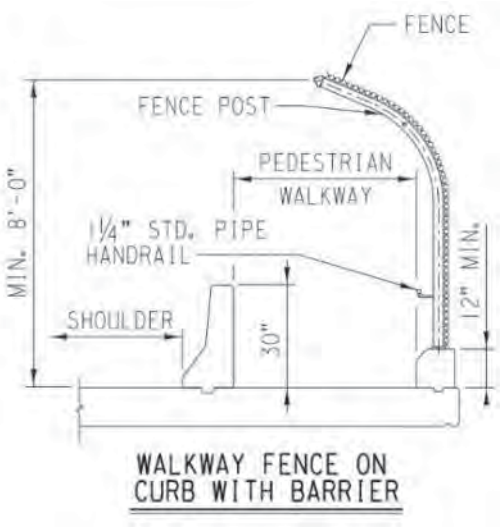
BRIDGE RAILING

Bridge railing can be selected for either functional, cost, or aesthetic considerations. The railing will need to meet minimum height and opening requirements, but the type and potential design should be considered with respect to the City and community preferences.



State law will require a railing at least 42” tall with a minimum opening sized such that the rail would not pass a 6” sphere. AASHTO 2012 guide for the development of Bicycle Facilities (4th edition) also recommends consideration of a 48” tall railing to prevent cyclist from falling over the rail during a crash. A smooth wide rub rail is also recommended at a height between 36” and 44” to reduce the likelihood that a bicyclist’s handlebar will be caught by the railing.

The rail mesh or pickets should also be designed to be climb resistant. UPRR will also have more stringent requirements over their right of way. UPRR requires a minimum 1’ tall solid concrete parapet with a rail that is a minimum of 8’ tall with a curved top to resist climbing and the ability to throw objects onto the railway. UPRR would also consider a vertical rail that is not curved but that rail must be a minimum of 10’ tall. The rail is a good place to incorporate aesthetic features. If a through truss is selected as the preferred alternative, pickets or mesh can be attached to the inside of the truss itself.



AESTHETIC REQUIREMENTS

The aesthetics of an overcrossing over US 101 and UPRR are a primary consideration, but functionality and cost will also be a priority to help best serve the community. The preferred alternative will incorporate aesthetic considerations to tie the design into the natural beauty of Santa Barbara. The design Team has already prepared renderings for the City to review which can be presented at public meetings. This allows the community to visualize the overall project and associated aesthetic features.

Artistic custom panel patterns are feasible on the fencing, however in order to meet union pacific railroad standards, the backside would need to be covered with a metal or coated metal mesh that does not allow for an opening greater than 2". It's also important to note that truss members like the one shown below would be present so aesthetics must also consider accommodation of these members. Typically, mesh or aesthetic panels are mounted to the inside of the truss members.

STORMWATER QUALITY

The project will create new impervious surfaces. This will primarily be the limited to the new elevated bridge deck itself. While this area will be relatively small (and located primarily above existing impermeable surfaces thereby reducing surface water on the parcels below), the project will still be subject to the City's post construction stormwater requirements as outlined in the Stormwater BMP Technical Guidance Manual (Dated 2020).

In general, the project will be designed with the minimum footprint required to meet the goals of the project. In addition, where possible, natural areas and flow paths will be maintained or restored, and soil disturbance and compaction will be limited to areas where improvements are proposed.

The high point of the project profile is located just south of the UPRR right of way (approx. Station 19+60). Therefore, stormwater would flow southwest toward Murphy Field (new impervious surface approx. 9,300 sqft) and to the north toward the stacked ramp structure (new impervious surface approx. 11,000 sqft) from that high point location. The total new impervious surface on the entire project is anticipated to be less than 0.5 acres.

Drainage or treatment within Caltrans or UPRR right of way will not be feasible. The design Team has identified two possible City owned right of way areas with adequate room where stormwater treatment measure could occur (see highlighted in yellow below). Water could run along the bridge deck curb or be collected with deck drains and piped just west of Sycamore Creek south of abutment 1. To the north water could be piped toward the stacked ramp structure and then down a column to be treated just west of the Sunrise RV Park. After treatment, stormwater could be discharged into the existing storm drain to the north or Sycamore Creek to the south.

The proposed stormwater basin location shown on the south does have the potential to conflict with existing underground utilities. This area may also be necessary for trucks to access the existing reclaimed water valves at this location. These potential conflicts will require further evaluation during final design.

GEOTECHNICAL/FOUNDATIONS

Yeh and Associates Inc. (Yeh) analyzed previous field exploration programs conducted by Caltrans in the vicinity of the project site for the replacement of the US 101 Sycamore Creek Bridge, and the design of the existing Soundwalls No. 1 and No.2 that run along the northbound lane of US 101.

Previous explorations by Caltrans include: 43.5’ boring at Sycamore Creek Bridge performed in 1944, (4) 24.5’-26.0’ deep auger borings performed in 2004 for Soundwalls No. 1 and No. 2, and (4) 82.5’–90’ deep mud rotary borings performed by Caltrans in 2005 for the replacement of the Sycamore Creek Bridge.

Geotechnical Conditions

The project site is located within the Transverse Ranges geomorphic province and lies within an alluvial plane bordered by the Santa Ynez Mountains to the north, and the Pacific Ocean to the south. The topography in the site vicinity is relatively flat with a grade typically between 0% and 3%. The flat surface is generally underlain by units of alluvium and colluvium, intermediate alluvial deposits, and older alluvium.

Groundwater

Groundwater levels and soil moisture conditions will vary seasonally and in association with changes in precipitation, runoff, irrigation, pumping and other factors. Groundwater data is based on the borings conducted in May 2004 and had a depth to groundwater from the ground surface elevation between 6.3 feet and 13.0 feet. It should be noted that 3 out of 8 borings did not encounter groundwater. These borings were with regards to the US 101 bridge replacement and soundwalls, so are located within the project vicinity, but not within the structural limits. Due to this, groundwater variation within the project site should be expected.

Corrosion

Nine soil samples and one water sample were taken for corrosion testing from the Caltrans borings for the US 101 Sycamore Creek Bridge Replacement. Results for pH, resistivity, sulfates, and chlorides indicated that the soils are considered non-corrosive based on Caltrans standards. In addition to soil, the air also has the potential to be corrosive due to the marine environment. Caltrans defines a marine environment as a structure located within 1000 feet of the ocean or tidal waters. This structure is located approximately 1300 feet from the ocean making it very close but just outside the marine environment zone. This means that special corrosion considerations such as increased concrete cover, epoxy coated reinforcement,

polyester concrete deck overlay and design of reinforcement with a reduced concrete exposure factor are not applicable to this structure. The code does allow for some engineering judgement to incorporate some of these features if adjacent structures are having corrosion issues.

Preliminary Foundation Considerations

Foundation alternatives studied for the proposed structures included spread footings, driven piles, cast-in-steel-shell (CISS) piles, and cast-in-drilled-hole (CIDH) piles. Various factors are considered in the type-selection of foundation elements. These factors include:

- Relatively shallow groundwater and alluvium composed of interbedded layers of loose to medium dense sand and very soft to stiff silt and clay.
- Potentially liquefiable layers of sand under the design earthquake.
- Scour potential at Sycamore Creek will need to be considered for adjacent supports.
- Space constraints due to adjacent UPRR right of way, Zoo parking spaces, Sycamore Creek future channel improvements, Caltrans right of way, and the existing soundwalls.
- Overhead and underground utilities.
- Soil and groundwater have the potential to be contaminated due to proximity to railroad corridor.

Spread footings were considered and would likely bear within 5 to 8 feet of existing site grades. Design of spread footings would consider bearing resistance, settlement, potential scour, footprint conflicts, and potential liquefaction. Although feasible, spread footings were not considered to be the preferred option. The design and construction would be relatively complex and includes risks for unanticipated costs associated with the compressibility and liquefaction potential of the support soil. The biggest disadvantage is the relatively large foundation footprint which would have the most impacts to the existing developed infrastructure.

Driven piles would typically consist of Caltrans standard plan steel pipe, square precast concrete piles, or steel H-piles. Class 400 driven concrete piles were used for the support of soundwall No. 1 as well as the wingwalls for Sycamore Creek bridge. A pile footing cap would be able to be constructed at or above the groundwater level, possibly presenting fewer construction challenges than a drilled deep foundation option. They wouldn't require slurry or cutting disposal and could develop scour and liquefaction resistance. They will however require a larger construction footprint relative to CIDH piles and will generate pile driving noise during construction. For environmental purposes, driving may not be permitted close to Sycamore Creek due to sensitive aquatic life.

CISS piles would consist of driving a steel pipe pile into the ground and casting reinforced concrete into the head of the pile to form a structural connection with the superstructure. These piles can be specified with a larger diameter that can help develop resistance at shallower depths compared to driven piles. Additionally, they can help resist lateral loads, along with scour and liquefaction related effects, if further analysis determines that this is necessary. This would, however, include soil disposal, pile driving with associated noise and unknowns near the creek, delays if splices are required, and may need to be installed with a group of driven piles to help support structure loads above standard pile capacity. CISS piles were used for the previously installed Sycamore Creek Bridge on US 101 and would need to consider additional down drag and potential lateral forces associated with seismic settlement and liquefaction.

CIDH piles typically consist of a reinforced concrete pile cast in a drilled hole. CIDH piles would need to develop frictional resistance within the older alluvium below elevation -25 feet. Loose, wet alluvium would require wet installation method (slurry-displacement) and/or a temporary casing. CIDH piles can be constructed with larger diameters, requiring only a single pile per support. They would not require a pile

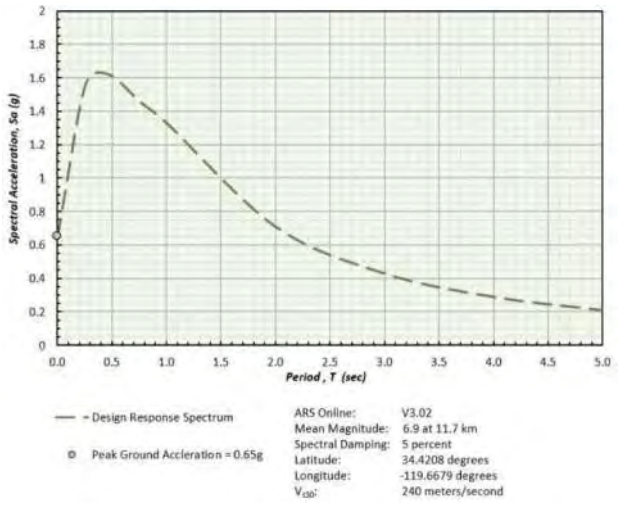
cap, which greatly reduces the overall footprint and impacts to the surrounding area. Without pile driving activities, noise limitations near Sycamore Creek and the surrounding neighborhoods would also not be a concern. They can be designed to provide resistance to scour and liquefaction related effects, making them well suited for this type of construction. Post-construction inspection and nondestructive testing required per the wet-spec method could identify anomalies and cause delays in construction. Additionally, this method would require tanks for slurry and spoils, along with potential special disposal requirements if the soil and groundwater are contaminated.

The preferred foundation type for design should be a deep foundation, bearing on the dense older alluvium deeper below the ground surface. The design Team has preliminarily selected 6 feet diameter CIDH piles for the feasibility study. Large diameters were chosen because they have the smallest permanent footprint. Cast in Drilled hole methods are preferred because they do not require pile driving adjacent to sensitive noise receptors and sensitive aquatic species. Last the team selected a Caltrans Type II shaft which are 2' diameter larger than the proposed 4' diameter columns. Type II shafts are seismically preferred and are better at resisting liquefaction and lateral spreading loads.

See Appendix H for additional Geotechnical information.

SEISMIC LOADING

Preliminary seismic data for the project was estimated using Caltrans' ARS Online application and guidelines set forth in Appendix B of the Caltrans Seismic Design Criteria (SDC). The design earthquake is estimated to have a mean magnitude of 6.9 with a mean site to source distance of approximately 7.3 miles. Subsurface data from the 2004 Caltrans borings for the adjacent Sycamore Creek Bridge Replacement was used in the determination of soil classification in accordance with the SDC. The site is classified as a Site Class D, stiff soil site, with a shear wave velocity of 780 feet per second. Yeh prepared Acceleration Response Spectrum for the Design Evaluation Earthquake (975-year return period, Design Earthquake).



The controlling design response spectrum is based on the probabilistic spectrum. The estimated peak ground acceleration for the bridge site is 0.65g.

Surface Fault Rupture

The closest Quaternary-age fault to the site is the Mission Ridge Fault system, approximately 0.4 miles northeast of the project site, with additional faults such as the Mesa Fault, Lavigia Fault Zone, Red Mountain Fault Zone, Ortega Hill Fault, and Santa Ynez Fault Zone occurring between 1.5 and 5.5 miles from the project site. The project site is not within an Alquist-Priolo Earthquake Fault Zone. No know active or potentially active faults are mapped though the site. Therefore, no special design considerations are needed to address fault rupture.

Liquefaction Potential

Liquefaction is the loss of soil strength due to an increase in soil pore water pressure due to seismic ground shaking. This typically occurs in loose to medium dense granular soil that is below the water table. Soil layers, based on the 2004 Caltrans borings for the Sycamore Creek Bridge, were preliminarily estimated to

be liquefiable. An evaluation of liquefaction potential would be needed to assess the impact of potentially liquefiable soils within the project footprint. Special recommendations would be needed for final design to address liquefaction or seismic related hazards for a potential structure and supports.

HYDRAULICS

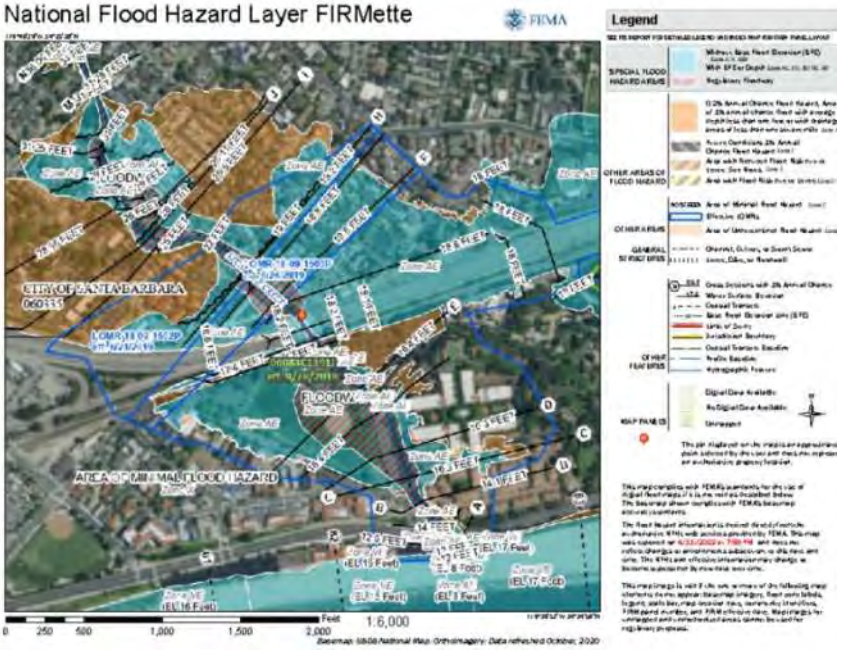
Based on the preliminary results of the hydraulics model, the proposed overcrossing structure will result in negligible impacts to the existing floodplain water surface elevation (WSE). Further analysis will be needed during the final design of this Project, and coordination with a floodplain administrator will be required to corroborate any potential floodplain impacts. The proposed structure has a wider opening and will provide more freeboard than the surrounding structures at the UPRR track and the US 101 bridge even after the future span 1 and 3 flood bays are opened. This proposed structure is not anticipated to reduce the target conveyance flow of 3,000 cfs in the channel. The proposed Project will be designed to convey the target discharge of 3,000 cfs and is anticipated to maintain the goals of the Master Plan for Sycamore Creek. Additional hydraulic sections and a 2-dimensional hydraulic model are recommended for the final design phase in order to determine accurate flow paths around the proposed structure.

Hydrology

HDR obtained flows from the following sources: FEMA Flood Insurance Study (FIS), South Coast Watershed Map (1975), and FEMA LOMR (2019). HDR selected the FEMA LOMR for the design flows (3,306 cfs 100 year, 2,942 cfs 50 year) but also considered a 3,000 cfs flow from the Master Plan and the Sycamore Creek Project Study Report prepared by Bengal in 2018. A flow of 3,000 cfs equates to a storm of approximately 55 years.

Water Surface Elevation and Freeboard

The project is located within a floodplain. The goals of the proposed bridge were to have negligible impacts on the existing creek hydraulics and to provide increased freeboard and hydraulic capacity relative to adjacent structures. The proposed bridge will have no freeboard for the 100 year storm, and provide just over 1’ of freeboard over the 50 year storm. A design exception for standard freeboard may be required since 2’ is the common standard over the 50 year storm. It was not feasible to provide 2’ of freeboard over a 50 year storm due to how close the existing grade conform is relative to the beginning of the bridge. ADA grade requirements prevented raising the profile rapidly to achieve 2’. If the conform elevation was pushed further from the creek it could be possible to provide standard freeboard over the 50 year storm, however very few bridges along Sycamore Creek meet that standard given the elevation of the adjacent ground and the capacity of Sycamore Creek.



Source: FEMA, 2018

Channel Scour and Slope Protection

The Abutment 1 and Bent 2 supports will be constructed adjacent to Sycamore Creek. Rock slope protection is recommended to protect these locations. Potential scour/slope protection will need to consider future improvements, such as flood walls, to widen the channel. A scour analysis was not conducted for this study and will need to be evaluated during a future design phase.

Sea Level Rise

The State of California Sea-Level Rise Guidance, 2018 (California Coastal Commission, 2018) can be used to determine Sea-Level Rise at the project site. Assuming a 75 year structure service life, and a 2025 construction season a projection year of 2100 was selected. Published water surface elevation guidance is probability-based ranging from Likely (66% probability to meet or exceed) to High Risk Aversion (0.5% probability to meet or exceed). Projections are further broken down by assumed future Low Emissions vs. future High Emissions. Assuming high future emissions, Sea Level rise could range between 3.1 and 6.6 feet with the probabilities outlined above. Further evaluation of Sea level Rise is recommended for the future project. Current studies to date have not included Sea Level Rise.

Tsunami Risk

Tsunamis are formed during seismic events or submarine landslides. they behave like a fast-moving tide and can result in run-ups extending great distances up streams, rivers and creeks. The site location for the overcrossing is located approximately 12-17 feet above sea level, and 0.3 miles north of the Pacific Ocean shoreline. Based on the AASHTO 2022 guide spec for Bridges Subjected to Tsunami Effect, and the Natural Hazards Risk and Resiliency Research Center Tsunami Inundation Portal (NHR3 2022), the proposed

overcrossing is not within the estimated tsunami design zone (for a 1000 year return period). It is possible that the westerly portions of the path south of US101 may need to consider tsunami hazards for design. See Appendix G for more hydraulic information.

OTHER PROJECT CONSTRAINTS

For a full list or project constraints see the constraints map exhibit located in Appendix A. In addition to some of the constraints listed above there are a few other specific issues worth mentioning that must be resolved during the final design.

NB US 101 Overhead sign

The proposed pedestrian/bicycle overcrossing will cross US 101 just prior to the NB US 101 Exit 96A sign. The pedestrian/bicycle overcrossing will obscure vision of this sign so the existing sign structure will need to be relocated. The sign could be relocated further east or west. The sign could also be also be mounted on the new pedestrian/bicycle structure, however both Caltrans and the City preferred that the sign remin on an independent sign structure. Relocation of the sign will also require reconfiguration of the existing concrete barrier and guardrail attachment which deflect vehciles away from the fixed sign structure base.

Soundwall Hydraulic Openings

The existing soundwall located north of US 101 has multiple openings at the base that can be opened if necessary to convey floodwaters. The existing project site is located in a floodplain so during higher flows the soundwall could act as a barrier and cause additional backwater effects. While most of the pedestrian/bicycle structure will be elevated with very little impact to existing flows there will be a portion of the stacked ramp structure that runs parallel to the soundwall shown to the left. The current planning study shows fill at this location since fill would be less expensive then keeping the structure elevated until conform. If fill is used then culverts would need to be placed though the fill what line up with the floodwall openings in order not restrict any flows. It could be more beneficial to just keep the north stacked structure elevated until the conform so flows could occur under the stacked ramps and through the soundwall openings.

Zoo Parking Lot Impacts

The project will result in both temporary and permanent impacts to the zoo parking lot. It has been determined that the UPRR right of way line is not located along the chain link fence shown to the right. The right of way line is located very near the asphalt limits (or just below the front of the car bumpers shown to the right). This means that the northern edge of deck can't extend into the planter stripe between the chain link fence and the parking spaces and that the proposed structure must be located entirely above the existing parking lot. These parking spaces will not be able to be utilized during the construction duration. Precast girder construction is proposed to reduce construction time and partially mitigate for the temporary parking loss.

The proposed locations of the support columns would result in the permanent loss of a parking place below them. Currently there are 6 columns that are necessary in the parking lot. There could also be some vertical clearance issues from the structure itself along the west end of the parking lot. The bridge profile is climbing as quickly as possible, however as discussed in many sections above the project is limited to the maximum grade of 5%. This does not allow the profile to climb enough to provide for adequate room below the structure for parking along the west end. In order to limit the loss of parking, the design team is proposing eliminating some of the existing intermediate planters between spaces and use that room for columns. Due to heavy equipment required for foundation installation much of the northern parking area asphalt could be damaged during construction. It is proposed to repave and restripe the northern parking area as part of the project. In total the design Team estimates the temporary loss of 56 parking spaces during construction, and 5 permanent parking spaces due to column support and western parking lot vertical clearance issues (See Appendix B for a parking lot exhibit). All trees between the fence and parking area must also be removed to allow room for the new bridge structure. The overhead utilities will also need to be relocated. Growth of the existing vegetation or future vegetation within UPRR right of way between the fence and parking lot may also be limited by additional shade from the pedestrian/bicycle structure.

Santa Barbara Green Mobile Home Park

Located at 1200 Punta Gorda Steet the Santa Barbara Green Mobile Home Park has the potential to be affected by the project. Typical circulation though the park is one way from Punta Gorda Street to the exit near the proposed location of the stacked ramp structure along the Cul-De-Sac from South Canada and Los Pitos Streets. The stacked ramp structure is current proposed to encroach within the existing pavement in order to provide a more gradual ramp grade. After City coordination with the fire department, they require a minimum of 20' for ingress and egress. A width of 21 feet is proposed, however that would require removal of several trees and realignment of the existing driveway along the existing fence line. If these encroachments are deemed to be unfeasible, the ramp structure grades could be increased to provide for less encroachment into the existing pavement. Further coordination is necessary to determine if temporary closures could be accommodated during construction. A temporary closure of this driveway is recommended based on safety concerns. Large cranes and other equipment will be necessary to construct the stacked ramp structure.

Sunrise RV Park

Impacts to the Sunrise RV Park are anticipated to be minimal and limited to temporary construction noise and perhaps some fencing along the existing right of way line. Overhead utilities would also need to be relocated at this location as they currently interfere with the proposed crossing location.

PROJECT COST ESTIMATES

The design Team has developed three different project estimates.

The first estimate is an alternative cost comparison. Only bid items and quantities that are different between alternatives are located in this estimate. Like items and quantities have been omitted. This estimate should only be used to compare the difference in price between the various alternatives.

The second estimate is the total construction cost for the preferred alternative. The design Team elected to prepare the construction cost for the single span truss alternative. All bid items necessary for construction are included in this estimate. Items may be added or subtracted in the future once more project studies are completed, however this list shows all the anticipated bid items to date.

The third estimate is a total project cost estimate. This estimate includes estimated design, City management, construction, construction engineering, contingency, and escalation to future design and construction years. This estimate can be used to program the entire project cost and secure future grant funding. Total project costs are summarized below. Detailed estimates are located in Appendix D.

Design Cost	$2,536,000
City Management Cost	$253,000
Construction Cost	$15,500,000
Construction Engineering	$2,325,000
Construction Contingency (20%)	$3,100,000
Escalation to 2030 (5%/yr)	$8,805,000
Total	**$32,519,000**

CONCLUSIONS

All structure alternatives were studies and are considered feasible. In general, the structure cost estimates show that there is only a marginal difference between the alternatives when compared to the total project cost. While the single clear span truss has a higher superstructure cost, the multi span alternatives are offset by higher foundation costs. The multi span alternatives also have more impacts within the Caltrans right of way represented with higher traffic control cost and cost for Temporary Railing Type K that would be necessary to provide a safe work zone to construct new bridge foundations.

Out of the three alternatives, the single span prefabricated steel truss alternative should be considered the preferred option. This prevents the need for the supporting structure within Caltrans right-of-way and simplifies the construction of the main span. A steel prefabricated truss could be manufactured offsite and assembled adjacent to the structure alignment. This could then be placed using multiple cranes during a single night closure of US 101. This alternative has the greatest aesthetic flexibility and minimizes the impact to US 101 and right of way impacts.