Attachment 1

City of Mountain View
North Bayshore Circulation Feasibility Study

Evaluation of Alternatives and Feasibility Report

May 25, 2021

Submitted by:

BkF ENGINEERS SURVEYORS PLANNERS
100+ YEARS

In association with:

TJKM

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1. PURPOSE AND BACKGROUND

1.1 Purpose

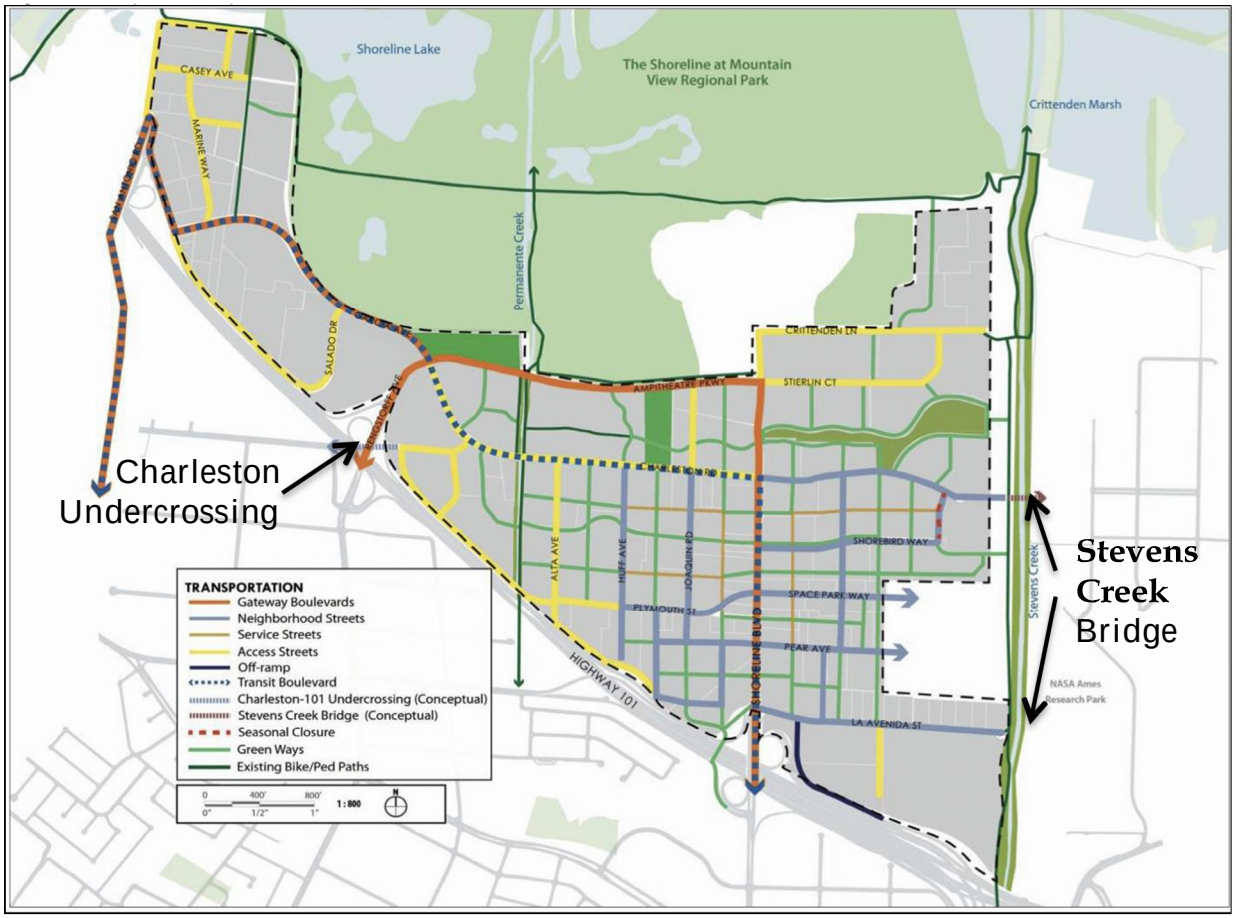
The purpose of the North Bayshore Circulation Feasibility Study is to review the options for gateway improvements at three locations in the North Bayshore area of the City of Mountain View and identify the feasibility for the various alternatives for each location. The study includes comparison of design characteristics and evaluation of screening criteria.

1.2 Background

The North Bayshore Precise Plan (2014 and amended 2017) envisions commercial and residential growth in North Bayshore while minimizing additional vehicles to the three gateway corridors.

The 2017 North Bayshore Precise Plan includes several priority transportation projects and strategies that would potentially augment the improvements embedded in the original 2014 North Bayshore Precise Plan. These projects include studies of potential gateway improvements (i.e., a new bridge over Stevens Creek and a Charleston Road connection under U.S. 101), see Figure 1.

Figure 1: North Bayshore Precise Plan Transportation Plan



2. ALTERNATIVES DESCRIPTION

The project team evaluated the potential gateway improvements in terms of feasibility, benefits of added capacity and mode shift, cost and constructability, and other significant issues. The gateway project locations include:

2.1 Charleston Undercrossing at US 101 (Location 1)

This improvement would potentially add a new gateway by constructing a new roadway under U.S. 101 connecting to Charleston Road on the west and Landings Drive on the east. The roadway would have sidewalks and bike lanes. The facility could be operated as regular lanes, reversible lanes, high-occupancy vehicle lanes or transit-only lanes. The purpose would be to add gateway capacity and promote mode shift. Two alternatives, two-lane and four-lane were explored as shown in Figure 2.

2.2 Stevens Creek Bridge (Locations 2 and 3)

This improvement is envisioned as a transit, pedestrian, and bicycle facility that would connect North Bayshore and NASA/Ames with a bridge over Stevens Creek. The bridge would add a new connection to the Stevens Creek Trail and provide a connection to North Bayshore for cyclists using the Moffett Boulevard corridor and the planned Manila Drive path. It could also facilitate a future transit connection to the NASA/Bayshore light rail station. Three concept alternatives were explored at each of the following locations:

- Charleston Road (Location 2) - An extension of Charleston Road connecting to a location just south of the Google Bayview campus, near R. T. Jones Road on the NASA/Ames campus. The concept alternatives prepared for this location are included in *Figure 3* and *Attachment A*.
- La Avenida Street (Location 3) - A connection in the vicinity of La Avenida Street that would pass through the property owned by the United States Army on the NASA/Ames side. The alternatives prepared for this location are included in *Figure 4* and *Attachment A*.

Figure 2: Charleston Underpass at US 101 Alternatives

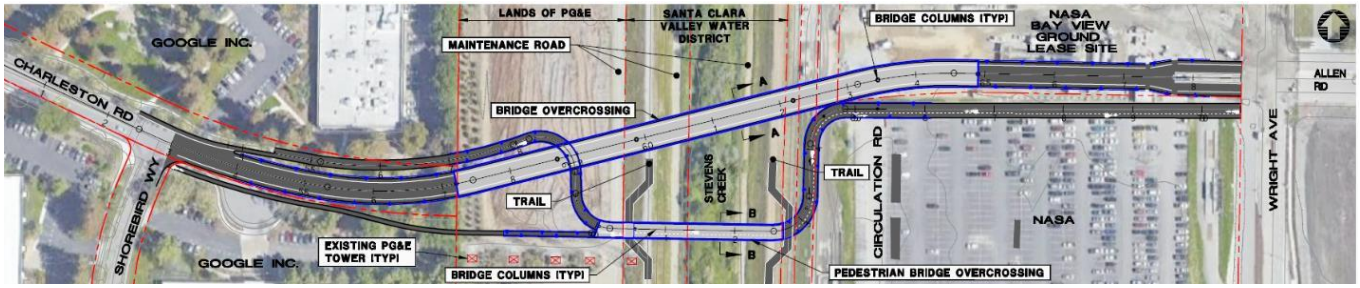
Alternative 1A: Undercrossing with Four Lane Alternative

Alternative 1B: Undercrossing with Two-Lane Alternative

Figure 3: Charleston Road at Stevens Creek Bridge (Location 2)

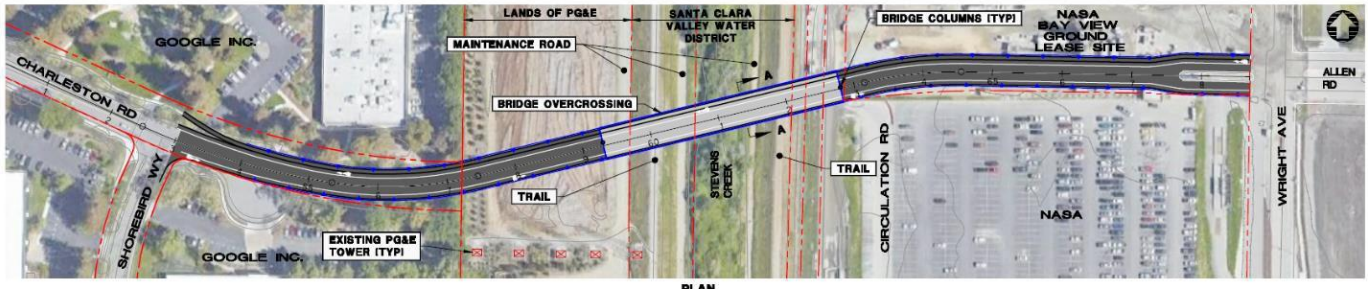
Alternative 2A: Separate Transit and Bike/Pedestrian Bridges

(Pedestrian/Bicycle Bridge Direct Connection to Trail)



Alternative 2B: High-Level, Clear-Span Combined Bridge

(Indirect Connection to Trail)



Alternative 2C: Lower-Level Combined Bridge

(At-Grade Crossing of Trail)

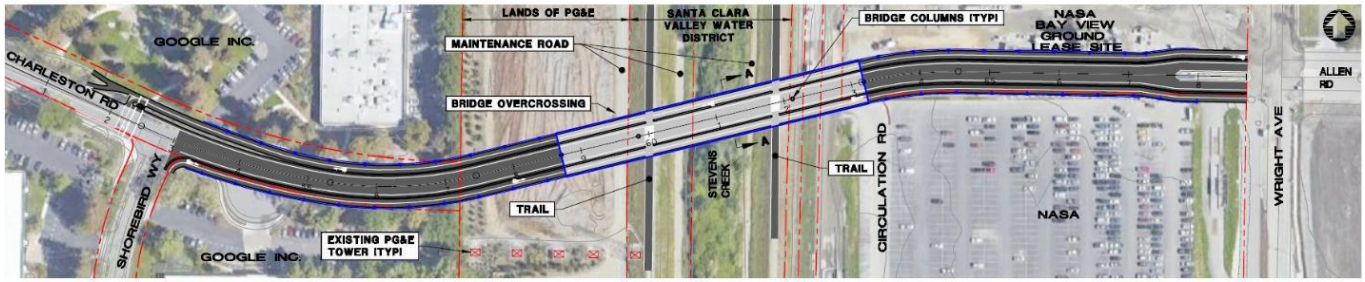


Figure 4: La Avenida Street at Stevens Creek at Bridge (Location 3)

Alternative 3A: Separate Transit and Bike/Pedestrian Bridges

(Pedestrian/Bicycle Bridge Direct Connection to Trail)

Alternative 3B: High-Level, Clear-Span Combined Bridge

(Indirect Connection to Trail)

Alternative 3C: Lower-Level Combined Bridge

(At-Grade Crossing of Trail)

3. EVALUATION PROCESS

3.1 Screening Process

The process of selecting a feasible alternative for design and construction begins with a series of screening activities that define and evaluate each alternative. These activities include the 6 steps identified below:

1. Establish overall goals for the project study locations
2. Establish screening criteria for evaluating conceptual alternatives
3. Establish roadway design criteria for preparing alternatives
4. Develop conceptual alternatives, up to 3 alternatives per location
5. Review with stakeholders and agencies
6. Evaluate conceptual alternatives against established screening criteria

The following is a summary of the process for each of the 6 steps identified above, and describes the overall goals, screening criteria and roadway design criteria as part of the first 3 steps.

Step 1 - Establish Project Goals

Well defined goals are required to define the purpose of the project and to develop the screening criteria for the Project. All of the proposed alternatives need to meet all of the goals for the project. These goals are consistent with the City's North Bayshore Precise Plan:

- Goal 1: To provide an alternative gateway into the North Bayshore area, consisting of a direct east west connection across Highway 101 or Stevens Creek.
- Goal 2: Help achieve modal goals for trips into and out of the North Bayshore area.
- Goal 3: Ensure that any new corridor meets complete street criteria and adheres to the design standards from the City of Mountain View, Caltrans and the Americans with Disabilities Act (ADA).
- Goal 4: Ensure compatibility with its surroundings. The alternatives should seek to minimize negative impacts on the environment, private property, neighborhoods and businesses and be compatible with future development goals of the North Bayshore area.

Step 2 - Establish Screening Criteria

The screening criteria were based on the overall project goals and include both quantitative and qualitative measures. Each criterion described below was given a weighted score to reflect the relative importance of each category. Each concept alternative was graded against these criteria.

- *Traffic Circulation* – The North Bayshore area in Mountain View has relatively high traffic volumes and the proposed alternatives were evaluated for impact to the existing and proposed traffic conditions in the area. Potential for additional person trip capability, including transit, auto, bicycle and pedestrian trips, mode shift and circulation analysis was evaluated.
- *Construction* – The constructability of each alternative was evaluated, which included

identification of construction method and potential roadway closures/detours. Lesser impacts to the surrounding areas indicate better constructability.

- *Environmental Impact* – A preliminary assessment of potential environmental impacts was conducted for each alternative. No technical investigations were performed at this stage. Potential environmental factors were identified and ability to mitigate each environmental impact was approximated.
- *Stakeholder Coordination* – The City and consultant team met with the major stakeholders for the project to identify stakeholder goals and concerns.
- *Right of Way and Utility Impacts* –Right of way impacts to neighboring properties and impacts to existing utilities/facilities were evaluated.
- *Cost* –A preliminary order of magnitude cost estimate was prepared for each alternative, which included construction, right of way, and utility relocation.
- *Schedule* – Design, construction methods, permitting and coordination will determine the duration of the project from initiation through construction. Complex projects with larger impacts and more coordination will prolong the schedule of a project. An order of magnitude construction duration was provided for each alternative.

Step 3 - Establish Design Criteria

An established basic design criterion has been applied to the geometric design for all concept alternatives. These criteria have been established to direct the alternatives toward the vision the City has for these gateway improvements and meet the goals of the project. See *Attachment F* for Design Criteria.

Step 4 - Develop Conceptual Alternatives

Preliminary engineering was conducted to develop up to three concept alternatives for each Stevens Creek Crossing location (Charleston Road, and La Avenida Street) based the goals established in Step 1 and the design criteria established in Step 3. Each conceptual alternative is outlined in a geometric exhibit showing the plan, profile and typical section, a structure exhibit showing abutment, bent and tunnel locations, a right of way exhibit showing fee acquisitions and easement areas, a utility exhibit showing potential utility relocations required, traffic analysis to determine persons throughput, travel time, connectivity and safety for all modes of transportation and an order of magnitude cost estimate and schedule. Exhibits showing these alternatives are included in *Attachment A*.

Step 5 – Stakeholder Outreach

Stakeholder outreach and coordination included meetings with Santa Clara Valley Water District, PG&E, Caltrans, Google, NASA/AMES and Microsoft.

Step 6 - Evaluate Conceptual Alternatives

Each conceptual alternative was evaluated for feasibility and received a numerical score based on the screening criteria established in Step 2. Each alternative received a score for each established screening criteria, where a higher score indicated higher feasibility. Screening criteria scores were weighted based on importance. The scores were totaled and summarized in the Alternatives

Screening Matrix shown in *Attachment B*. A qualitative discussion regarding the constructability, environmental studies, and stakeholder coordination is provided in Sections 3.2 and 3.3.

3.2 Evaluation of Charleston Undercrossing at US 101 (Location 1)

For the purposes of this report, the Charleston Road underpass at US 101 alternatives were evaluated based on the screening process. Due to multiple constraints within the study area, these alternatives were replaced with proposed improvements (realignment) of the northbound US 101/Rengstorff Avenue on/off Ramp. Exhibit showing the northbound US 101/Rengstorff Avenue on/off Ramp realignment is included in Figure 6.

The initial design (Alternative 1C) assumed a direct route crossing US 101. However, the alignment conflicted with the existing Rengstorff Avenue overcrossing abutment structure at US 101. As a result, two alternative designs, Alternative 1A and 1B, were explored, as illustrated in *Figure 2* and *Attachment A*. Alternatives 1A and 1B shifted the undercrossing to the north. Alternative 1A provided four traffic lanes plus sidewalks and bike lanes. Alternative 1B provided only two traffic lanes. Operationally, both options could allow for reversible auto or transit-only lanes.

Below is summary identifying the screening elements considered for the Charleston Undercrossing at US 101 alternatives:

- *Traffic Circulation* – The North Bayshore area in Mountain View has relatively high traffic volumes and the proposed alternatives were evaluated for impact to the existing and proposed traffic conditions in the area. Potential for additional person trip capability, including transit, auto, bicycle and pedestrian trips, mode shift and circulation analysis was evaluated.

  Analysis of these undercrossing alternatives for this location revealed a critical limitation for both alternatives. The depth of the structure and the appropriate grades caused the entries to the undercrossing to be at locations that would be inefficient for the intended purpose of providing an alternative gateway. On the west side of US 101, the entrance would be located west of North Rengstorff Avenue near the adjacent Costco store, which would inhibit access for vehicles using the Rengstorff Avenue/US 101 interchange. In addition, new right-of-way would be required along Charleston Road, including along the Costco site.

  On the east side, the undercrossing entrance would occur on Landings Drive east of the Landings frontage road. This would restrict access to the proposed Landings development and require a reconfiguration of the frontage road.

  Construction – Construction of the Route 101 underpass would consist of top-down method with the following construction sequence:

  1. Drill piles on each side and center of underpass.
  2. Install pre-cast concrete cap beams and bridge slabs.
  3. Excavate between piles and beneath bridge beams. Install temporary and permanent struts or ground anchors as excavation progresses.
  4. Install permanent concrete struts at base of excavation and remove temporary struts or ground anchors.

Staged construction for pile installation and bridge construction may require overnight lane closures of Route 101. Temporary closures of adjacent roads may also be required.

Significant traffic control and staging will be required for lane closures. It is anticipated that road surface will be restored for traffic at the end of each work shift.

Building/structure modifications on 1000 N. Rengstorff Ave (Costco) and 2171 Landings Drive (Google) due to roadway improvements may be required. Additional modifications for the conversion of Landings Drive into a Cul-de-sac may be required.

- *Environmental Impact* – A preliminary assessment of potential environmental studies necessary for this project was provided. No technical investigations were performed at this stage. Potential environmental factors were identified and ability to mitigate each environmental impact was approximated. Environmental impacts will be determined at a later phase. Potential environmental studies to include are the following:
    - Air Quality and GHG
    - Biological Resources
    - Cultural Resources
    - Hazardous Materials/Waste
    - Noise & Vibration
    - Stormwater Management/ Water Quality
    - Community Impact Assessment
    - Visual Impact Assessment
    - Traffic
- *Stakeholder Coordination* – Stakeholders for this location include the City of Mountain View, Caltrans, Santa Clara County, Santa Clara Valley Water District, and surrounding private properties.
- *Right of Way and Utility Impacts* – The grade separation, was evaluated based on right of way impacts to existing neighboring properties. Impacts to existing properties for the Charleston crossing under US 101 include 3 partial impacts, 4 full takes and impacts to Caltrans Right of way.

  Additional temporary construction easements (TCE), ingress-egress easements (IEE) and permanent easements may be required for purposes of the project construction and relocation of utilities. Both alternatives would result in similar right of way and utility impacts.
- *Cost* – Order of magnitude cost for these alternatives is estimated to range from $133 Million to $202 Million.
- *Schedule* – Considering construction methods, permitting and coordination, duration for utilities for the Charleston crossing under US 101 alternatives is estimated to range from 6.5 years to 7.5 years.

Due to the right of way impacts and the estimated project cost, proceeding with further development of the Charleston Undercrossing as a Precise Plan Priority Transportation Project is not recommended.

Since this potential improvement is likely to be costly and challenging to construct, the study also explored other improvements on Rengstorff Avenue that could improve capacity and traffic operations.

3.3 Evaluation of Stevens Creek Bridge Alternatives (Locations 2 and 3)

The Stevens Creek Bridge alternatives include three options for each location (Charleston Road and La Avenida) and three basic configurations for each:

1. Separate transit vehicle and pedestrian/bicycle bridges at different elevations. The pedestrian/bicycle bridge would provide a direct connection to the Stevens Creek Trail.
2. A high-level combined transit and pedestrian/bicycle bridge that fully spans the creek. The bridge would not directly connect to the Stevens Creek Trail.
3. A lower-level integrated transit and pedestrian/bicycle bridge that includes piers within the creek channel. The Stevens Creek Trail would intersect with the bridge via an at-grade crossing.

These alternatives are illustrated in *Figures 3* and *Figure 4* and Attachments 1 and 2. Definitions, characteristics, cost, benefits, and issues for each alternative are summarized in *Table 1* and *Table 2*. Definitions, characteristics, cost, benefits, and issues for each alternative are summarized in *Attachment B*. Following are key considerations that distinguish the alternatives:

- The Charleston Bridge alternatives provide a more direct connection to the Charleston Transit Corridor, the primary east-west transit connection through North Bayshore envisioned in the North Bayshore Precise Plan. The Charleston Transit Corridor also includes cycle tracks and is envisioned as an active transportation corridor.
- The Charleston alternatives provide a new connection to the Stevens Creek Trail, while a connection already exists at La Avenida.
- The La Avenida location better serves the Microsoft campus.
- The La Avenida location crosses the U.S. Army's Orion Park property, which introduces access challenges.
- The Charleston location needs to cross an easement controlled by PG&E.
- Alternative 2A and 3A require two separate bridges but separate pedestrians and bikes from transit traffic. Google is pursuing a pedestrian/bicycle bridge near La Avenida that may eliminate need for the second bridge at that location.
- Alternative 2B and 3B require a higher, clear-span bridge and are the most costly alternatives but have the least impact on the creek channel. A tied arch or suspension design would be needed. The connection to the Stevens Creek Trail would be indirect for pedestrians and cyclists.
- Alternative 2C and 3C directly integrate with the Stevens Creek Trail, allowing a lower bridge profile. Trail users will cross the new bridge at grade, potentially requiring signals or signage that could delay transit operations.

The stakeholder discussions did not identify any major flaws with the alternatives but did identify several design issues which needed further investigation, including: (1) hydraulic and flow studies to better determine creek impacts and pier locations; (2) wind tunnel evaluations for NASA; (3) analysis of structural clearances to access roads for NASA, Google, PG&E, and Valley Water; and (4) impacts to overhead PG&E transmission lines.

Table 1: Charleston Bridge Alternatives

Alternative	2A	2B	2C
Description	Transit bridge with two travel lanes; separate pedestrian/bicycle bridge with at-grade connections to Stevens Creek Trail.	Clear-span bridge with two travel lanes; Class II bike lanes and sidewalk on both sides.	Combined transit and pedestrian/bicycle bridge; two travel lanes on the bridge, Class II bike lanes and sidewalks with at-grade connections to Stevens Creek Trail.
Key Stakeholder	PG&E, Valley Water, NASA, Google		
Preliminary Cost Estimate	$69 million	$73 million	$59 million
Key Benefits	As transit bridge is separate from pedestrian/bicycle bridge, no conflicts for transit bridge at the trail crossings.	Clear-span structure over creek and trails minimizes impacts. Provides opportunity for "signature span" or "gateway structure."	Lower, shorter bridge structure reduces cost and overall footprint. Potential fewer visual and biological impacts compared to Alternatives 2A and 2B.
Key Concerns and Questions	Pedestrian/bicycle bridge impacts the existing trail requiring realignment both sides of the creek. Wider impact area because of two separate bridges.	Visual and biological impacts would be more than the other two alternatives with lower profiles. Nonstandard structure type (tied arch or suspension) may increase the uncertainty of cost and schedule.	Requires raising existing trail to the same level as proposed bridge on both sides of the creek. Creates potential conflicts between bikes and buses. Requires modification of creek berms.
Issues Needing Future Resolution	• Easement or other appropriate agreement required between the City and NASA. • Further design refinement needed to understand impacts to the Bayview Campus parking and transit center on the east side, to the NASA wind tunnel, and to creek flow and operation. • Impacts to PG&E lines and tree farm.		

Table 2: La Avenida Bridge Alternatives

Alternative	3A	3B	2C
Description	Transit bridge with two travel lanes and separated pedestrian/bicycle bridge with at-grade connections to Stevens Creek Trail.	Clear span bridge with two travel lanes; Class II bike lanes and sidewalk on both sides.	Combined transit and pedestrian/bicycle bridge; two travel lanes on the bridge, Class II bike lanes, and sidewalk on both sides with connections to Stevens Creek Trail.
Key Stakeholders	PG&E, Valley Water, NASA, Army, Microsoft		
Preliminary Cost Estimate	$48 million	$63 million	$61 million
Key Benefits	As transit bridge is separate from pedestrian/bicycle bridge, there are no conflicts for transit bridge at the trail crossings.	Clear-span structure over creek and trails minimizes impacts. Provides opportunity for "signature span" or "gateway structure."	Lower, shorter bridge structure reduces cost and overall footprint. Potential fewer visual and biological impacts compared to Alternatives 3A and 3B.
Key Concerns and Questions	Wider impact area because of two separate bridges. Duplicates pedestrian/bicycle bridge being developed by Google.	Visual and biological impacts would be more than the other two alternatives with lower profiles. Nonstandard structure type (tied arch or suspension) may increase the uncertainty of cost and schedule.	Requires raising existing trail to the same level as proposed bridge on both sides of the creek. Creates potential conflicts between bikes and buses. Requires modification of creek berms.
Issues Needing Future Resolution	• Impacts to Army property and NASA/Ames • Analysis of creek flow and Valley Water operations		

In regard to the three Charleston Bridge alternatives, the following prioritization is recommended:

1) Alternative 2A—Separate transit and pedestrian/bicycle bridges. This alternative provides a balance in addressing costs and concerns. It will provide a direct connection to the trail for pedestrians and bicycles while avoiding conflicts between trail users and transit that could occur with the at-grade crossing in Alternative 3. It also avoids the visual and biological impacts of the Alternative 2 clear span concept.
2) Alternative 2C—Combined transit/pedestrian/bicycle bridge with at-grade trail crossings. This alternative provides direct access to the trail while shortening the span of the bridge.
3) Alternative 2B—Clear-span combined bridge with indirect trail access. This alternative provides for the longest of the bridge alternatives and therefore the costliest with no direct connection to the Stevens Creek levy trail from the bridge.

Additional preliminary design work would focus on the preferred alternative. However, a priority list would be utilized in case further analysis shows the preferred alternative to have significant design issues.

4. STAKEHOLDER COORDINATION

4.1 Stakeholder Coordination

City staff, BKF Engineers, and representatives from NASA, GOOGLE and SCVWD attended a series of Stakeholder meetings to review the various alternatives for each location. The stakeholder discussions did not identify any major flaws with the alternatives but did identify several design issues which needed further investigation, including:

a) Hydraulic and flow studies to better determine creek impacts and pier locations
b) Wind tunnel evaluations for NASA
c) Analysis of structural clearances to access roads for NASA, Google, PG&E, and Valley Water
d) Impacts to overhead PG&E transmission lines

Coordination with key stakeholders was taken into careful consideration. Permits from various stakeholders may be required. Summaries from stakeholder meetings are available in *Attachment C*.

5. CITY COUNCIL PRESENTATION

5.1 Presentation to City Council

The alternatives and conclusions identified herein were presented to City of Mountain View City Council on May 12, 2020.

Study *Recommendations for Stevens Creek Bridge Alternatives included the following:*
In the next steps for this proposed project, more detailed engineering and environmental studies be included. To narrow the options needing further study, only the Charleston corridor options should be pursued. The reasons included the following:

- Charleston best serves current and planned transit operations. La Avenida has limited benefit for transit operations since it does not directly connect to the Charleston Transit

Corridor.

- Charleston connects directly to NASA/Ames and Google's Bayview campus. With planned housing near Charleston Road (as identified in the Shorebird area of the North Bayshore Precise Plan), the bridge can provide pedestrian and bike access to the new campus.
- The Charleston location provides for a new connection to the Stevens Creek Trail, while a connection currently exists at La Avenida.
- Google is planning a separate new pedestrian/bicycle bridge near La Avenida, so that element may not be needed at La Avenida.

The following are the recommended priorities regarding the three Charleston alternatives.

1. Alternative 2A *(preferred alternative)*—Separate transit and pedestrian/bicycle bridges. This alternative provides a balance in addressing costs and concerns. It will provide a direct connection to the trail for pedestrians and bicycles while avoiding conflicts between trail users and transit that could occur with the at-grade crossing in Alternative 3. It also avoids the visual and biological impacts of the Alternative 2 clear span concept.
2. Alternative 2C - Combined transit/pedestrian/bicycle bridge with at-grade trail crossings.
3. Alternative 2B - Clear-span combined bridge with indirect trail access.

Additional preliminary design work would focus on the preferred alternative. However, the priority list should be utilized in case further analysis shows the preferred alternative to have significant design issues.

6. CONCLUSIONS/RECOMMENDATIONS AND NEXT STEPS

6.1 Conclusions/Recommendations

It is recommended to focus further development on the Charleston alignment for the proposed Stevens Creek bridge and not pursue the La Avenida Alignment.

As part of the task to further develop the preferred alternative for the Charleston alignment an additional alternative for Bicycle/pedestrian-only bridge has been developed. This alternative should be further studied to identify key issues such as: creek analysis, possible center column, landing on NASA side, and integration with Bayview project. See *Figure 5* for the Charleston Bicycle/Pedestrian-only Bridge alternative.

It is recommended, and supported by the City Council, to drop the Charleston Undercrossing at US 101 as a Precise Plan Priority Transportation Project and instead, substitute for further evaluation, the proposed Rengstorff Avenue/Landings Drive/US 101 On/Off Ramp Realignment shown in *Figure 6*.

Figure 5: Charleston Bicycle/Pedestrian-only Bridge

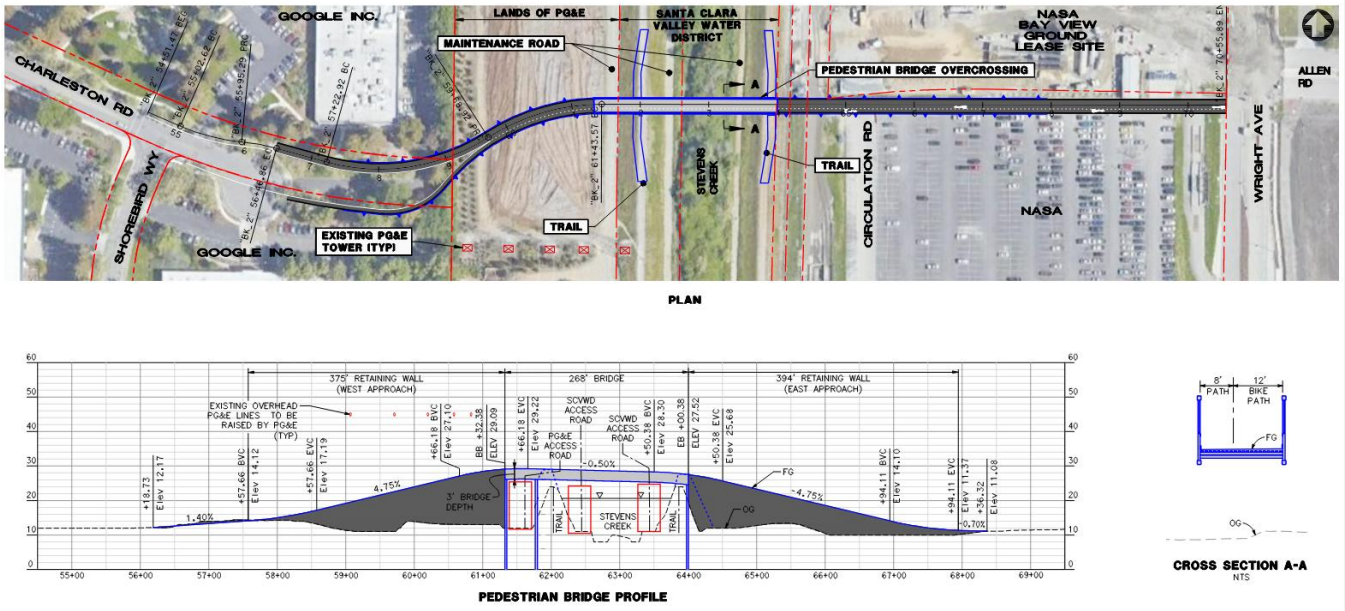
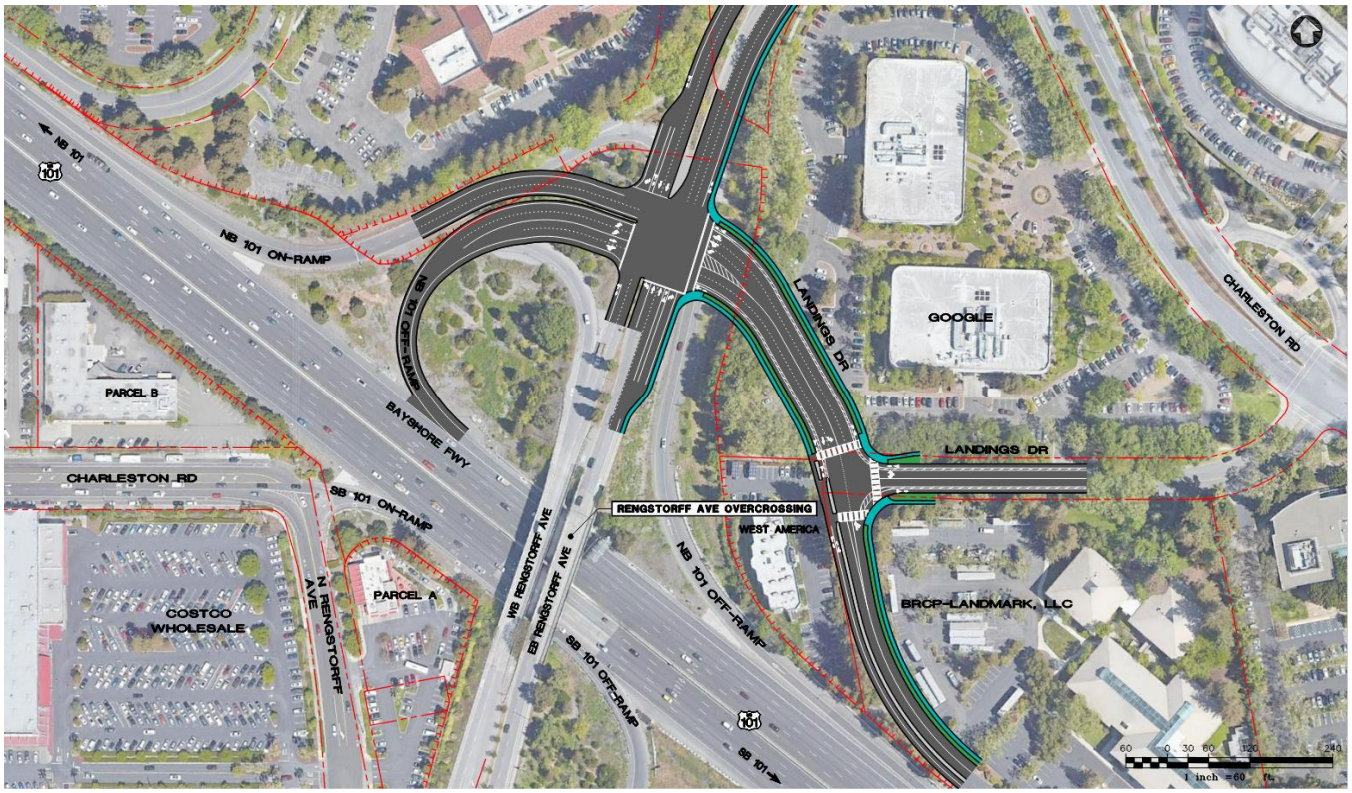


Figure 6: Rengstorff Avenue/Landings Drive/US 101 On/Off Ramp Realignment



6.2 Next Steps

Based on Council comments and direction, City staff and the consultant team will further develop the North Bayshore Circulation and Feasibility Study for additional Council discussion later in the year. That work will include:

- Evaluation of additional scenarios related to the full development of the Precise Plan and identification of a potential transportation strategy that may include lowering the 45 percent SOV requirement, enhanced TDM programs, and/or congestion pricing in addition to transit and active transportation improvements.
- Evaluation of the potential long-term impacts of COVID-19 shelter-in-place orders on transportation strategies and operations, including increased telecommuting, social distancing on transit vehicles, and other possible changes to commuter behavior.
- Coordination with VTA and Caltrans to further evaluate the U.S. 101/Rengstorff Avenue Ramp Realignment project through a study initiated by VTA.

ATTACHMENTS

A. Plan Exhibits
B. Screening Matrix
C. Summaries from Stakeholder Meetings
D. Design Criteria