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Alternatives Analysis

September 2, 2025 Project# 30555

To: Charlie Coles, City of Palo Alto

From: Kittelson & Associates, Inc.

RE: South Palo Alto Bike/Ped Connectivity – Alternatives Analysis

Introduction

The City of Palo Alto is conducting the South Palo Alto Bike/Ped Connectivity Project (Project) to assess ways to improve bicycle and pedestrian access across the rail corridor in the southern portion of the City. To improve bicycle and pedestrian connectivity and in support of the City's mobility and sustainability goals, this Project will identify locations and design concepts where two new grade-separated bicycle and pedestrian crossings of the Caltrain corridor in south Palo Alto (south of Oregon Expressway) may be constructed.

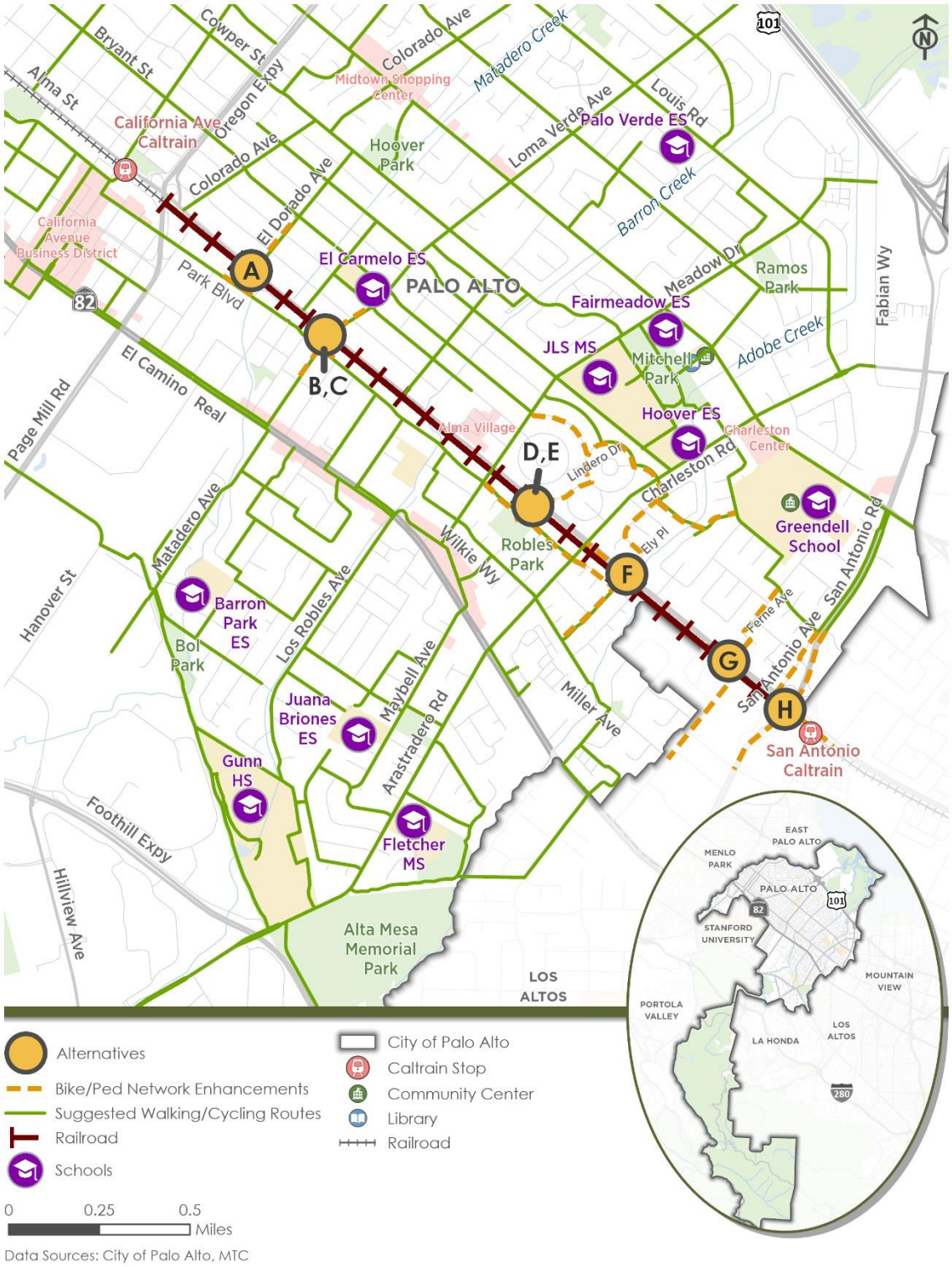
This Alternatives Analysis presents an assessment of eight conceptual design alternatives for community review and feedback that builds on the analysis of existing conditions, incorporates feedback from the community gathered during the first phase of engagement for this Project, and is consistent with the Project goals and design priorities in support of Council approved plans and direction. Eight conceptual design alternatives presented and discussed further in this analysis include the following:

- Alternative A: El Dorado Ave Tunnel
- Alternative B: Loma Verde Ave Tunnel
- Alternative C: Loma Verde Ave Tunnel with Alma St Signal
- Alternative D: Lindero Dr Tunnel
- Alternative E: Lindero Dr Tunnel with Alma St Signal
- Alternative F: Ely Pl Tunnel
- Alternative G: Ferne Ave Tunnel
- Alternative H: San Antonio Bridge Enhancements

Figure 1 shows the locations of the eight alternatives evaluated in this Alternatives Analysis. The concept design, description, and assessment of each alternative is presented in the following sections.

Over 25 potential design alternatives considering crossing opportunity locations (or facility alignments) and facility types (e.g., bridge or tunnel) were included as part of the initial screening process. Alternatives that would involve minor variations or shifts in alignment were not considered as part of the initial screening, since minor changes in alignment would not meaningfully affect the performance of an alternative. Attachment A describes the process used to develop and identify eight conceptual design alternatives through the initial screening process.

Figure 1: Locations of Crossing Alternatives



Alternatives A, C, E, F, and G propose new at-grade crossings of Alma Street with a tunnel underneath the railroad tracks, while Alternatives B and D propose tunnels underneath Alma Street and the railroad tracks. Alternative H is a bridge/tunnel combination, utilizing the existing overpass structure on San Antonio Road to provide a grade-separated crossing of the railroad tracks for bicycles. Alternative H will also include enhancements to the existing at-grade crossing of Alma Street at San Antonio Avenue to provide improved connection to the existing bike/ped tunnel underneath the railroad tracks at the San Antonio Caltrain Station at Mayfield Avenue in Mountain View.

Alternatives A, B, C, and H appear to have the most potential to move forward based on initial input from the community and prior Council approved plans and direction. However, in an effort to present a range of potentially feasible options and confirm preferred locations and designs, the City developed eight conceptual design alternatives for analysis, review and feedback from the community.

All conceptual design alternatives has been developed in accordance with applicable design guidelines and standards, including the Caltrans Highway Design Manual, Caltrain Engineering Standards, Caltrain Corridor Crossings Delivery Guide dated August 2024, Caltrain Design Criteria, 4th Edition dated January 2024, Caltrain Standards for Design and Maintenance of Structures Revised January 2024, American Railway Engineering and Maintenance-of-Way Association (AREMA) standards, American Association of State Highway and Transportation Officials (AASHTO) standards, Americans with Disabilities Act (ADA) standards, guidance from National Association of City Transportation Officials (NACTO), and informed by the principles of Crime Prevention Through Environmental Design (CPTED).

Design concepts presented in this analysis are preliminary and intended for discussion purposes only. All concepts are flexible and subject to refinement. Additional community engagement, technical design work, and agency coordination will be needed once locations and basic design concepts have been decided.

These conceptual design alternatives were developed with the intent of getting input from the community to inform key design elements, such as the location and alignment of the tunnel and ramps/stairs, treatment at Alma Street (tunnel or signal), as well as general design characteristics, including ramp/tunnel widths and grades. These potential design variations are described in more detail for each alternative in the following sections. Community feedback on the alternatives and design variations is being gathered during the next phase of engagement. This input will be considered in selection of the locally preferred alternatives to carry forward to 15 percent concept design.

While identifying and developing 15 percent concept designs for two preferred railroad crossing options is the primary aim of the Project, an additional purpose is to identify the surface street improvements that would be paired with each crossing to make walking and biking easier and more comfortable. The specific bicycle and pedestrian network enhancements will be developed for each of the two alternatives in the next phase of this Project and constructed in combination with each crossing to provide high comfort connections to existing and planned bicycle and pedestrian infrastructure.

Alternatives are scored using design priorities and evaluation criteria developed in the previous project phase based on community input, engineering expertise, and professional judgement (see Table 1). Design priorities are organized in order of importance based on community feedback, with the highest design priority (Improve Mobility) listed first. A High (most desirable) score indicates stronger alignment with community values, and a Low (least desirable) score indicates weaker alignment.

Table 1: Design Priorities and Evaluation Criteria

Design Priority	Evaluation Criteria[1]	Description
Improve Mobility	Neighborhood accessibility	Walk and bike access within 5- 10- and 15-minutes of each crossing location. Information will be presented as an isochrone map of walk and bike sheds overlaid with key destinations such as schools and parks[2].
	Demand[#]	Projected number of users (people walking and biking) on a daily basis and during the weekday a.m. peak hour. This analysis will account for future population growth and land use development.
	Facility width and capacity[#]	Width of facility and ability of rail crossing to accommodate people walking and biking, including people with mobility devices (e.g., wheelchairs), cargo bikes, and bike trailers.
Enhance User Experience	Crossing length[#]	Total length of the crossing facility. This analysis considers the crossing distance of the tunnel/bridge and ramp structures.
	Crossing elevation and ramp grade[#]	Total change in elevation of the crossing facility. This analysis considers the ramp grades and distance below/above grade required for the tunnel/bridge structure.
	Pedestrian and bicyclist comfort	Extent to which existing pedestrian and bicycle network would provide low-stress access to and through the rail crossing(s). This analysis considers the existing network and the types of improvements (e.g., new or upgraded facilities) required to provide comfortable on-street connections to and through the new crossing.
	Personal security	Alignment of rail crossing facility (e.g., directness of the crossing, number of turns) and approaches with Crime Prevention Through Environmental Design (CPTED) best practices. This analysis considers access control to direct people to designated entrances and exits, as well as maximizing visibility and sightlines to allow for natural observation of people within the crossing, reducing opportunities for criminal activities and other unwanted behaviors.
Maximize Ease of Construction	Utility impacts	Level of disruption to existing and planned utilities, extent of relocations required.
	Construction cost[#]	Rough order of magnitude of project construction cost, including cost of the tunnel/bridge and new or upgraded facilities required to provide low-stress on-street connections.
	Construction duration	Anticipated duration of construction, level of disruption and level of coordination with the Meadow/Charleston Rail Grade Separation Project expected during the construction period.
	Operations and maintenance cost	Magnitude of projected annual cost of operations and maintenance (e.g., flooding, landscaping).

Design Priority	Evaluation Criteria[1]	Description
Enhance Visual Appeal	Public space and green infrastructure	Potential to create new public spaces and implement green infrastructure.
Minimize Community Impacts	Environmental impacts	Extent to which crossing impacts the environment - impervious areas, creeks/drainage, sea level rise, wetlands, sensitive habitats, and existing parkland.
	Parcel impacts[#]	Number of parcels needed, all or in part, to construct crossing and approach facilities.
	Traffic, parking, and driveway impacts	Extent to which rail crossings affect existing vehicle circulation, vehicle parking, and access to existing driveways.

Notes:
[1] Criteria marked with an "#" are quantitative and a specific value will be presented. Criteria without a "#" are qualitative and will be scored using a scale of high, medium, and low, for its performance.
[2] An isochrone map of a walk or bike shed represents areas accessible within the same amount of time from a specific point.

The results of these evaluations are one of several considerations in the process of seeking locally preferred alternatives. The evaluation criteria and scoring methodology is included as Attachment B. The accessibility analysis maps are included as Attachment C.

Importantly, no decision has yet been made by the City to acquire any property. Before that decision can be made, the law requires that properties to be acquired first be appraised. If the City continues to consider the acquisition of property after completion of an appraisal, then representatives of the City will contact the owner and make a formal written offer to purchase. The offer will be for an amount determined by the City to be just compensation and in no event will be less than the value reported in an appraisal approved by the City. Without authority from the City Council, Staff has no authority to commit to the acquisition of any property that might be impacted by the conceptual design alternatives presented in this analysis.

A. El Dorado Ave Tunnel

Description. Alternative A would construct a 110 foot long and 20 foot wide tunnel underneath the railroad tracks. Both ramps would be 12 feet wide with a 7% slope. The ramp on the east side would be 180 feet long. The ramp on the west side would be 200 feet long. The total crossing would be 490 feet long and would be the shortest of the eight crossings.

The intersection of Alma Street/El Dorado Avenue would be reconfigured with a new traffic signal and high visibility crosswalks. A stairway would be constructed to provide direct access to the tunnel with ramps extending along the landscaping strip between Caltrain right-of-way and Alma Street in both directions. Alma Street would be reconfigured to provide a widened sidewalk and bulbouts at the intersection. Construction of the stairway and ramps would require the shifting of travel lanes on Alma Street. The ramp on the west side would connect to Park Boulevard through an existing surface parking lot. This alternative would require partial acquisition of the surface parking lot on Park Boulevard, resulting in the removal of about 40 off-street parking spaces.

Alternative A is located approximately 2,450 feet from the nearest northern crossing at California Avenue and 4,475 feet from the nearest southern crossing at Meadow Drive. This alternative, along with the Alternatives B and C at Loma Verde Avenue would provide the greatest increase in access for people walking and biking and would result in the following estimated weekday trips[1]:

- AM Peak Hour – 220 peak hour trips (70 walking and 150 biking trips)
- Daily – 2,600 daily trips (800 walking and 1,800 biking trips)

This alternative would provide a direct connection to existing bike routes on Park Boulevard and would provide an enhanced bike connection on El Dorado Avenue between Alma Street and existing bicycle routes on Bryant Street. The proposed alignment would be fairly direct for people walking as stairs would provide a shorter and more direct path from El Dorado Avenue and the ramp connection to Park Boulevard would be relatively straight. Some out of direction travel would be required for bicyclists accessing the ramps along Alma Street with 90 degree turns potentially limiting visibility and creating increased potential for conflicts between people walking and biking.

Alternative A involves constructing a short tunnel beneath only the Caltrain corridor, with generally favorable site conditions for staging and access. On the east side, the design would require narrowing Alma Street to accommodate the tunnel and associated ramps. On the west side, an open parking lot would provide space for staging and for the proposed meandering pathway connection. This configuration avoids the need to grade separate Alma Street, substantially reducing the complexity of traffic handling, utility relocations, and construction phasing. The tunnel box would likely be bore-and-jacked beneath the tracks to minimize impacts to rail operations, allowing work to proceed with minimal disruption to train service.

[1] For reference, based on counts collected in April 2025 there were about 1,800 daily pedestrian and bicycle trips and 300 peak hour pedestrian and bicycle trips observed on the California Avenue underpass; around 600 daily bicycle trips and 170 peak hour bicycle trips were observed crossing the railroad tracks at Meadow Drive; and around 400 daily bicycle trips and 100 peak hour bicycle trips were observed crossing the railroad tracks at Charleston Road. Pedestrian counts were not collected at Meadow Drive or Charleston Road.

The straightforward nature of the construction, combined with the absence of major constraints or overlapping work zones, positions this alternative as having the lowest anticipated cost and an approximate construction duration of 18 months—one of the shortest among the tunnel options considered. While the design includes two ramps along Alma Street, these do not introduce significant additional complexity compared to other alternatives.

Alternative A will likely have moderate utility impacts as there is an existing sewer line and overhead lines within the proximity of the proposed crossing alignment. Alternative A proposes to tunnel underneath the railroad tracks and would not encroach on Caltrain right-of-way at the surface level. A partial right-of-way acquisition from the private parking lot near Park Boulevard would remove several stalls and require reconfiguration to accommodate the meandering pathway to the new tunnel crossing. Alternative A would have a minimal potential impact on the environment as it would not be anticipated to result in substantial increases in impervious areas, would not impact creeks or drainage, or sensitive habitats, and would have no impact on existing wetlands or parkland. There is an opportunity to provide green infrastructure and new open space as part of the stair/ramp design at El Dorado Avenue and as part of the ramp design through the surface parking lot connecting to Park Boulevard.

Design Variations. There are several design variations that may be considered for Alternative A, including:

- Traffic control. A traffic signal would be required to facilitate bicycle and pedestrian crossings of Alma Street to access the new tunnel. A Pedestrian Hybrid Beacon could be installed instead of a traffic signal. This design variation would require people walking or biking to activate the device before crossing, which may reduce potential delay impacts to vehicle traffic.
- Ramp configuration, east side. One ramp, instead of two, could be constructed on Alma Street at El Dorado Avenue. This variation would reduce construction costs. However, it would also limit connectivity for people biking or rolling. Other variations to ramp configurations could be considered, including reconfiguring the ramp to make a 90-degree turn below grade to meet the top of the stairs at-grade, reducing the crossing length for bicyclists.
- Increase ramp width, east side. The ramps on Alma Street could be increased from 12 feet to 16 or 20 feet wide to increase capacity and minimize potential for conflicts between people walking and biking. This design variation would require further reconfiguration of Alma Street and may require the narrowing or removal of vehicle travel lanes, increasing potential impacts to vehicle traffic.
- Increase ramp width, west side. The ramp through the surface parking lot could be increased from 12 feet to 16 or 20 feet wide to increase capacity and minimize potential for conflicts between people walking and biking. This design variation would increase the extent of parcel acquisition and increase the number of parking spaces impacted.

Evaluation. Table 2 presents the results of the analysis, evaluating the degree to which the alternative aligns with the design priorities and each of the selected evaluation criteria. Results are presented using a scale of high (dark green) indicating strong alignment to low (dark orange) indicating weak alignment.

Table 2: Alternative A. El Dorado Ave Tunnel Results

Evaluation Criteria	Alternative A
Neighborhood Accessibility	
Demand	
Facility Width and Capacity	
Crossing Length	
Crossing Elevation and Ramp Grade	
Pedestrian and Bicycle Comfort	
Personal Security	
Utility Impacts	
Construction Cost	
Construction Duration	
Operation and Maintenance Cost	
Public Space and Green Infrastructure	
Environmental Impacts	
Parcel Impacts	
Traffic, Parking and Driveway Impacts	

Notes: Alternatives are scored using design priorities and evaluation criteria developed in the previous project phase based on community input, engineering expertise, and professional judgement. A high (most desirable) score indicates stronger alignment with community values and a low (least desirable) score indicates weaker alignment. Note that the results of these evaluations are one of several considerations in the process of seeking locally preferred alternatives.

High (most desirable) **Low (least desirable)**

Alternative A: El Dorado Ave Tunnel (Draft)

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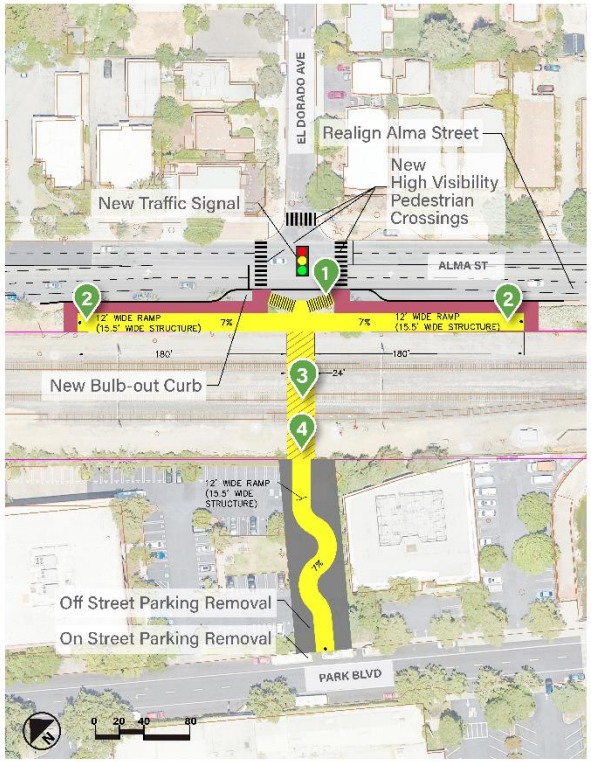
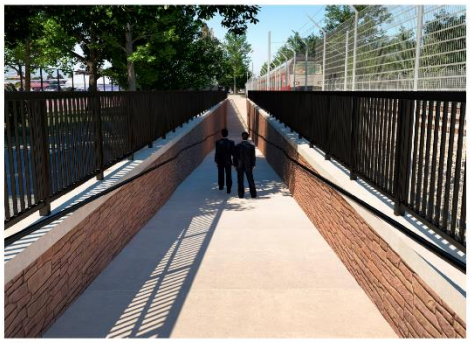
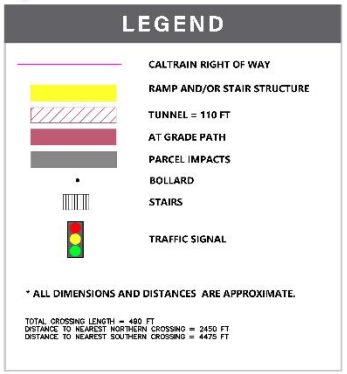
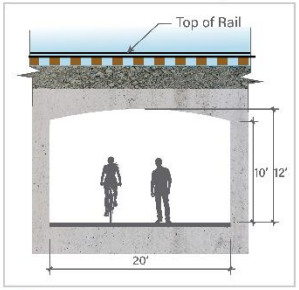


1 Example Stairway Leading to Undercrossing
(Homer Tunnel in Palo Alto)



2 Example 12' Wide Ramp at 7% Grade Parallel to Caltrain Tracks





3 Section Through Tunnel

4 Example 20' Wide and 10' High Tunnel
(San Antonio Caltrain Station in Mountain View)

Draft design concepts shown are preliminary and intended for discussion purposes only. All concepts are flexible and subject to refinement. Additional community engagement and technical design work will be needed once locations and basic design concepts have been decided.

B. Loma Verde Ave Tunnel

Description. Alternative B would construct a 220 foot long and 20 foot wide tunnel underneath Alma Street and the railroad tracks. Both ramps would be 12 feet wide with a 7% slope. The ramp on the east side would be 180 feet long. The ramp on the west side would be 250 feet long. The total crossing would be 650 feet long. While it would be the longest of the eight crossings it provides a relatively direct path with minimal out-of-direction travel.

The tunnel would connect a center-running two-way bike/ped ramp on Loma Verde Avenue to the intersection of Park Boulevard/Margarita Avenue using a combination of switchback ramps and stairs. It is anticipated that this alternative would require the acquisition of two parcels on Park Boulevard. Construction of the center-running ramp on Loma Verde Avenue would require the reconfiguration of Loma Verde Avenue to remove about 10 spaces of existing on-street parking and require right-in/right-out driveway operations for the four parcels adjacent to the ramp. Construction of the ramp connecting to Park Boulevard would require the removal of about two existing on-street parking spaces on Park Boulevard.

Alternative B is located approximately 3,900 feet from the nearest northern crossing at California Avenue and 3,000 feet from the nearest southern crossing at Meadow Drive. This alternative, along with Alternative A at El Dorado Avenue and Alternative C also at Loma Verde Avenue would provide the greatest increase in access and would result in the following estimated weekday trips:

- AM Peak Hour – 230 peak hour trips (70 walking trips and 160 biking trips)
- Daily – 2,470 daily trips (740 walking trips and 1,720 biking trips)

This conceptual design alternative would provide a direct connection to existing bike routes on Park Boulevard and Margarita Avenue and would provide an enhanced bike connection on Loma Verde Avenue from the tunnel entrance to the existing bicycle routes on Bryant Street. The proposed alignment on Loma Verde Avenue would be relatively direct with switchbacks limiting visibility and creating increased potential for conflicts between people walking and biking on the ramp to the Park Boulevard/Margarita Avenue intersection. Stairs would provide a more direct path enabling pedestrians to avoid mixing with bicyclists for a portion of the crossing, including at the entry/exit to Park Boulevard.

Alternative B involves constructing a long tunnel beneath both the Caltrain corridor and Alma Street, with the alignment positioned generally in the center of Loma Verde Avenue. The portion of the tunnel beneath the Caltrain tracks would likely be constructed using a bore-and-jack method to minimize impacts to rail operations. Outside of the Caltrain corridor, the tunnel would be constructed using open-cut methods to be more cost effective. This configuration introduces significant construction complexity due to the need to grade separate Alma Street while maintaining traffic along the corridor during construction. Doing so would likely require staged construction, temporary traffic shifts, and more intricate traffic handling measures compared to alternatives that avoid grade separating Alma Street. The longer tunnel length also increases the amount of excavation, structural concrete, and associated construction activities relative to shorter tunnel options.

Alternative B would have a substantial impact on existing utilities, as the proposed tunnel would cross Alma Street and be located within the middle of Loma Verde Avenue. Existing utilities within both

roadways would need to be relocated outside of the proposed tunnel limits. While the tunnel would pass underneath the railroad tracks, it would not encroach on Caltrain right-of-way at the surface level.

Staging areas for Alternative B are more constrained than at other sites, further complicating construction sequencing and equipment access. The combination of longer structure length, traffic management requirements, major utility relocations, and limited staging areas is anticipated to result in higher construction costs and an approximate construction duration of 24 months—longer than alternatives that avoid grade separating Alma Street.

Alternative B would have a minimal potential impact on the environment as it would not be anticipated to result in substantial increases in impervious areas, would not impact creeks or drainage, or sensitive habitats, and would have no impact on existing wetlands or parkland. There is an opportunity to provide green infrastructure and new open space as part of the ramp/stair design connecting to Park Boulevard.

Design Variations. There are several design variations that may be considered for Alternative B, including:

- Ramp alignment, east side. The ramp that is currently proposed to run down the middle of Loma Verde Avenue could be realigned to the north or south side of the street. This variation would increase potential driveway impacts, limiting access to the two parcels on the ramp side.
- Increase ramp width, east side. The ramp on Loma Verde Avenue could be increased from 12 feet to 15.5 feet wide to increase capacity and minimize potential for conflicts between people walking and biking. This design variation would require the reconfiguration of Loma Verde Avenue to provide one-way travel for vehicles and increase potential impacts to traffic and driveway access.
- Decrease ramp slope and increase length, east side. The ramp slope could be reduced, and the ramp lengthened to connect directly to the intersection of Loma Verde Avenue/Emerson Street. This design variation would require a larger ramp structure, increasing the cost of construction.
- Decrease ramp slope and increase length, west side. The ramp slope could be reduced and the ramp lengthened to provide looser switchbacks, resulting in increased visibility around corners, improving personal security and reducing potential for conflicts between people walking and biking. This design variation would increase the number of parcels required, which would also increase opportunities to provide green infrastructure and open space.
- Increase ramp slope and decrease length, west side. The ramp slope could be increased and the ramp shortened with tighter switchbacks, resulting in decreased visibility around corners and increasing potential for conflicts between people walking and biking while reducing the extent of parcel acquisition required from two parcels to one.

Evaluation. Table 3 presents the results of the analysis, evaluating the degree to which the alternative aligns with the design priorities and each of the selected evaluation criteria. Results are presented using a scale of high (black) indicating strong alignment to low (light gray) indicating weak alignment.

Table 3: Alternative B. Loma Verde Ave Tunnel Results

Evaluation Criteria	Alternative B
Neighborhood Accessibility	
Demand	
Facility Width and Capacity	
Crossing Length	
Crossing Elevation and Ramp Grade	
Pedestrian and Bicycle Comfort	
Personal Security	
Utility Impacts	
Construction Cost	
Construction Duration	
Operation and Maintenance Cost	
Public Space and Green Infrastructure	
Environmental Impacts	
Parcel Impacts	
Traffic, Parking and Driveway Impacts	

Notes: Alternatives are scored using design priorities and evaluation criteria developed in the previous project phase based on community input, engineering expertise, and professional judgement. A high (most desirable) score indicates stronger alignment with community values and a low (least desirable) score indicates weaker alignment. Note that the results of these evaluations are one of several considerations in the process of seeking locally preferred alternatives.

Alternative B: Loma Verde Ave Tunnel (Draft)

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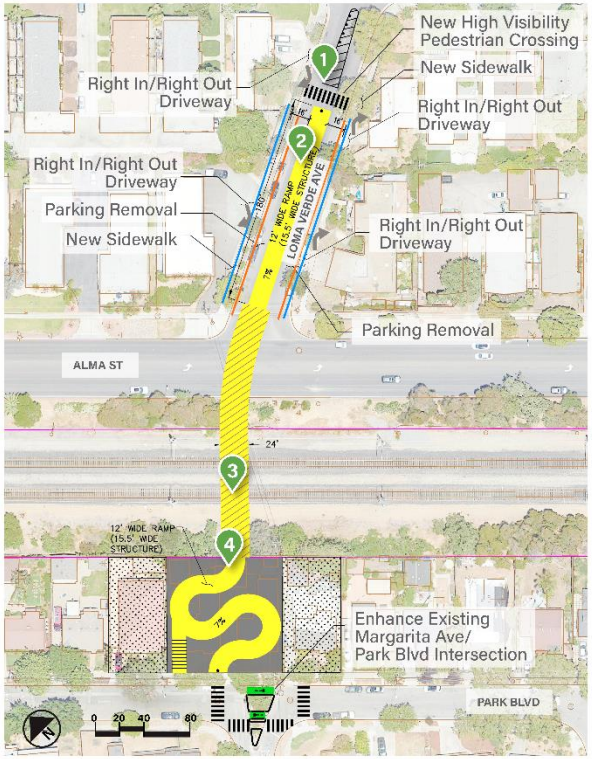
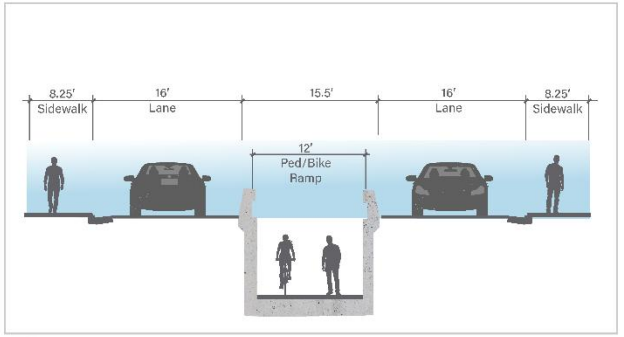
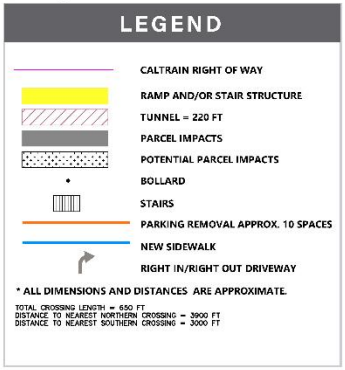
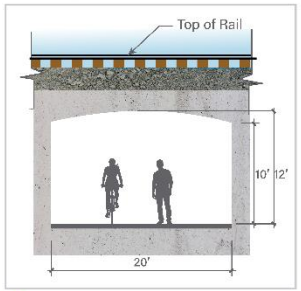


1 Example 12' Wide Ramp at 7% Grade Perpendicular to Caltrain Tracks



2 Section Through Loma Verde Ave





3 Section Through Tunnel

4 Example of Switchback Ramp

Draft design concepts shown are preliminary and intended for discussion purposes only. All concepts are flexible and subject to refinement. Additional community engagement and technical design work will be needed once locations and basic design concepts have been decided.

C. Loma Verde Ave Tunnel with Alma St Signal

Description. Alternative C would construct a 110 foot long and 20 foot wide tunnel underneath the railroad tracks. Both ramps would be 12 feet wide with a 7% slope. The ramp on the east side would be 180 feet long. The ramp on the west side would be 250 feet long. The total crossing would be 540 feet long.

The intersection of Alma Street/Loma Verde Avenue would be reconfigured with a new traffic signal. A stairway would be constructed to provide direct access to the tunnel with ramps extending along the landscaping strip between Caltrain right-of-way and Alma Street in both directions. Alma Street would be reconfigured to provide a widened sidewalk and bulbouts at the intersection. Construction of the stairway and ramps would require the shifting of travel lanes on Alma Street. Similar to Alternative B, the tunnel would connect to the intersection of Park Boulevard/Margarita Ave using a combination of switchback ramps and stairs. Alternative C would require the acquisition of two parcels and removal of two existing on-street parking spaces on Park Boulevard.

Alternative C is located approximately 3,900 feet from the nearest northern crossing at California Avenue and 3,000 feet from the nearest southern crossing at Meadow Drive. This alternative, along with Alternative A and Alternative B would provide the greatest increase in access and would result in the following estimated weekday trips:

- AM Peak Hour – 230 peak hour trips (70 walking trips and 160 biking trips)
- Daily – 2,460 daily trips (740 walking trips and 1,720 biking trips)

This conceptual design alternative would provide a direct connection to existing bike routes on Park Boulevard and Margarita Avenue and would provide an enhanced bike connection on Loma Verde Avenue from the tunnel entrance to the existing bicycle routes on Bryant Street. The proposed alignment at Loma Verde Avenue would be relatively indirect for people biking as bicyclists would need to cross at the signal and travel out-of-direction to access the ramps, which would require one U-turn and one 90 degree turn, limiting visibility and opportunities for natural surveillance, and creating increased potential for conflicts between people walking and biking. Stairs would provide a more direct path enabling pedestrians to avoid mixing with bicyclists for a portion of the crossing, including at the entry/exit to Park Boulevard and Loma Verde Avenue.

Alternative C is located in the same general area as Alternative B, but avoids the need to grade separate Alma Street. On the east side, this would require slightly narrowing Alma Street to accommodate the parallel ramp connections. On the west side, the design includes a meandering structure pathway that will require parcel acquisitions to accommodate tying into the surrounding network.

The tunnel portion beneath the Caltrain corridor would likely be constructed using a bore-and-jack method to minimize impacts to rail operations. Alternative C would have a minimal potential impact on utilities, except for overhead lines near Alma Street. The tunnel would pass underneath the railroad tracks and would not encroach on Caltrain right-of-way at the surface level. Because the alignment does not pass beneath Alma Street, the overall structure length and construction complexity are reduced compared to the full Alma grade separation option. The absence of significant traffic staging along Alma Street also limits potential disruption to local travel. Overall, Alternative C is expected to have lower construction

costs and shorter durations than options requiring Alma Street grade separation, with an approximate construction duration of 18 months.

Alternative C would have a minimal potential impact on the environment as it would not be anticipated to result in substantial increases in impervious areas, would not impact creeks or drainage, or sensitive habitats, and would have no impact on existing wetlands or parkland.

Design Variations. There are several design variations that may be considered for Alternative C, including:

- Traffic control. A traffic signal would be required to facilitate bicycle and pedestrian crossings of Alma Street to access the new tunnel. A Pedestrian Hybrid Beacon could be installed instead of a traffic signal. This design variation would require people walking or biking to activate the device before crossing, which may reduce potential delay impacts to vehicle traffic.
- Ramp configuration, east side. One ramp, instead of two, could be constructed on Alma Street at Loma Verde Avenue. This variation would reduce construction costs. However, it would also limit connectivity for people biking.
- Increase ramp width, east side. The ramps on Alma Street could be increased from 12 feet to 16 or 20 feet wide to increase capacity and minimize potential for conflicts between people walking and biking. This design variation would require further reconfiguration of Alma Street and may require the narrowing or removal of vehicle travel lanes, increasing potential impacts to traffic.
- Decrease ramp slope and increase length, west side. The ramp slope could be reduced and the ramp lengthened to provide looser switchbacks, resulting in increased visibility around corners, improving personal security and reducing potential for conflicts between people walking and biking. This design variation would increase the number of parcels required, which would also increase opportunities to provide green infrastructure and open space.
- Increase ramp slope and decrease length, west side. The ramp slope could be increased and the ramp shortened with tighter switchbacks, resulting in decreased visibility around corners and increasing potential for conflicts between people walking and biking while reducing the extent of parcel acquisition required from two parcels to one.

Evaluation. Table 4 presents the results of the analysis, evaluating the degree to which the alternative aligns with the design priorities and each of the selected evaluation criteria. Results are presented using a scale of high (black) indicating strong alignment to low (light gray) indicating weak alignment.

Table 4: Alternative C. Loma Verde Ave Tunnel with Alma St Signal Results

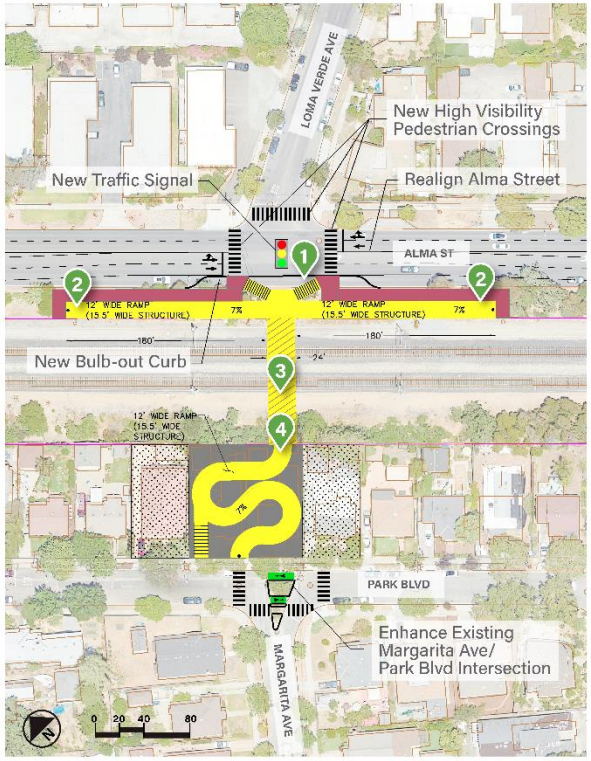
Evaluation Criteria	Alternative C
Neighborhood Accessibility	
Demand	
Facility Width and Capacity	
Crossing Length	
Crossing Elevation and Ramp Grade	
Pedestrian and Bicycle Comfort	
Personal Security	
Utility Impacts	
Construction Cost	
Construction Duration	
Operation and Maintenance Cost	
Public Space and Green Infrastructure	
Environmental Impacts	
Parcel Impacts	
Traffic, Parking and Driveway Impacts	

Notes: Alternatives are scored using design priorities and evaluation criteria developed in the previous project phase based on community input, engineering expertise, and professional judgement. A high (most desirable) score indicates stronger alignment with community values and a low (least desirable) score indicates weaker alignment. Note that the results of these evaluations are one of several considerations in the process of seeking locally preferred alternatives.

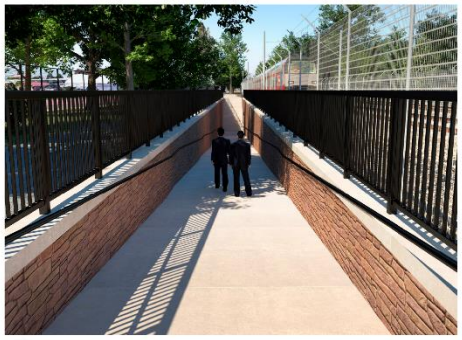
High (most desirable) **Low (least desirable)**

Alternative C: Loma Verde Ave Tunnel with Alma St Signal (Draft)

CITY OF PALO ALTO



1 Example Stairway Leading to Undercrossing
(Homer Tunnel in Palo Alto)



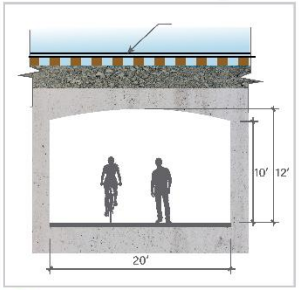
2 Example 12' Wide Ramp at 7% Grade Parallel to Caltrain Tracks

LEGEND

- CALTRAIN RIGHT OF WAY
- RAMP AND/OR STAIR STRUCTURE
- TUNNEL = 110 FT
- AT GRADE PATH
- PARCEL IMPACTS
- POTENTIAL PARCEL IMPACTS
- BOLLARD
- STAIRS
- TRAFFIC SIGNAL

* ALL DIMENSIONS AND DISTANCES ARE APPROXIMATE.

TOTAL CROSSING LENGTH = 540 FT
DISTANCE TO NEAREST NORTHERN CROSSING = 3900 FT
DISTANCE TO NEAREST SOUTHERN CROSSING = 3000 FT



3 Section Through Tunnel

4 Example 20' Wide and 10' High Tunnel
(San Antonio Caltrain Station in Mountain View)

Draft design concepts shown are preliminary and intended for discussion purposes only. All concepts are flexible and subject to refinement. Additional community engagement and technical design work will be needed once locations and basic design concepts have been decided.

D. Lindero Dr Tunnel

Description. Alternative D would construct a 160 foot long and 20 foot wide tunnel underneath Alma Street and the railroad tracks. Both ramps would be 12 feet wide with a 7% slope. The ramp on the east side would be 180 feet long. The ramp on the west side would be 230 feet long. The total crossing would be 570 feet long.

The intersection of Alma Street/Lindero Drive would be realigned to a T-intersection and a ramp would be constructed in the landscaping strip and extend in the north-south direction on the east side of Alma Street. The ramp would meet the tunnel and turn 90 degrees to cross under Alma Street and the railroad tracks and connect to the intersection of Park Boulevard at Robles Park using a combination of a curving ramp and stairs. This alternative is anticipated to require the acquisition of one parcel on Park Boulevard and would reconfigure/extend the existing driveway on Lindero Drive at the northeast corner of the Alma Street/Lindero Drive intersection. It may require the removal of one existing on-street parking space on Park Boulevard.

Alternative D is located approximately 850 feet from the nearest northern crossing at Meadow Drive and 850 feet from the nearest southern crossing at Charleston Road. This alternative would provide a limited increase in access for people walking and biking as it is located immediately between the existing crossings at Meadow Drive and Charleston Road. The alternative would primarily attract bicycle trips that would use the lower stress crossing compared to crossing at Meadow Drive and Charleston Road. Alternative D would result in the following estimated weekday trips:

- AM Peak Hour – about 50 peak hour trips (<10 walking trips and 40 biking trips)
- Daily – 570 daily trips (100 walking trips and 470 biking trips)

This conceptual design alternative would provide a direct connection to existing bike roures on Park Boulevard and would provide an enhanced bike connection on Lindero Drive from the ramp entrance to the existing bicycle routes on Starr King Circle, Redwood Circle, and Bryant Street. This alternative would also enhance connections to and through Robles Park. The proposed alignment would be fairly direct, though it does include one 90 degree turn, limiting visibility and opportunities for natural surveillance, and creating increased potential for conflicts between people walking and biking. Stairs would provide a more direct path to Park Boulevard enabling pedestrians to avoid mixing with bicyclists for a portion of the crossing.

Alternative D involves constructing a long tunnel beneath both the Caltrain corridor and Alma Street, with the alignment positioned to connect to Lindero Drive. On the east side, this configuration would require grade separating Alma Street, introducing significant construction complexity due to the need to maintain traffic along the corridor during construction. On the west side, the design includes a meandering pathway connection that would require a parcel acquisition to tie into the surrounding network.

The portion of the tunnel beneath the Caltrain tracks would likely be constructed using a bore-and-jack method to minimize impacts to rail operations. Outside of the Caltrain corridor, the tunnel would be constructed using open-cut methods to be more cost effective. Alternative D would have a significant impact on existing utilities, as the proposed tunnel would cross Alma Street. Existing utilities within both

roadways would need to be relocated outside of the proposed tunnel limits. While the tunnel would pass underneath the railroad tracks, it would not encroach on Caltrain right-of-way at the surface level.

In June 2024, Council advanced the Hybrid Alternative (including a mixed wall/column approach) and Underpass Alternative for the Rail Grade Separation Project at Meadow Drive and Charleston Road—with only one expected to advance following the City's decision process. [2] Alternative D overlaps with areas proposed for construction (subject to change) for rail grade separation, specifically the Hybrid Alternative (including a mixed wall/column approach) currently under consideration, and would require close coordination to address potential changes in site conditions, available staging areas, and construction sequencing. This coordination could add cost risk and schedule impacts, depending on how the two projects interface. In addition, if the Hybrid Alternative advances, construction of this alternative would need to be sequenced to follow completion of the Meadow-Charleston project. Both projects are located in the same physical area, making concurrent construction not feasible. As a result, the start of this Project would be directly dependent on the Meadow-Charleston schedule, and any delays to that project would extend the overall delivery time for this crossing.

The combination of longer structure length, the need for Alma Street grade separation, major utility relocations, parcel acquisition requirements, constrained staging areas, and potential coordination with the Rail Grade Separation Project is anticipated to result in higher construction costs, potentially longer construction start time and an approximate construction duration of 24 months—longer than alternatives that avoid grade separating Alma Street.

Alternative D would have a minimal potential impact on the environment as it would not be anticipated to result in substantial increases in impervious areas, would not impact creeks or drainage, or sensitive habitats, and would have no impact on existing wetlands or parkland.

Design Variations. There are several design variations that may be considered for Alternative D, including:

- Increase ramp width, east side. The ramp on Alma Street could be increased from 12 feet to 16 or 20 feet wide to increase capacity and minimize potential for conflicts between people walking and biking. This design variation would require further reconfiguration of Alma Street and may require the narrowing or removal of vehicle travel lanes, increasing potential impacts to vehicle traffic.
- Increase ramp width, west side. The ramp connecting to Park Boulevard could be increased from 12 feet to 16 or 20 feet wide to increase capacity and minimize potential for conflicts between people walking and biking. This design variation may increase the number of parcels required, which would also increase opportunities to provide green infrastructure and open space.
- Decrease ramp slope and increase length, west side. The ramp slope could be reduced and the ramp lengthened to provide looser switchbacks, resulting in increased visibility around corners, improving opportunities for natural surveillance and reducing potential for conflicts between people walking and biking. This design variation would likely increase the number of parcels required, which would also increase opportunities to provide green infrastructure and open space.

[2] https://www.paloalto.gov/Departments/Transportation/Transportation-Projects/Rail-Grade-Separation

Evaluation. Table 5 presents the results of the analysis, evaluating the degree to which the alternative aligns with the design priorities and each of the selected evaluation criteria. Results are presented using a scale of high (black) indicating strong alignment to low (light gray) indicating weak alignment.

Table 5: Alternative D. Lindero Dr Tunnel Results

Evaluation Criteria	Alternative D
Neighborhood Accessibility	
Demand	
Facility Width and Capacity	
Crossing Length	
Crossing Elevation and Ramp Grade	
Pedestrian and Bicycle Comfort	
Personal Security	
Utility Impacts	
Construction Cost	
Construction Duration	
Operation and Maintenance Cost	
Public Space and Green Infrastructure	
Environmental Impacts	
Parcel Impacts	
Traffic, Parking and Driveway Impacts	

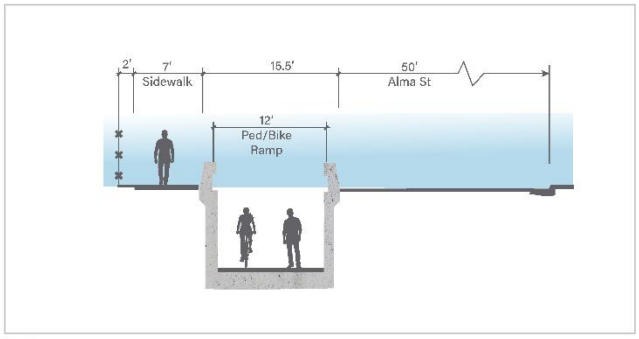
Notes: Alternatives are scored using design priorities and evaluation criteria developed in the previous project phase based on community input, engineering expertise, and professional judgement. A high (most desirable) score indicates stronger alignment with community values and a low (least desirable) score indicates weaker alignment. Note that the results of these evaluations are one of several considerations in the process of seeking locally preferred alternatives.

High (most desirable) **Low (least desirable)**

Alternative D: Lindero Dr Tunnel (Draft)

CITY OF PALO ALTO

1 Example 12' Wide Ramp at 7% Grade to Tunnel



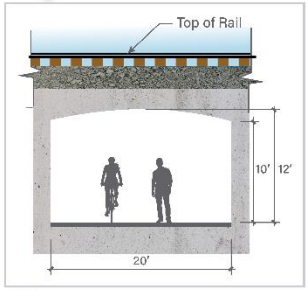
2 Section at 12' Wide Ramp

LEGEND

- CALTRAIN RIGHT OF WAY
- RAMP AND/OR STAIR STRUCTURE
- TUNNEL = 160 FT
- PARCEL IMPACTS
- POTENTIAL PARCEL IMPACTS
- BOLLARD
- STAIRS

* ALL DIMENSIONS AND DISTANCES ARE APPROXIMATE.

TOTAL CROSSING LENGTH = 570 FT
DISTANCE TO NEAREST NORTHERN CROSSING = 850 FT
DISTANCE TO NEAREST SOUTHERN CROSSING = 850 FT



3 Section Through Tunnel

4 Example of Switchback Ramp

Draft design concepts shown are preliminary and intended for discussion purposes only. All concepts are flexible and subject to refinement. Additional community engagement and technical design work will be needed once locations and basic design concepts have been decided.

E. Lindero Dr Tunnel with Alma St Signal

Description. Alternative E would construct a 100 foot long and 20 foot wide tunnel underneath the railroad tracks. Both ramps would be 12 feet wide with a 7% slope. The ramp on the east side would be 180 feet long. The ramp on the west side would be 230 feet long. The total crossing would be 510 feet long and would be the second shortest crossing distance of the eight alternatives.

The intersection of Alma Street/Lindero Drive would be realigned to a signalized T-intersection. A ramp would be constructed in the landscaping strip and extend in the north-south direction on the west side of Alma Street. The ramp would meet the tunnel and turn 90 degrees to cross under Alma Street and the railroad tracks and connect to the intersection of Park Boulevard at Robles Park using a combination of a curving ramp and stairs. This alternative would require the acquisition of one parcel on Park Boulevard and would reconfigure/extend the existing driveway on Lindero Drive at the northeast corner of the Alma Street/Lindero Drive intersection. It may require the removal of one existing on-street parking space on Park Boulevard.

Alternative E is located approximately 850 feet from the nearest northern crossing at Meadow Drive and 850 feet from the nearest southern crossing at Charleston Road. This alternative would provide a limited increase in access for people walking and biking as it is located immediately between the existing crossings at Meadow Drive and Charleston Road. The alternative would primarily attract bicycle trips that would use the lower stress crossing. Alternative E would result in the following estimated weekday trips:

- AM Peak Hour – about 50 peak hour trips (<10 walking trips and 40 biking trips)
- Daily – 570 daily trips (100 walking trips and 470 biking trips)

Similar to Alternative D, this conceptual design alternative would provide a direct connection to the existing bike route on Park Boulevard and would enhance connections to and through Robles Park. This alternative would also provide an enhanced bike connection on Lindero Drive from the signalized intersection at Alma Street to the existing bicycle routes on Starr King Circle, Redwood Circle, and Bryant Street. The proposed alignment would be fairly direct, though it does include one 90-degree turn, limiting visibility and opportunities for natural surveillance, and creating increased potential for conflicts between people walking and biking. On the east side of the railroad, stairs would provide a more direct path to Park Boulevard enabling pedestrians to avoid mixing with bicyclists for a portion of the crossing.

Alternative E involves tunneling beneath the Caltrain corridor, which would likely be constructed using a bore-and-jack method to minimize impacts to rail operations. This alternative would have a minimal potential impact on utilities and right-of-way, as no major underground utilities are located within the proposed crossing alignment. Overhead lines near Alma Street would require relocation based on available information. The tunnel would pass underneath the railroad tracks and would not encroach on Caltrain right-of-way at the surface level.

Alternative E overlaps with areas proposed for construction (subject to change) for the Rail Grade Separation Project at Meadow Drive and Charleston Road, specifically the Hybrid Alternative (including a mixed wall/column approach) currently under consideration, and would require close coordination to address potential changes in site conditions, available staging areas, and construction sequencing. This coordination could add cost risk and schedule impacts, depending on how the two projects interface. In

addition, if the Hybrid Alternative advances, construction of this alternative would need to be sequenced to follow completion of the Meadow-Charleston project. Both projects are located in the same physical area, making concurrent construction not feasible. As a result, the start of this Project would be directly dependent on the Meadow-Charleston schedule, and any delays to that project would extend the overall delivery time for this crossing.

Overall, Alternative E is expected to have lower construction costs and shorter durations than options requiring Alma Street grade separation, with an approximate construction duration of 18 months.

Alternative E would have a minimal potential impact on the environment as it would not be anticipated to result in substantial increases in impervious areas, would not impact creeks or drainage, or sensitive habitats, and would have no impact on existing wetlands or parkland.

Design Variations. There are several design variations that may be considered for Alternative E, including:

- Ramp configuration, east side. The ramp on Alma Street could be reconfigured to extend from the intersection to the south. This design variation would change the alignment and location of the tunnel to connect south of Robles Park and would impact one different parcel along Park Boulevard.
- Increase ramp width, east side. The ramp width on Alma Street could be increased from 12 feet to 16 or 20 feet wide to increase capacity and minimize potential for conflicts between people walking and biking. This design variation would require further reconfiguration of Alma Street and may require the narrowing or removal of vehicle travel lanes, increasing potential impacts to vehicle traffic.
- Increase ramp width, west side. The ramp connecting to Park Boulevard could be increased from 12 feet to 16 or 20 feet wide to increase capacity and minimize potential for conflicts between people walking and biking. This design variation may increase the number of parcels required, which would also increase opportunities to provide green infrastructure and open space.
- Decrease ramp slope and increase length, west side. The ramp slope could be reduced and the ramp lengthened to provide looser switchbacks, resulting in increased visibility around corners, improving personal security and reducing potential for conflicts between people walking and biking. This design variation would increase the number of parcels required, which would also increase opportunities to provide green infrastructure and open space.

Evaluation. Table 6 presents the results of the analysis, evaluating the degree to which the alternative aligns with the design priorities and each of the selected evaluation criteria. Results are presented using a scale of high (black) indicating strong alignment to low (light gray) indicating weak alignment.

Table 6: Alternative E. Lindero Dr Tunnel with Alma St Signal Results

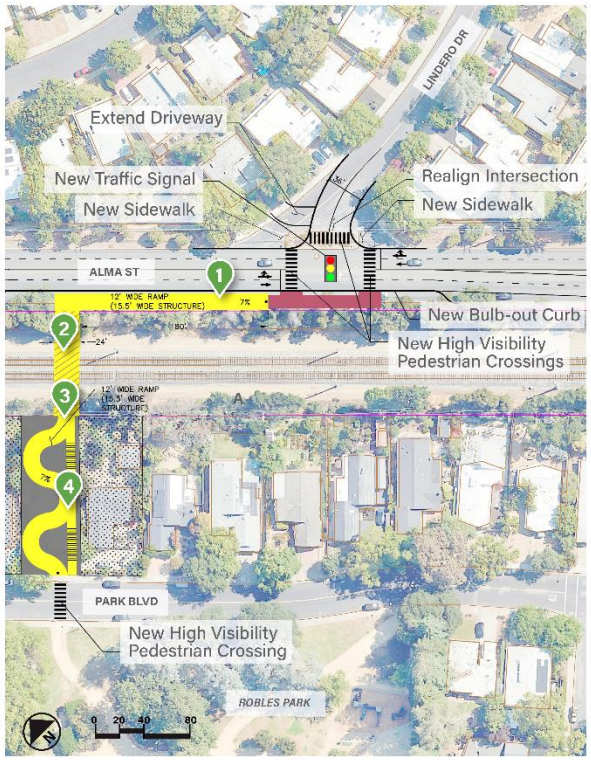
Evaluation Criteria	Alternative E
Neighborhood Accessibility	
Demand	
Facility Width and Capacity	
Crossing Length	
Crossing Elevation and Ramp Grade	
Pedestrian and Bicycle Comfort	
Personal Security	
Utility Impacts	
Construction Cost	
Construction Duration	
Operation and Maintenance Cost	
Public Space and Green Infrastructure	
Environmental Impacts	
Parcel Impacts	
Traffic, Parking and Driveway Impacts	

Notes: Alternatives are scored using design priorities and evaluation criteria developed in the previous project phase based on community input, engineering expertise, and professional judgement. A high (most desirable) score indicates stronger alignment with community values and a low (least desirable) score indicates weaker alignment. Note that the results of these evaluations are one of several considerations in the process of seeking locally preferred alternatives.

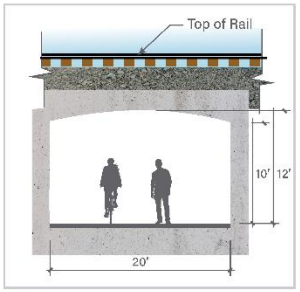
High (most desirable) **Low (least desirable)**

Alternative E: Lindero Dr Tunnel with Alma St Signal (Draft)

CITY OF PALO ALTO



1 Example 12' Wide Ramp at 7% Grade Parallel to Caltrain Tracks



2 Section Through Tunnel

3 Example 20' Wide and 10' High Tunnel (San Antonio Caltrain Station in Mountain View)

LEGEND

- CALTRAIN RIGHT OF WAY
- RAMP AND/OR STAIR STRUCTURE
- TUNNEL = 100 FT
- AT GRADE PATH
- PARCEL IMPACTS
- POTENTIAL PARCEL IMPACTS
- BOLLARD
- STAIRS
- TRAFFIC SIGNAL

* ALL DIMENSIONS AND DISTANCES ARE APPROXIMATE.

TOTAL CROSSING LENGTH = 510 FT
DISTANCE TO NEAREST NORTHERN CROSSING = 850 FT
DISTANCE TO NEAREST SOUTHERN CROSSING = 850 FT

4 Example of Switchback Ramp

Draft design concepts shown are preliminary and intended for discussion purposes only. All concepts are flexible and subject to refinement. Additional community engagement and technical design work will be needed once locations and basic design concepts have been decided.

F. Ely Pl Tunnel

Description. Alternative F would construct an 85 foot long and 20 foot wide tunnel underneath the railroad tracks. Both ramps would be 12 feet wide with a 7% slope. The ramp on the east side would be 180 feet long. The ramp on the west side would be 300 feet long. The total crossing would be 565 feet long.

A Pedestrian Hybrid Beacon would be installed at the intersection of Alma Street/Ely Place. A pathway and ramp would extend in the north-south direction along the landscaping strip on the west side of Alma Street, within Caltrain right-of-way. The alignment would turn 90 degrees to cross under the railroad tracks and connect to the intersection of Park Boulevard/Whitclem Drive using a combination of a curving ramp and stairs that would pass through one existing property and may impact one parking space.

Alternative F is located approximately 750 feet from the nearest northern crossing at Charleston Road and 3,600 feet from the nearest southern crossing at Mayfield Drive. This alternative would provide limited access improvements for walking and biking as it is located adjacent to the existing Charleston Road crossing. The alternative would result in the following estimated weekday trips:

- AM Peak Hour – 50 peak hour trips (10 walking trips and 40 biking trips)
- Daily – 680 daily trips (50 walking trips and 630 biking trips)

This alternative would enhance the bike connection on Ely Place to existing bike routes on Duncan Place and Carlson Court/Carlson Circle, on Whitclem Drive to existing routes on Wilkie Way, and on Park Boulevard to existing routes on Park Boulevard north of Charleston Road. The proposed alignment would include one 90-degree turn and tight switchbacks on the ramp abutting Adobe Creek, limiting visibility and opportunities for natural surveillance, and creating increased potential for conflicts between people walking and biking. On the east side of the railroad, stairs would provide a more direct path to Whitclem Drive/Park Boulevard enabling pedestrians to avoid mixing with bicyclists for a portion of the crossing.

Alternative F proposes a short tunnel beneath the Caltrain corridor, with limited available right-of-way for the required parallel ramp connection to Alma Street. Due to the constrained site conditions, the ramp structure would need to be located within Caltrain right-of-way. This would require obtaining a variance from the Caltrain Board, a process that introduces additional coordination requirements and approval uncertainty, as there is no guarantee that the variance would be granted. The outcome and timing of this process could affect both the overall cost and the construction schedule.

The tunnel portion beneath the Caltrain tracks would likely be constructed using a bore-and-jack method to minimize impacts to rail operations. This conceptual design alternative would have a minimal potential impact on utilities, with the exception of an existing gas line along Alma Street. The tunnel would pass underneath the railroad tracks but would require a ramp structure within the Caltrain right-of-way to connect at Alma Street. In addition, a full acquisition would be required on Park Boulevard to accommodate the new tunnel approach pathway. While the alignment does not pass beneath Alma Street, its proximity to the corridor still requires careful coordination to manage potential traffic and utility impacts during construction.

Alternative F overlaps with areas proposed for construction (subject to change) for the Rail Grade Separation Project at Meadow Drive and Charleston Road, specifically the Hybrid Alternative (including a

mixed wall/column approach) currently under consideration, and would require close coordination to address potential changes in site conditions, available staging areas, and construction sequencing. This coordination could add cost risk and schedule impacts, depending on how the two projects interface. In addition, if the Hybrid Alternative advances, construction of this alternative would need to be sequenced to follow completion of the Meadow-Charleston project. Both projects are located in the same physical area, making concurrent construction not feasible. As a result, the start of this Project would be directly dependent on the Meadow-Charleston schedule, and any delays to that project would extend the overall delivery time for this crossing.

If the Caltrain variance is approved, the approximate construction duration for this alternative would be 18 months.

Alternative F would have a minimal potential impact on the environment as it would not be anticipated to result in substantial increases in impervious areas, would not substantially impact creeks or drainage, or sensitive habitats, and would have no impact on existing wetlands or parkland.

Design Variations. There are several design variations that may be considered for Alternative F, including:

- Crossing alignment. The pedestrian crossing could be relocated to the north side of the Alma Street/Ely Place intersection and relocated to tie in at Whitclem Drive/Park Boulevard. This design variation may require additional parcel acquisitions on Park Boulevard.
- Ramp configuration, east side. The ramp on Alma Street could be reconfigured to extend from the intersection to the north. This design variation would change the alignment and location of the tunnel and ramps to connect within 500 feet of the intersection of Alma Street/Charleston Road, which would likely reduce the benefits to accessibility resulting in lower estimated demand.
- Increase ramp width, east side. The ramp width on Alma Street could be increased from 12 feet to 16 or 20 feet wide to increase capacity and minimize potential for conflicts between people walking and biking. This design variation would require further reconfiguration of Alma Street and may require the narrowing or removal of vehicle travel lanes, increasing potential impacts to vehicle traffic. This design variation would continue to impact Caltrain right-of-way.
- Shift ramp, east side. The path and ramp on the east side of Alma Street could be shifted to the north to avoid encroaching on Caltrain right-of-way. This design variation would require reconfiguration of Alma Street and would require the removal of vehicle travel lanes.
- Increase ramp width, west side. The ramp connecting to Park Boulevard/Whitclem Drive could be increased from 12 feet to 16 or 20 feet wide. This design variation may increase the number of parcels required, which would also increase opportunities to provide green infrastructure.
- Decrease ramp slope and increase length, west side. The ramp slope could be reduced and the ramp lengthened to provide looser switchbacks, resulting in increased visibility around corners, improving personal security and reducing potential for conflicts. This design variation would increase the number of parcels required.

Evaluation. Table 7 presents the results of the analysis, evaluating the degree to which the alternative aligns with the design priorities and each of the selected evaluation criteria. Results are presented using a scale of high (black) indicating strong alignment to low (light gray) indicating weak alignment.

Table 7: Alternative F. Ely Pl Tunnel Results

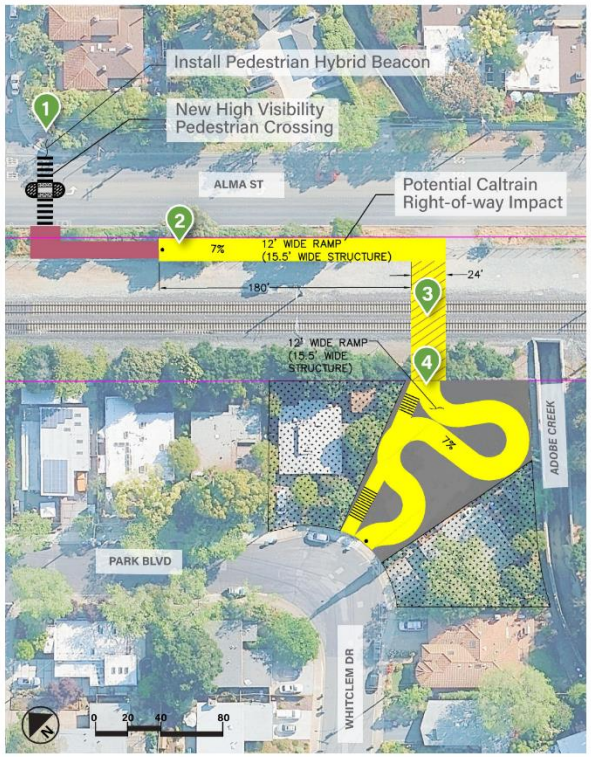
Evaluation Criteria	Alternative F
Neighborhood Accessibility	
Demand	
Facility Width and Capacity	
Crossing Length	
Crossing Elevation and Ramp Grade	
Pedestrian and Bicycle Comfort	
Personal Security	
Utility Impacts	
Construction Cost	
Construction Duration	
Operation and Maintenance Cost	
Public Space and Green Infrastructure	
Environmental Impacts	
Parcel Impacts	
Traffic, Parking and Driveway Impacts	

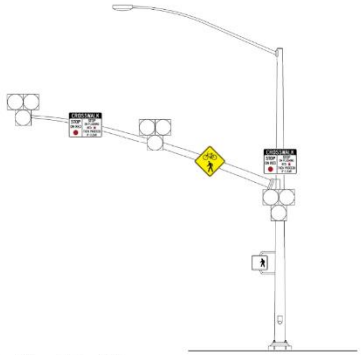
Notes: Alternatives are scored using design priorities and evaluation criteria developed in the previous project phase based on community input, engineering expertise, and professional judgement. A high (most desirable) score indicates stronger alignment with community values and a low (least desirable) score indicates weaker alignment. Note that the results of these evaluations are one of several considerations in the process of seeking locally preferred alternatives.

High (most desirable) **Low (least desirable)**

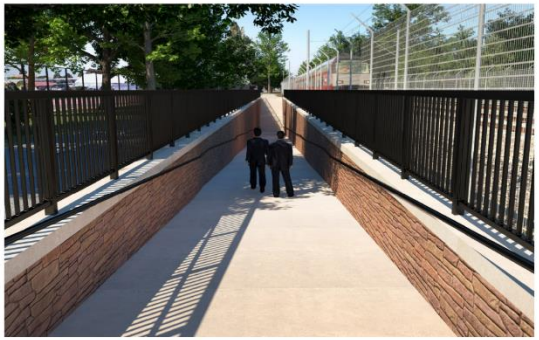
Alternative F: Ely Pl Tunnel (Draft)

CITY OF PALO ALTO





1 Pedestrian Hybrid Beacon



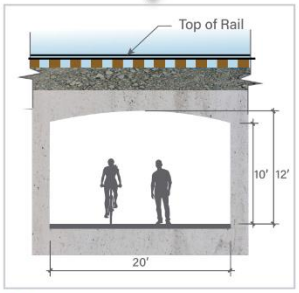
2 Example 12' Wide Ramp at 7% Grade Parallel to Caltrain Tracks

LEGEND

- CALTRAIN RIGHT OF WAY
- RAMP AND/OR STAIR STRUCTURE
- TUNNEL = 85 FT
- AT GRADE PATH
- PARCEL IMPACTS
- POTENTIAL PARCEL IMPACTS
- BOLLARD
- STAIRS

* ALL DIMENSIONS AND DISTANCES ARE APPROXIMATE.

TOTAL CROSSING LENGTH = 565 FT
DISTANCE TO NEAREST NORTHERN CROSSING = 760 FT
DISTANCE TO NEAREST SOUTHERN CROSSING = 3600 FT



3 Section Through Tunnel

4 Example 20' Wide and 10' High Tunnel (San Antonio Caltrain Station in Mountain View)

Draft design concepts shown are preliminary and intended for discussion purposes only. All concepts are flexible and subject to refinement. Additional community engagement and technical design work will be needed once locations and basic design concepts have been decided.

G. Ferne Ave Tunnel

Description. This alternative would require further coordination with Mountain View as the majority of the Project would be constructed within Mountain View. For purposes of the analysis, assumptions were made about specific design elements, including ramp configuration and alignment. These are described in this section and are subject to change pending community input and coordination on design elements within Mountain View.

Alternative G would construct an 85 foot long and 20 foot wide tunnel underneath the railroad tracks. Both ramps would be 12 feet wide with a 7% slope. The ramp on the east side would be 180 feet long. The ramp on the west side would be 280 feet long. The total crossing would be 545 feet long.

The intersection of Alma Street/Ferne Avenue would be reconfigured with a new traffic signal. A ramp would extend north-south along the landscaping strip on the west side of Alma Street, within Caltrain right-of-way. The alignment would turn 90 degrees to cross under the railroad tracks and then turn back another 90 degrees to connect Del Medio Avenue via a ramp and path running alongside Caltrain right-of-way.

Alternative G is located approximately 2,650 feet from the nearest northern crossing at Charleston Road and 1,950 feet from the nearest southern crossing at Mayfield Drive. This conceptual design alternative would provide increased access for the areas of Palo Alto immediately north of San Antonio Avenue, as the tunnel at Mayfield Avenue is not easily accessed from south of San Antonio Avenue and is more likely to serve trips starting and ending in Mountain View. The alternative would result in the following estimated weekday trips:

- AM Peak Hour – 190 peak hour trips (50 walking trips and 140 biking trips)
- Daily – 2,510 daily trips (460 walking trips and 2,050 biking trips)

This conceptual design alternative would enhance connections on Ferne Avenue to existing bike routes on Mackay Drive and Shasta Drive and on Del Medio Avenue to existing routes at Miller Avenue. The proposed alignment would include two 90-degree turns, limiting visibility and opportunities for natural surveillance, and creating increased potential for conflicts between people walking and biking.

Alternative G proposes an underpass beneath the Caltrain corridor constructed using a bore-and-jack method to minimize impacts to rail operations. The alternative would also require a ramp structure within the Caltrain right-of-way to conform at Alma Street. In addition, partial property acquisition was assumed to be required in Mountain View, to accommodate the ramp structure and the at-grade pathway connecting to Del Medio Avenue.

Alternative G would have a minimal potential impact on utilities, with the exception of an existing gas line along Alma Street. Utility conflicts within Caltrain right-of-way or near the tunnel approaches would need to be addressed during design. Any use of Caltrain property, including the longitudinal ramp segment, would require additional coordination, including securing variances that must be approved by the Caltrain Board. This process introduces cost and schedule risk, as approval is not guaranteed and could add procedural steps and review cycles.

The location falls within the City of Mountain View, requiring additional coordination that may introduce further permitting steps, review cycles, and staging considerations. Overall, the combination of Caltrain

variance requirements, property acquisition needs, and multi-jurisdictional review is anticipated to add complexity compared to tunnel alternatives without these constraints. If Caltrain approvals are secured and coordination proceeds without significant delays, the approximate construction duration for this alternative would be 18 months.

Alternative G would have a minimal potential impact on the environment as it would not be anticipated to result in substantial increases in impervious areas, would not substantially impact creeks or drainage, or sensitive habitats, and would have no impact on existing wetlands or parkland.

Design Variations. There are several design variations that may be considered for Alternative G, including:

- Traffic control. A Pedestrian Hybrid Beacon could be installed instead of a traffic signal. This design variation would require people to activate the device before crossing, which may reduce delays to vehicle traffic but would be less convenient for people walking and biking.
- Alignment. The ramp on Alma Street could be configured to extend from the intersection at Ferne Avenue to the north or to the south before turning 90 degrees to tunnel underneath the railroad and turn 90 degrees to the north or south to ramp along the backside of existing parcels in Mountain View. These design variations would change the alignment and location of the tunnel and ramps, which would impact different properties and would change impacts to parking.
- Shift ramp and construct additional crosswalk, east side. The ramp on the east side of Alma Street could be shifted to the north and a new crosswalk installed on the north side of the intersection to facilitate bicycle and pedestrian movements on both sides of the intersection. This design variation would require additional path construction which would increase construction cost.
- Shift ramp, east side. The path and ramp on the east side of Alma Street could be shifted to the north to avoid encroaching on Caltrain right-of-way. This design variation would require reconfiguration of Alma Street and removal of vehicle travel lanes.
- Increase ramp width, east side. The ramp width on Alma Street could be increased from 12 feet to 16 or 20 feet wide. This design variation would require further reconfiguration of Alma Street and may require the narrowing or removal of vehicle travel lanes.
- Increase ramp and path width, west side. The ramp and path width on the west side of the railroad could be increased from 12 feet to 16 or 20 feet wide to increase capacity and minimize potential for conflicts between people walking and biking. This design variation would require additional right-of-way, increasing potential impacts to existing vehicle parking.

Evaluation. Table 8 presents the results of the analysis, evaluating the degree to which the alternative aligns with the design priorities and each of the selected evaluation criteria. Results are presented using a scale of high (black) indicating strong alignment to low (light gray) indicating weak alignment.

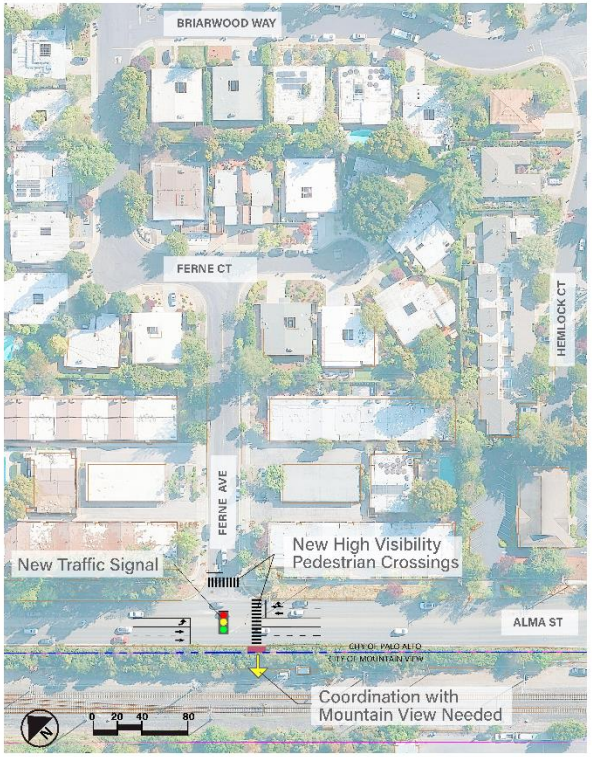
Table 8: Alternative G. Ferne Ave Tunnel Results

Evaluation Criteria	Alternative G
Neighborhood Accessibility	
Demand	
Facility Width and Capacity	
Crossing Length	
Crossing Elevation and Ramp Grade	
Pedestrian and Bicycle Comfort	
Personal Security	
Utility Impacts	
Construction Cost	
Construction Duration	
Operation and Maintenance Cost	
Public Space and Green Infrastructure	
Environmental Impacts	
Parcel Impacts	
Traffic, Parking and Driveway Impacts	

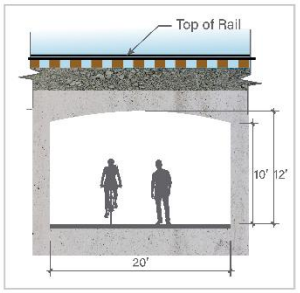
Notes: Alternatives are scored using design priorities and evaluation criteria developed in the previous project phase based on community input, engineering expertise, and professional judgement. A high (most desirable) score indicates stronger alignment with community values and a low (least desirable) score indicates weaker alignment. Note that the results of these evaluations are one of several considerations in the process of seeking locally preferred alternatives.

Alternative G: Ferne Ave Tunnel (Draft)

CITY OF PALO ALTO

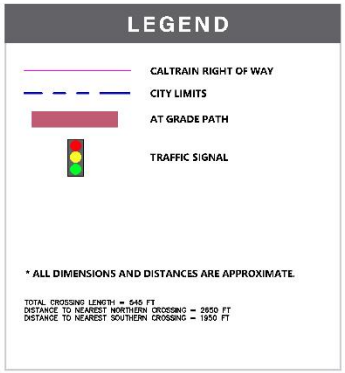


Example 12' Wide Ramp at 7% Grade Parallel to Caltrain Tracks



Example Section Through Tunnel

Example 20' Wide and 10' High Tunnel (San Antonio Caltrain Station in Mountain View)



Example Pathway Through a Parking Lot (Caltrain Bike Path in Palo Alto)

Draft design concepts shown are preliminary and intended for discussion purposes only. All concepts are flexible and subject to refinement. Additional community engagement and technical design work will be needed once locations and basic design concepts have been decided.

H. San Antonio Bridge Enhancements

Description. This alternative would require further coordination with Mountain View as the Project extends into Mountain View. For purposes of the analysis, assumptions were made about specific design elements, such as the connection at California Street/San Antonio Road. These are described in this section and are subject to change pending community input and coordination on design elements within Mountain View.

Alternative H would install a 10-foot-wide center-running two-way separated bike lane along San Antonio Road connecting from Nita Avenue to California Street in Mountain View. Installation would not impact lane number and would be accomplished by reducing travel lane widths on San Antonio Road to two 10.5 foot wide lanes and one 11 foot wide lane in each direction. This alternative would also enhance the existing connection for people walking and biking along San Antonio Avenue to the San Antonio Caltrain Station and tunnel at Mayfield Avenue by installing a Class II bicycle facility on San Antonio Avenue with crossbike markings[3] at the intersection of Alma Street/San Antonio Avenue and widening and improving the existing sidewalk/shared use path on the west side of Alma Street, between San Antonio Avenue and Mayfield Avenue.

Alternative H would modify existing crossings at San Antonio Road and at Mayfield Drive and would not construct a new tunnel crossing as in the other alternatives. The alternative would improve conditions for people biking by creating a dedicated crossing of the train tracks along San Antonio Road and by creating bike crossings across San Antonio Road. The alternative would result in an estimated 190 AM peak hour and 2,640 daily bicycle trips. The estimate only included bike trips that travel along San Antonio Road to cross train tracks. Pedestrian trips were not included as pedestrians would cross via the existing tunnel.

Alternative H proposes the most straightforward construction methods given all improvements are at the roadway surface and additional grade separations are not proposed. As a result, there are minimal potential impacts to utilities as no major above- or under-ground utilities are located within the proposed crossing alignment. The alternative proposes to enhance the existing sidewalk on/along Alma Street and may impact Caltrain right-of-way. In general, the overall construction duration is anticipated to be approximately 12 months. Since this alternative does not involve new subsurface structures or significant structural modification, it is assumed that no seismic upgrades would be required, consistent with standard practice.

Alternative H would not require tunneling and therefore would have a minimal potential impact on the environment. It would not be anticipated to result in substantial increases in impervious areas, would not impact creeks or drainage, or sensitive habitats, and would have no impact on existing wetlands or parkland.

Design Variations. There are several design variations that may be considered for Alternative H, including:

- Increase bike lane width. The width of the proposed center-running two-way separated bike lane could be increased from 10 feet to 12 feet wide to increase capacity and minimize potential for

[3] Crossbike markings are a paint treatment that uses green paint to make a crosswalk-like stripes at intersections to illustrate where there is potential conflict between people biking and motor vehicle.

conflicts between people biking in opposite directions. This design variation would require further reconfiguration of San Antonio Road and would require the narrowing or removal of vehicle travel lanes, increasing potential impacts to vehicle traffic.

- Install shared use path. The width of the proposed center-running two-way separated bike lane could be increased from 10-feet to 12- or 14-feet wide to increase provide sufficient space for a shared use path for pedestrians and bicyclists. This design variation would require further reconfiguration of San Antonio Road and would require the narrowing or removal of vehicle travel lanes, increasing potential impacts to vehicle traffic.

Evaluation. Table 9 presents the results of the analysis, evaluating the degree to which the alternative aligns with the design priorities and each of the selected evaluation criteria. Results are presented using a scale of high (black) indicating strong alignment to low (light gray) indicating weak alignment.

Table 9: Alternative H. San Antonio Bridge Enhancements Results

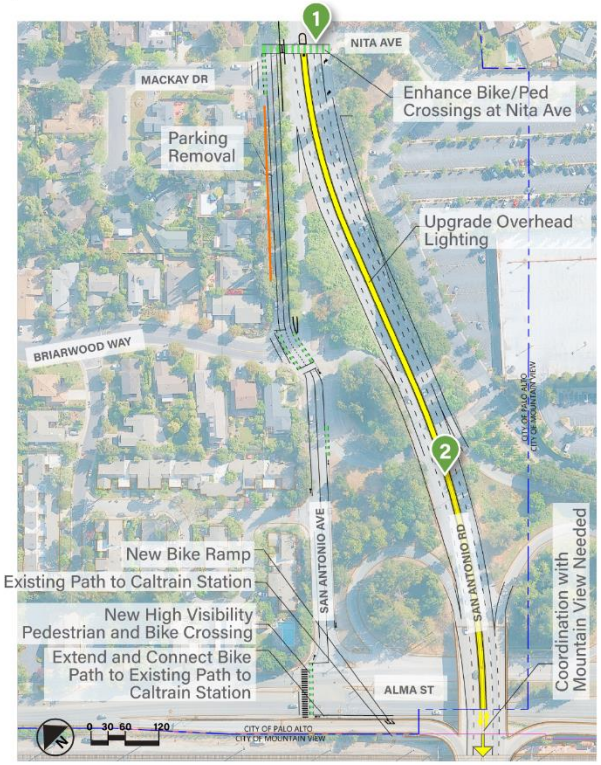
Evaluation Criteria	Alternative H
Neighborhood Accessibility	
Demand	
Facility Width and Capacity	
Crossing Length	
Crossing Elevation and Ramp Grade	
Pedestrian and Bicycle Comfort	
Personal Security	
Utility Impacts	
Construction Cost	
Construction Duration	
Operation and Maintenance Cost	
Public Space and Green Infrastructure	
Environmental Impacts	
Parcel Impacts	
Traffic, Parking and Driveway Impacts	

Notes: Alternatives are scored using design priorities and evaluation criteria developed in the previous project phase based on community input, engineering expertise, and professional judgement. A high (most desirable) score indicates stronger alignment with community values and a low (least desirable) score indicates weaker alignment. Note that the results of these evaluations are one of several considerations in the process of seeking locally preferred alternatives.

High (most desirable) **Low (least desirable)**

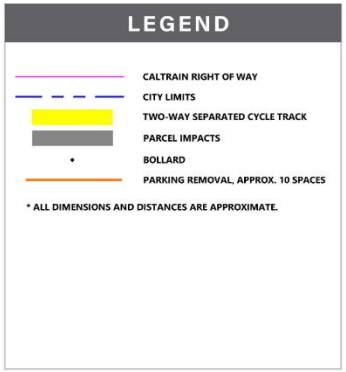
Alternative H: San Antonio Bridge Enhancements (Draft)

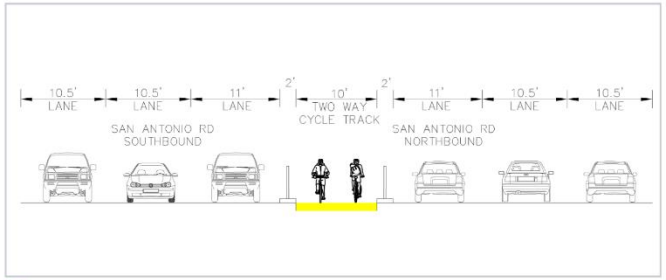
CITY OF PALO ALTO



1 Example of Intersection that Transitions from Side-Running to Center-Running Bike Lanes (Monterey, CA)

1 Example of Two-Way Cycle Track at the Median (N. Fremont St in Monterey, CA)





2 Section through San Antonio Rd

Draft design concepts shown are preliminary and intended for discussion purposes only. All concepts are flexible and subject to refinement. Additional community engagement and technical design work will be needed once locations and basic design concepts have been decided.

Evaluation Summary

The team completed a technical evaluation of the alternatives, considering each of the crossing options and the corresponding community connections. Table 10 present the results of this Alternatives Analysis used to evaluate the degree to which the preliminary conceptual design alternatives align with the design priorities and each of the selected evaluation criteria, using a scale of high (black) indicating strong alignment to low (light gray) indicating weak alignment.

Table 10: Evaluation Criteria Results Summary

Evaluation Criteria	A. El Dorado Ave Tunnel	B. Loma Verde Ave Tunnel	C. Loma Verde Ave Tunnel with Alma St Signal	D. Lindero Dr Tunnel	E. Lindero Dr Tunnel with Alma St Signal	F. Ely Place Tunnel	G. Ferne Ave Tunnel	H. San Antonio Bridge Enhancements
Neighborhood Accessibility								
Demand								
Facility Width and Capacity								
Crossing Length								
Crossing Elevation & Ramp Grade								
Pedestrian and Bike Comfort								
Personal Security								
Utility Impacts								
Construction Cost								
Construction Duration								
Operation and Maintenance Cost								
Public Space								
Environmental Impacts								
Parcel Impacts								
Traffic, Parking, and Driveways								

Notes: Alternatives are scored using design priorities and evaluation criteria developed in the previous project phase based on community input, engineering expertise, and professional judgement. A high (most desirable) score indicates stronger alignment with community values and a low (least desirable) score indicates weaker alignment. Note that the results of these evaluations are one of several considerations in the process of seeking locally preferred alternatives.

High (most desirable) **Low (least desirable)**

Neighborhood Accessibility. Alternatives A, B, and C provide the greatest increase in accessibility and would close the largest gap in distance between crossings. Alternative D and E would provide the lowest reduction to travel times to crossings.

Demand. Alternatives A, B, C, G and H are estimated to attract the greatest number of bike and pedestrian users. Alternatives D, E, and F are expected to attract the fewest users.

Facility Width and Capacity. Facility width and capacity would be similar across alternatives, with the exception of Alternative H, which would construct a narrower 10 foot wide two-way separated bike lane compared to the 20 foot wide tunnel and 12 foot wide ramps proposed for other alternatives.

Crossing Length. Alternative H would utilize existing crossings and would not reduce the distance to cross relative to existing conditions. Alternative A would have the shortest crossing length but would require some out of direction travel along the crossing alignment, while Alternative B would have the longest crossing length but would provide the most direct connections to the existing bike network.

Crossing Elevation and Ramp Grade. Alternatives would perform the same with respect to crossing elevation and ramp grade. Alternatives A through G propose ramps constructed with a 7% slope. Alternative H would enhance connections to the existing tunnel at the San Antonio Caltrain Station near Mayfield Drive, which is constructed at the same depth and with similar ramping as the other alternatives.

Pedestrian and Bicyclist Comfort. Alternative B would provide the greatest level of pedestrian and bicyclist comfort to and through the tunnel, as it would create a low-stress connection across Alma Street and the Caltrain tracks and would provide the most direct and comfortable connections to existing bicycle and pedestrian facilities.

Personal Security. While all alternatives were designed with consideration for Crime Prevention Through Environmental Design (CPTED) principles, and relevant safety standards and design practices, Alternative B would rank the highest, providing the greatest level of visibility and opportunities for natural surveillance because of the shorter and more direct tunnels and use of the existing bridge structure. Alternative F and G would be least desirable as a result of the number of 90-degree turns and ramp access locations in less active areas.

Utility Impacts. Alternative H would have the least impact on utilities, except for the overhead lighting in the center median on San Antonio Road. Alternatives B and D would have the greatest potential impact, requiring relocation of existing utilities within the roadway to outside of the proposed tunnel limits.

Construction Cost. Alternatives B and D are projected to be the most expensive to build, while Alternative H would have the lowest estimated construction cost.

Construction Duration. Alternatives A, B, and C are anticipated to have the shortest construction duration and earliest possible construction start time since they are outside proposed construction limits (subject to change) for the Rail Grade Separation Project. Alternatives G and H are also anticipated to have shorter construction durations and start times but require additional coordination with the City of Mountain View and other agencies that may extend overall durations.

Operations and Maintenance Cost. Alternatives B and D would be anticipated to have the highest operations and maintenance costs, while Alternative H would have the lowest operations and maintenance costs.

Public Space and Green Infrastructure. Alternatives D and E provide more opportunities for landscaping, benches, and bio-retention in new plaza areas. Alternatives C and F would have the least potential to improve existing public space or provide new green infrastructure.

Environmental Impacts. Alternative H would have a minimal potential impact on the environment as it would not require tunneling, would not result in substantial increases in impervious areas, would not impact creeks or drainage, or sensitive habitats, and would have no impact on existing wetlands or parkland.

Parcel Impacts. Alternatives A, G and H are anticipated to impact (either fully or partially) the fewest number of parcels, while Alternative D, E, and F are projected to fully impact one parcel. Alternatives B and C are estimated to impact two parcels.

Traffic, Parking, and Driveway Impacts. Alternatives D and H would have the least potential to increase vehicle delays, reduce parking availability, or affect driveway access compared to other alternatives.

ATTACHMENTS

ATTACHMENT A. INITIAL SCREENING MEMORANDUM

ATTACHMENT B. EVALUATION CRITERIA AND ANALYSIS METHODOLOGY

ATTACHMENT C. ACCESSIBILITY ANALYSIS MAPS

ATTACHMENT A. INITIAL SCREENING MEMORANDUM

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September 2, 2025

SOUTH PALO ALTO BIKE/PED CONNECTIVITY

ATTACHMENT A – ALTERNATIVES DEVELOPMENT & INITIAL SCREENING MEMORANDUM

The City of Palo Alto is conducting the South Palo Alto Bike/Ped Connectivity Project ("Project") to assess ways to improve bicycle and pedestrian access across the rail corridor in the southern portion of the City. To improve bicycle and pedestrian connectivity and in support of the City's mobility and sustainability goals, this Project will identify locations and design concepts where two new grade-separated bicycle and pedestrian crossings of the Caltrain corridor in south Palo Alto (south of Oregon Expressway) may be constructed.

This memorandum describes the process used to develop and identify the eight crossing design concept options ("alternatives") in southern Palo Alto for further development and evaluation as part of this Project. The alternatives identification and initial screening process consisted of the following three steps:

1. Identify comprehensive list of potential crossing locations and designs
2. Apply initial screening criteria
3. Select eight alternatives for evaluation and feedback

Each step is discussed further in the following sections.

Step 1: Identify Potential Crossing Locations and Designs

The first step in the development of eight alternatives was identifying the full range of crossing alignments and potential design options. A total of 27 potential design alternatives were identified. These alternatives consider crossing opportunity locations (or facility alignment) and facility type (e.g., bridge or tunnel). Designs that would involve minor variations or shifts in alignment were not considered as part of the initial screening, since minor changes in alignment would not meaningfully affect their performance. The list of potential crossing locations and designs that were considered during initial screening are presented in Table 1.

Step 2: Apply Initial Screening

The purpose of the initial screening is to narrow down the list of potential crossing locations and designs. The criteria for the initial screening aligns with the Project goals and objectives and community values, and is intended to systematically and objectively identify reasonable alternatives by screening out

unreasonable alternatives. There are three primary reasons why an alternative might be eliminated from further consideration:

1. The alternative does not satisfy the Project goals and design priorities in support of Council approved plans and direction
2. The alternative is determined to be not practical or feasible from a technical, environmental, and/or economic standpoint
3. The alternative substantially duplicates another alternative and offers little to no advantage and it has impacts and/or costs that are similar to or greater than that of the similar alternative(s)

Crossing locations and designs that were determined to not satisfy the Project and design priorities are not carried forward for further refinement and analysis. For example, overpasses (i.e., bridges) were removed from consideration as these structures require long and high spans to clear the Caltrain catenary system (i.e., overhead wires) making them costly and not as attractive or comfortable to use as a pedestrian or cyclist. The results of the initial screening are presented in Table 1 below.

Step 3: Select Alternatives for Evaluation

Table 2 lists the crossing locations and designs identified in the initial screening process (Step 2) above, describes potential design variations, and identifies the alternatives selected for further evaluation based on the Project goals, design priorities, and Council approved plans and direction. Eight preliminary conceptual design alternatives were selected for further development and evaluation as part of the Alternatives Analysis and are listed below:

- Alternative A: El Dorado Ave Tunnel
- Alternative B: Loma Verde Ave Tunnel
- Alternative C: Loma Verde Ave Tunnel with Alma St Signal
- Alternative D: Lindero Dr Tunnel
- Alternative E: Lindero Dr Tunnel with Alma St Signal
- Alternative F: Ely Pl Tunnel
- Alternative G: Ferne Ave Tunnel
- Alternative H: San Antonio Bridge Enhancements

Design concepts presented in the Alternatives Analysis are preliminary and intended for discussion purposes only. All concepts are flexible and subject to refinement. Additional community engagement, technical design work, and agency coordination will be needed once locations and basic design concepts have been decided.

Table 1: Potential Crossing Locations and Design Options

Crossing Location		Facility Type (Bridge, Tunnel)	Carried Forward? (Yes, No)	Notes
Colorado Ave	Page Mill Rd	Bridge	No	Bridge structures would require long and high spans to clear the Caltrain railroad tracks and overhead catenary system making them costly and less comfortable to use as a pedestrian or cyclist.
Colorado Ave	Page Mill Rd	Tunnel	No	Wider section of Alma Street and sloping exit ramp creates challenges for tunnel structure and would require deeper and longer ramp and tunnel sections.
El Dorado Ave	Park Blvd	Bridge	No	Bridge structures would require long and high spans to clear the Caltrain railroad tracks and overhead catenary system making them costly and less comfortable to use as a pedestrian or cyclist.
El Dorado Ave	Park Blvd	Tunnel	Yes	
El Dorado Ave	Park Blvd (City-Owned Substation)	Bridge	No	Bridge structures would require long and high spans to clear the Caltrain railroad tracks and overhead catenary system making them costly and less comfortable to use as a pedestrian or cyclist. Limited right-of-way available for pathway in/near City-owned Alma Street substation due to challenges moving/consolidating electrical equipment and desire to preserve space for utility maintenance, future growth, and safety.
El Dorado Ave	Park Blvd (City-Owned Substation)	Tunnel	No	Limited right-of-way available for pathway in/near City-owned Alma Street substation due to challenges moving/consolidating electrical equipment and desire to preserve space for utility maintenance, future growth, and safety.
Matadero Creek	Park Blvd (City-Owned Substation)	Tunnel	No	Insufficient right-of-way along Matadero Creek. Would require tunneling and impacts to environmentally sensitive area. Limited right-of-way available for pathway in/near City-owned Alma Street substation due to challenges moving/consolidating electrical equipment and desire to preserve space for utility maintenance, future growth, and safety.
El Carmelo Ave	Park Blvd/Chestnut Ave	Bridge	No	Bridge structures would require long and high spans to clear the Caltrain railroad tracks and overhead catenary system making them costly and less comfortable to use as a pedestrian or cyclist.

Crossing Location		Facility Type (Bridge, Tunnel)	Carried Forward? (Yes, No)	Notes
El Carmelo Ave	Park Blvd/Chestnut Ave	Tunnel	No	Constraints identified near Matadero Creek.
Loma Verde Ave	Park Blvd/Margarita Ave	Bridge	No	Bridge structures would require long and high spans to clear the Caltrain railroad tracks and overhead catenary system making them costly and less comfortable to use as a pedestrian or cyclist.
Loma Verde Ave	Park Blvd/Margarita Ave	Tunnel	**Yes**	
El Verano Ave	Park Blvd/Curtner Ave-Ventura Ave	Bridge	No	Bridge structures would require long and high spans to clear the Caltrain railroad tracks and overhead catenary system making them costly and less comfortable to use as a pedestrian or cyclist.
El Verano Ave	Park Blvd/Curtner Ave-Ventura Ave	Tunnel	No	Constraints due to narrow roadway width of El Verano and frequent driveway spacing on Alma Street.
W Meadow Dr			No	Constructing a bike/ped crossing here would duplicate efforts with the Rail Grade Separation Project at Meadow Drive and Charleston Road.
Lindero Dr	Park Blvd (Robles Park)	Bridge	No	Bridge structures would require long and high spans to clear the Caltrain railroad tracks and overhead catenary system making them costly and less comfortable to use as a pedestrian or cyclist.
Lindero Dr	Park Blvd (Robles Park)	Tunnel	**Yes**	
W Charleston Rd			No	Constructing a bike/ped crossing here would duplicate efforts with the Rail Grade Separation Project at Meadow Drive and Charleston Road.
Ely Pl	Park Blvd/Edlee Ave	Bridge	No	Bridge structures would require long and high spans to clear the Caltrain railroad tracks and overhead catenary system making them costly and less comfortable to use as a pedestrian or cyclist.
Ely Pl	Whitclem Dr	Tunnel	**Yes**	
Adobe Creek	Park Blvd/Whitclem Dr-Monroe Dr	Tunnel	No	Insufficient right-of-way along Adobe Creek. Would require tunneling and impacts to environmentally sensitive area.

Crossing Location		Facility Type (Bridge, Tunnel)	Carried Forward? (Yes, No)	Notes
Greenmeadow Way	Monroe Dr	Bridge	No	Bridge structures would require long and high spans to clear the Caltrain railroad tracks and overhead catenary system making them costly and less comfortable to use as a pedestrian or cyclist.
Greenmeadow Way	Monroe Dr	Tunnel	No	Lack of direct bicycle and pedestrian connections, and limited right-of-way that would require substantial parcel acquisition.
Hemlock Ct	Del Medio Ave	Bridge	No	Bridge structures would require long and high spans to clear the Caltrain railroad tracks and overhead catenary system making them costly and less comfortable to use as a pedestrian or cyclist.
Hemlock Ct	Del Medio Ave	Tunnel	No	Lack of direct bicycle and pedestrian connections, and limited right-of-way that would require substantial parcel acquisition.
San Antonio Ave Frontage		Bridge	No	Bridge structures would require long and high spans to clear the Caltrain railroad tracks and overhead catenary system making them costly and less comfortable to use as a pedestrian or cyclist.
San Antonio Ave		Tunnel	**Yes**	Enhance bike and pedestrian connections to existing tunnel located nearby at San Antonio Caltrain Station.
San Antonio Road		Bridge	**Yes**	Consider use of existing overpass structure.

Table 2: Selected Alternatives for Evaluation

Crossing Location		Facility Type (Bridge, Tunnel)	Description	Alternative Selected for Evaluation? (Yes, No)
East Side	West Side			
El Dorado	Park Blvd	Tunnel	Two ramps along west side of Alma Street connecting to Park Blvd through an existing surface parking lot.	**Yes**
Loma Verde Ave	Park Blvd at Margarita Ave	Tunnel	Center running straight ramp along Loma Verde connecting to Park Blvd at Margarita Ave with tight switchbacks.	No
Loma Verde Ave	Park Blvd at Margarita Ave	Tunnel	Ramp along Loma Verde WB landscaping strip and curb lane connecting to Park Blvd at Margarita Ave with tight switchbacks.	No
Loma Verde Ave	Park Blvd at Margarita Ave	Tunnel	Ramp along southeast side of Alma connecting to Park Blvd at Margarita Ave with tight switchbacks.	No
Loma Verde Ave	Park Blvd at Margarita Ave	Tunnel	Ramp along Alma Street NB landscaping strip connecting to Park Blvd at Margarita Ave with tight switchbacks.	No
Loma Verde Ave	Park Blvd at Margarita Ave	Tunnel	Center running straight ramp along Loma Verde connecting to Park Blvd at Margarita Ave with curves and connecting staircase.	**Yes**
Loma Verde Ave	Park Blvd at Margarita Ave	Tunnel	Ramp along Loma Verde WB connecting to Park Blvd at Margarita Ave with curves and connecting staircase.	No
Loma Verde Ave	Park Blvd at Margarita Ave	Tunnel	Ramp along west side of Alma Street connecting to Park Blvd at Margarita Ave with curves and connecting staircase.	No
Loma Verde Ave	Park Blvd at Margarita Ave	Tunnel	Two ramps along west side of Alma Street connecting to Park Blvd at Margarita Ave with curves and connecting staircase.	**Yes**
Loma Verde Ave	Park Blvd at Margarita Ave	Tunnel	Ramp along Alma Street NB landscaping strip connecting to Park Blvd at Margarita Ave with curves and connecting staircase.	No
Loma Verde Ave	Park Blvd at Margarita Ave	Bridge	Triple helix ramp structure at southeast corner of Loma Verde/Alma Street connecting to triple helix ramp structure at Park Blvd/Margarita Ave.	No
Lindero Dr	Park Blvd (at Robles Park)	Tunnel	Center running slightly curved ramp along Lindero Dr connecting to Park Blvd at Robles Park with tight curves.	**Yes**

Crossing Location		Facility Type (Bridge, Tunnel)	Description	Alternative Selected for Evaluation? (Yes, No)
East Side	West Side			
Lindero Dr	Park Blvd (at Robles Park)	Tunnel	Hooked ramp from property on southeast corner of Lindero Dr/Alma St connecting to Park Blvd at Robles Park midblock with tight curves.	No
Lindero Dr	Park Blvd (at Robles Park)	Tunnel	Ramp along Alma Street NB landscaping strip connecting to Park Blvd at Robles Park midblock with tight curves.	No
Lindero Dr	Park Blvd (at Robles Park)	Tunnel	Ramp along Alma Street SB landscaping strip from Lindero Dr connecting to Park Blvd at Robles Park existing trail with tight curves.	No
Lindero Dr	Park Blvd (at Robles Park)	Tunnel	Ramp along Alma Street NB landscaping strip from northwest corner of Lindero St/Alma St connecting to Park Blvd at Robles Park existing trail with tight curves.	**Yes**
Ely Place	Whitclem Drive	Tunnel	Ramp along Alma Street SB landscaping strip across from Ely Place and connect through corner property to cul-de-sac at Whitclem Dr	**Yes**
Ely Place	Edlee Ave	Tunnel	Straight connection between Ely Place and Edlee Avenue	No
Ferne Ave	Del Medio Ave	Tunnel	Ramp along Alma St SB landscaping strip across from Ferne Ave and connect with a tunnel to connect to cul-de-sac on Del Medio Ave in Mountain View	**Yes**
San Antonio Rd/Nita Ave & San Antonio Ave/Alma St	San Antonio Rd/California St & Mayfield Dr/Tunnel	Existing Bridge & Tunnel	Center running separated bike lane from Nita Ave to California St with strengthened pedestrian connection from San Antonio Ave to existing tunnel at Mayfield Ave at San Antonio Caltrain Station	**Yes**

ATTACHMENT B. EVALUATION CRITERIA AND ANALYSIS METHODOLOGY

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September 2, 2025

SOUTH PALO ALTO BIKE/PED CONNECTIVITY

ATTACHMENT B – EVALUATION CRITERIA & ANALYSIS METHODOLOGY

Alternatives were scored using design priorities and evaluation criteria in Table 1 developed in the previous project phase based on community input, engineering expertise, and professional judgement. Design priorities and evaluation criteria were used to evaluate the degree to which each crossing design alternative aligns with community values. The Updated Design Priorities and Evaluation Criteria Memorandum, available online on the project webpage (www.paloalto.gov/BikePedCrossings), provides additional background on how the design priorities and evaluation criteria were selected.

Table 1: Design Priorities and Evaluation Criteria

Design Priorities	Criteria
Improve Mobility Enhances bike and pedestrian access between key destinations.	• Neighborhood Accessibility • Demand • Facility Width and Capacity
Enhance User Experience Prioritizes spaces that are comfortable for people of all ages and abilities.	• Crossing Length • Crossing Elevation and Ramp Grade • Pedestrian and Bicyclist Comfort • Personal Security
Maximize East of Construction Limits costs (time and money) and prioritizes designs that are feasible to implement.	• Utility Impacts • Construction Costs • Construction Duration • Operation and Maintenance Costs
Enhance Visual Appeal Enhances the sense of community with spaces and structures that are visually appealing.	• Public Space and Green Infrastructure
Minimize Community Impacts Limits potential impacts on existing neighborhoods and the natural environment.	• Environmental Impacts • Parcel Impacts • Traffic, Parking, and Driveway Impacts

The following section describes how each criterion was scored. The results of these evaluations are one of several considerations in the process of seeking locally preferred alternatives.

IMPROVE MOBILITY

Design Priority: Prioritize locations and designs that integrate with surrounding networks, provide access to critical destinations, serve the most users, and accommodate current and future transportation needs.

NEIGHBORHOOD ACCESSIBILITY

Criteria Goal: Prioritize alternatives that reduce existing barriers to crossing the train tracks by shortening the distance to the closest rail crossing for walking and biking.

Process: Alternatives were evaluated to identify the degree to which they reduce travel time and increase the area that can be accessed within a 5, 10, or 15 minute walk or bike trip from a rail crossing. For each alternative, the proposed crossing was added to the transportation network and the accessibility analysis was re-run to observe how travel times for walking and biking changed compared to existing conditions.[1] More details on the accessibility analysis and results under the existing conditions can be found in the Existing Conditions Report available online on the project webpage. Note that the bike accessibility analysis varies slightly from the Existing Conditions Report, as the baseline analysis for existing conditions was updated to allow cyclists to use high-stress intersections. This change was made to reflect the use of crossing guards at some locations and assumed new crossings would be paired with enhancements at signalized intersections providing better bike accessibility.

Results for each alternative are shown in Attachment C. Scores were assigned by visually comparing the alternatives to identify the degree to which each crossing reduces walking and biking travel times to a crossing. For reference, Figure 1 showed the walking accessibility results for a high and low performing crossing. Thin lines indicated walk or bike access area under existing conditions, and thick lines indicated locations where a new crossing reduces travel time to a rail crossing. Table 2 illustrates how the Neighborhood Accessibility criterion was scored.

[1] The analysis assumed one crossing would be built and did not assess how accessibility might change under a combination of buildout scenarios.

Figure 1: Walking Access for Alternative A (Left) and Alternative D (Right)

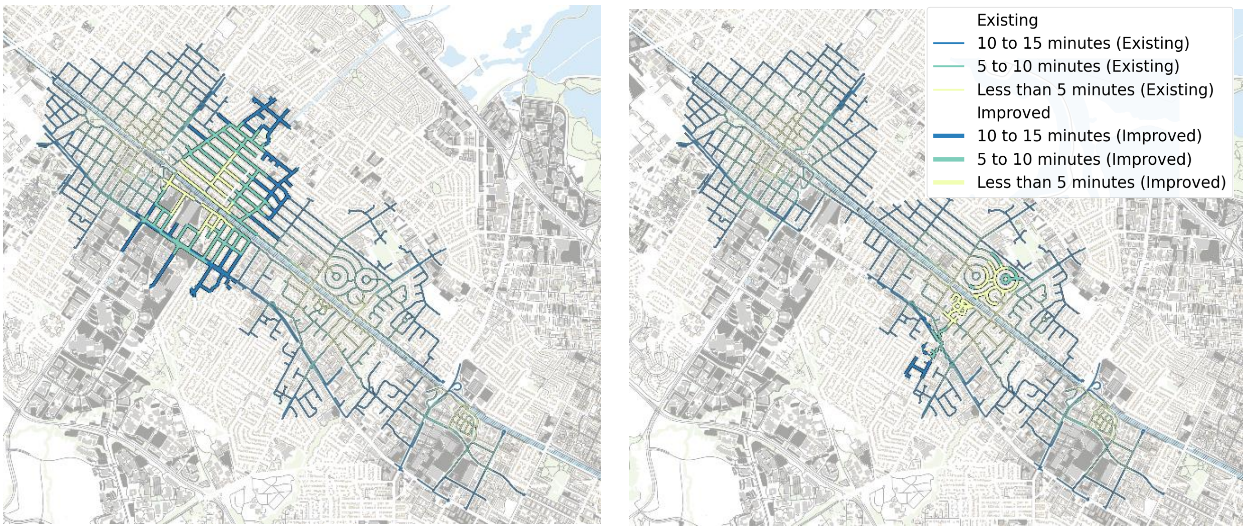


Table 2: Scoring Neighborhood Accessibility

Change in Neighborhood Accessibility	Score
Substantial decrease in travel time walking and biking to a crossing	High (most desirable)
Decrease in travel time walking and biking to a crossing	
Limited decrease in travel time walking and biking to a crossing	
Isolated reduction in travel time walking and biking to a crossing	
No reduction in travel time (high overlap with existing crossing	Low (least desirable)

DEMAND

Criteria Goal: Prioritize alternatives that are expected to attract more walking and biking trips.

Process: The analysis estimated weekday daily and weekday peak hour (morning commute) walking and biking trips for each alternative. The future year of 2031 was selected for analysis to be consistent with the adopted Housing Element and to account for future land use and population growth. Trips were estimated using a six-step calculation process that factored for planned growth and captured both route shift (existing walk and bike trips shifting from existing crossings to proposed alternatives) and mode shift (existing driving trips changing to walk or bike trips) as a result of a more comfortable or shorter route.

Step 1 Create Existing Origin-Destination Trip Matrix

The existing origin-destination (O-D) trip matrix was created using trip data from the travel data company Replica.[2] The trip data represented trips for a typical weekday in Spring 2023. Trips were filtered to include

[2] Replica is a transportation data company that models travel patterns based on multiple data sources, including data collected by vehicles, land use and Census data, and public transportation data sets. More information about Replica can be found at Appendix C of the Existing Conditions Report at https://www.paloalto.gov/Departments/Transportation/Transportation-Projects/South-Palo-Alto-BikePed-Connectivity.

trips that (1) started, ended, or passed through the City of Palo Alto and Stanford (2) had a distance of 5-miles or shorter, and (3) were completed by walking, biking, driving, rider in personal vehicle, taxi, or ride-hail. The 5-mile trip limit was used to exclude trips that were unlikely to change from driving due to their length.

Step 2 Grow Trip Matrix to Represent 2031 Scenario

The existing O-D matrix was then adjusted to account for planned land use and population growth in Palo Alto as captured in the VTA Model.[3] Trip data for all modes combined was extracted for the years of 2015 (existing conditions year for the Housing Element) and 2031, respectively. An annualized growth rate was calculated for each O-D pair using the following formula and applied to 2023 trips volumes from Step 1.[4]

$$Annual\ Growth\ Rate_{O,D} = \frac{2031\ Trips\ of\ All\ Modes_{O,D} - 2015\ Trips\ of\ All\ Modes_{O,D}}{2031 - 2015}$$

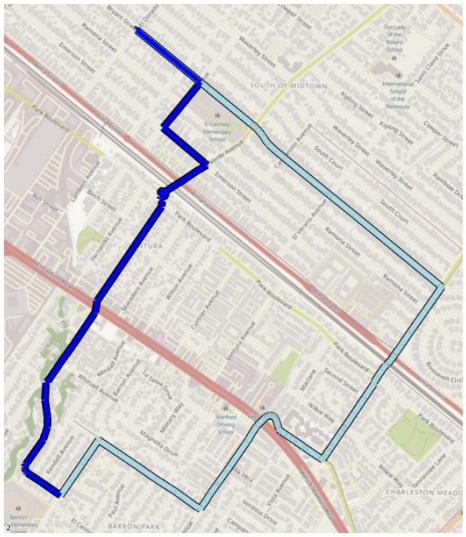
Step 3 Identify Walk and Bike Routes

For each O-D pair, a script was used to identify the preferred walking and biking route under existing conditions and when each alternative was made available. Walking routes were routed based on the shortest travel path. Biking routes were calculated based on a combination of trip length and the stress level for using different roads (i.e., if there were two similar length routes, the route would reflect the more comfortable route). Figure 2 illustrated an example O-D where the availability of Alternative B. Loma Verde Ave Tunnel for walking resulted in a 0.6 miles shorter walking route compared to the existing conditions.

For each alternative, the O-D matrix from Step 2 was reduced to include only trip patterns where an improved route became available for walking or biking and the corresponding change in trip length. The change in trip length for walking was based on the length of the route. The change in the length of the biking trip used a weighted trip length that considered the stress of routes (i.e., if a new crossing created a route that was equal in length but more comfortable, the weighted length would reflect a reduction in length).

[3] The refined version of the VTA model by the City of Palo Alto was used to incorporate land use and population from the Housing Element.
[4] Individual growth rates for each O-D. It was found that a small fraction of O-D pairs were calculated as having unrealistic rates due to small sample sizes in the model data. These pairs were capped at a 200% growth in trips.

Figure 2: Example Walking Route Evaluation



Line	Description	Distance
	Existing Conditions	2.0 miles
	Alternative B: Loma Verde Ave Tunnel	1.4 miles

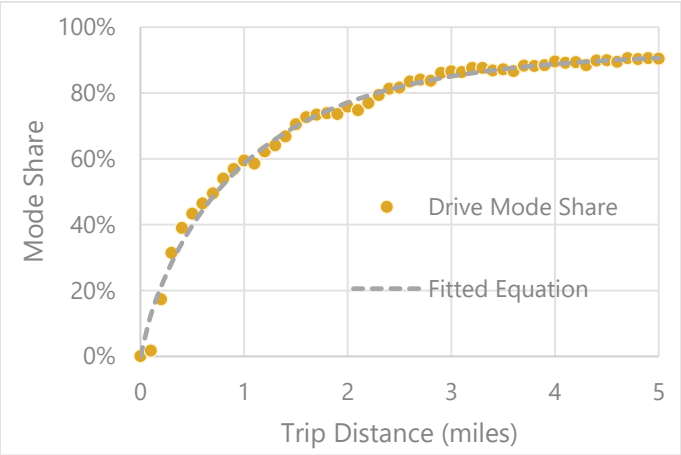
Step 4 Estimate Rerouted Walking and Biking Trips

If an alternative provided an improved route for trips that were already being complete by walking or biking, the trip was assumed to shift to the new alternative. Table 4 and Table 5 provided the final estimates at the end of the section reported the total shifted walk and bike trips under each alternative for the year 2031.

Step 5 Estimate Mode Shift from Driving

If an alternative provided an improved route for trips that were driving trips under existing conditions (including driver, passenger, or taxi and ride-hail passenger), the trips were evaluated based on their trip lengths under existing conditions and under each alternative to determine potential for trips to change mode. The model assumed increasing share of driving trips as distance increased and given the same distance change, a higher percentage of mode shift would occur for shorter trips (e.g., the share of driving trips would increase by about 20 percent when distance increased from one to two miles while it would increase by less than 5 percent when distance increased from four to five miles). To calculate potential mode shift, an equation was fit to the mode share for driving trips in the replica data, comparing trip length to percent of trip driving. Figure 3 showed the trip data and fitted curve.

Figure 3: Percent Mode Share by Distance



$$Driving\% = 0.926\,x\,(1 - e^{(-trip\ distance^{0.837})})$$

Source: Kittelson & Associates, Inc. from Replica Fall 2023 Weekday Trips that start, end, or pass through Palo Alto.

For each O-D pair, the possibility to shift from driving to walking and to biking, respectively, was estimated based on the ratio of walk to bike mode share by distance for existing trips. The evaluation was done in tandem to avoid double counting the same driving trip as both new walk and bike trips.

Table 3 provides an illustrative example for a single O-D pair. In this example, there were projected to be 50 person-trips between an O-D pair, and the proposed crossing would reduce the trip distance from 1.5 miles to 0.5 miles. Using the mode-choice equation, 70 percent (~35 trips) of the total 50 trips were driving trips under existing conditions and 40 percent (~20 trips) of the total 50 trips would be driving trips with the proposed crossing. Therefore, the delta, 30 percent (~15 trips) of the total 50 trips would be converted to walk or bike trips. At 0.5 miles, it was observed that 75 percent of walking and biking trips were walking and 25 percent were biking. Therefore, after rounding to the nearest whole number, the 15 shifted trips were estimated to result in 11 walking trips (75% x 15 trips) and 4 biking trips (25% x 15 trips).

Table 3 Example Mode Shift Calculation

Metrics	Values
Trip Demand between O-D Pair	50 trips
Existing Distance (Miles)	1.5
% Existing Trips Driving (Trip Counts)	70% (35)
Alternative Distance (Miles)	0.5
% Alternative Trips Driving (Trip Counts)	40% (20)
% of Trips Shifted to Walk and Bike Trips (Trip Counts)	-30% (-15)
% of Driving Trips Shifted to Walk Trip (Trip Counts)	75% (11)
% of Driving Trips Shifted to Bike Trip (Trip Counts)	25% (4)

Source: Kittelson & Associates, Inc. numbers are representative of process for single O-D pair for all day travel.

Step 6 Final Matrix and Score Assignment

Total estimated demand of each alternative was calculated as the sum of estimated route shift and estimated mode shift, for walk and bike trips, respectively. The final estimates for each alternative are provided in Table 4 and Table 5. Note that the estimates for San Antonio Bridge Enhancements (Alternative H) did not include trips for walking, as the alternative would not create a new crossing; however, the estimate for the alternative did include bike trips that were shifted by the addition of a new lower-stress biking facility along San Antonio Road.

Table 4: Estimated Weekday Trips by Crossing, Future Year 2031

Weekday Total 2031	Shifted		Mode Change		Total		
	Walk	Bike	Walk	Bike	Walk	Bike	Total
Alternative A: El Dorado Ave Tunnel	560	1,620	240	180	800	1,800	2,600
Alternative B: Loma Verde Ave Tunnel	550	1,550	190	170	740	1,720	2,460
Alternative C: Loma Verde Ave Tunnel with Alma St Signal	550	1,550	190	170	740	1,720	2,460
Alternative D: Lindero Dr Tunnel	90	450	10	20	100	470	570
Alternative E: Lindero Dr Tunnel with Alma St Signal	90	450	10	20	100	470	570
Alternative F: Ely Pl Tunnel	50	560	-	70	50	630	680
Alternative G: Ferne Ave Tunnel	390	1,700	70	350	460	2,050	2,510
Alternative H: San Antonio Bridge Enhancements[1]	NA	2,100	NA	540	NA	2,640	2,640

1. Estimate does not include trips for walking, as alternative does not create a new crossing. Estimate includes bike trips that are improved by adding a new lower stress biking facility along San Antonio Road.

Table 5: Estimated Weekday AM Peak Hour Trips by Crossing, Future Year 2031

Weekday AM Peak Hour Total 2031	Shifted		Mode Change		Total		
	Walk	Bike	Walk	Bike	Walk	Bike	Total
Alternative A: El Dorado Ave Tunnel	60	140	10	10	70	150	220
Alternative B: Loma Verde Ave Tunnel	60	140	10	20	70	160	230
Alternative C: Loma Verde Ave Tunnel with Alma St Signal	60	140	10	20	70	160	230
Alternative D: Lindero Dr Tunnel	-	40	-	-	-	40	40
Alternative E: Lindero Dr Tunnel with Alma St Signal	-	40	-	-	-	40	40
Alternative F: Ely Pl Tunnel	10	40	-	-	10	40	50
Alternative G: Ferne Ave Tunnel	50	110	-	30	50	140	190
Alternative H: San Antonio Bridge Enhancements[1]	NA	150	NA	40	NA	190	190

1. Estimate does not include trips for walking, as alternative does not create a new crossing. Estimate includes bike trips that are improved by adding a new lower stress biking facility along San Antonio Road.

A High score was assigned to crossings with the highest daily estimated use. A Low score was assigned to crossing with the lowest daily estimated use. Other crossings were scored relative to the highest and lowest demand proportionally based on estimated use. Table 6 illustrates how the Demand criterion was scored.

Table 6: Scoring Demand

Estimated Daily Walk/Bike Demand	Score
2,600 or more daily trips	High (most desirable)
2,000 to 2,599 daily trips	
1,500 to 1,999 daily trips	
1,000 to 1,499 daily trips	
1,000 or less daily trips	Low (least desirable)

As shown in the demand estimates presented in Table 4 and Table 5., Alternative A, B, C, G, and H have higher estimated demand, and are projected to have more than 2,400 weekday daily trips and more than 190 weekday AM peak hour trips. As a comparison, there were around 1,800 daily pedestrian and bicycle trips and 300 peak hour pedestrian and bicycle trips observed at the California Avenue underpass in April 2025.[5] Alternatives D, E, and F would generate lower demand of fewer than 800 weekday daily trips and around 50 weekday AM peak hour trips. As a comparison, there were around 600 daily trips and 170 peak hour trips observed crossing the railroad tracks at Meadow Drive, and around 400 daily trips and 100 peak hour trips observed crossing the railroad tracks at Charleston Road.

FACILITY WIDTH AND CAPACITY

Criteria Goal: Prioritize alternatives that maintain a wider cross-section that allows for more comfortable and efficient travel for people walking and biking across the crossing.

Process: Alternatives were evaluated based on the minimum cross-section of the ramps shown in the concept designs. Tunnels would be 20 feet wide per standards documented in Caltrain Design Criteria 3.1.2 Pedestrian Underpass. In addition, the Guide for the Development of Bicycle Facilities published by American Association of State Highway and Transportation Officials (AASHTO) in 2012 recommended wider pathways (11 to 14 feet) for shared use paths expected to serve a high percentage of pedestrians (30 percent or more of the total volume) or high user volumes (more than 300 peak hour users). The National Association of City Transportation Officials (NACTO) Urban Bikeway Design Guide identifies a preferred width of 11 feet and minimum width of 8 feet for shared use paths with low volumes (50 peak hour cyclists) and a preferred width of 15 feet and minimum width of 11 feet for shared use paths with

[5] Observed counts at existing crossings were collected over a 12-hour period between 7am and 7pm on Thursday, April 24, 2025. The daily demand would be slightly higher than the 12-hour counts. Pedestrian counts at Meadow Drive and Charleston Road were collected for the same time period on Thursday, May 16, 2024.

medium volumes (up to 400 peak hour cyclists). For reference, the Embarcadero Bike Path varies from eight feet to 12 feet wide and the US 101 Bike/Ped Overpass is 12 feet wide.

As shown in Table 4 and Table 5,, no alternatives were projected to serve more than 300 peak hour walk/bike trips in 2031. Regarding pedestrian percentage, three alternatives (Alternative A, B, and C) met the 30 percent threshold. All three alternatives had a minimum ramp cross-section of 12 feet and met the AASHTO and NACTO recommendation.

A High score was assigned to crossings with a minimum ramp cross-section of 12 feet or more. This ramp cross-section width would allow bidirectional travel by people walking and biking with minimal potential for conflict between users. A Low score was assigned to crossings with a minimum ramp cross-section of 9.9 feet or less. At less than 10 feet wide there would be potential for conflict between users and would likely need to require people biking to walk through the crossing. Table 7 illustrates how the Facility Width and Capacity criterion was scored.

Table 7: Scoring Facility Width and Capacity

Facility Width and Capacity	Score
12′ or more	High (most desirable)
11′ to 11.9′	
10′ to 10.9′ with low demand and low pedestrian percentage	
10′ to 10.9′ with high demand or high pedestrian percentage	
Less than 10′	Low (least desirable)

ENHANCE USER EXPERIENCE

Design Priority: Design facilities guided by the prioritization of the most vulnerable populations[6], and create safe, well-lit spaces that are comfortable to access and utilize.

CROSSING LENGTH

Criterial Goal: Crossing length considered both the length of the new crossing itself and the degree of which it would allow direct routes (i.e., a short route that would require a lot of out-of-direction travel was not considered a short crossing). The goal of this criterion was to prioritize alternatives that provide more direct connections between the transportation network on either side of rail and to discourage designs that included hairpin turns or other features that would increase the amount of out of direction travel a person may be required to complete.

Process: The criterion was evaluated qualitatively by referencing the concept designs. A High score was assigned to alternatives that provide a direct crossing, similar to the California Avenue Underpass which

[6] Vulnerable populations are groups or communities at a higher risk of experiencing negative health, social, or economic outcomes due to various factors. These factors can be related to social, economic, political, environmental, or individual circumstances. Examples include children, older adults, people with disabilities, low-income individuals, and racial and ethnic minorities.

draws a straight line between California Avenue on either side of the train tracks. A Low score was assigned to alternatives that generate substantial out-of-direction travel, similar to the crossing by the underpass at the San Antonio Caltrain Station where ramps for the crossing run parallel to the train tracks. The evaluation was conducted based on the alignment of ramps and length of the crossing and did not consider the potential for more direct paths using stairs, as stairs are not accessible for all users, including people biking and people in wheelchairs or using other wheeled mobility devices. Table 8 illustrates how the Crossing Length criterion was scored.

Table 8: Scoring Crossing Length

Crossing Length and Path of Travel	Score
Direct route that connects to crossing locations	High (most desirable)
Direct route with limited potential out of direction travel for specific routes	
Limited out-of-direction travel for most routes	
Substantial out-of-direction travel for some routes	
Includes substantial out-of-direction travel for most routes	Low (least desirable)

CROSSING ELEVATION AND RAMP GRADE

Criteria Goal: Prioritize alternatives that provide lower ramp grades that increase user comfort, encouraging all ages and abilities.

Process: A High score was assigned to alternatives that provide ramping at 4.9% or lower. A Low score was assigned to alternatives with ramp grades in excess of 8.33%. Alternatives A through G propose ramps at 7% grade and score Medium under this criteria. For reference, ramps at the Homer Avenue Tunnel are around 5 percent, ramps at the Palo Alto Caltrain Station are between 7 and 8 percent, and ramps at the California Avenue Tunnel are around 9 percent. Table 9 illustrates how the Crossing Elevation and Ramp Grade criterion was scored.

Table 9: Scoring Elevation and Ramp Grade

Crossing Elevation and Ramp Grade Character	Score
All ramping is 4.9% or lower	High (most desirable)
Ramping is between 5 and 6.9% grade	
Ramping is primarily at 7%	
Ramping is between 7 and 8.33%	
Grade exceeds 8.33%	Low (least desirable)

PEDESTRIAN AND BICYCLIST COMFORT

Criteria Goal: Prioritize alternatives with design characteristics that create a more comfortable walking and biking experience by (1) reducing potential for conflicts between people walking and biking on the alternative and (2) creating seamless connections to the larger transportation network.

Process: Each alternative was qualitatively evaluated for potential to reduce or eliminate conflicts and provide low-stress connections to the existing network. The factors evaluated were:

- Grade separated intersections. Alternatives that tunnel underneath Alma Street were assigned a higher score, because they would provide a more seamless and lower-stress connection across by removing potential conflicts at the intersection with Alma Street.
- Ninety (90)-degree turns. Alternatives that would require a 90-degree turn into the tunnel were assigned a lower score as turns increase potential for conflicts between people traveling in opposite directions. Turns may also reduce visibility and line of sight, making it difficult to see people ahead and difficult to judge distances and react.
- Ramp access locations. Higher scores were assigned to ramp access locations near existing low-stress bicycle routes and pedestrian crossings.

A High score was assigned to alternatives identified as having the least potential for conflict and greatest comfort for people walking and biking, and for alternatives that could be accessed via more direct and low-stress routes. A Low score was assigned to alternatives with the greatest potential for conflict and/or features likely to make use and access more uncomfortable. Table 10 illustrates how the Pedestrian and Bicyclist criterion was scored.

Table 10: Scoring Pedestrian and Bicyclist Comfort

Pedestrian and Bicycle Comfort	Score
More comfortable	High (most desirable)
↕	
Less comfortable	Low (least desirable)

PERSONAL SECURITY

Criteria Goal: All alternatives were designed with consideration for Crime Prevention Through Environmental Design (CPTED) principles, and relevant safety standards and design practices and meet the basic standards for personal security. However, some alternatives provided relatively more visibility and connectivity. The goal of this criterion was to prioritize alternatives that would increase pedestrian and bicyclist security by providing good visibility and access points at high-traffic locations.

Process: Each alternative was qualitatively evaluated for visibility at crossing and connectivity of access points based on the conceptual design layouts.[7] The factors evaluated were:

- Ninety (90)-degree turns at tunnels. Unobstructed and well-lit tunnel entrances and exits allow users to see ahead and offer natural surveillance, which allows nearby observers to monitor activities within the tunnel, essentially acting as "eyes on the street". Alternatives that would require a 90-degree turn into the tunnel were assigned a lower score as turns may limit visibility and natural surveillance, therefore, lowering personal security.

[7] Further treatments, such as security cameras, lighting, skylights, emergency phones, can be used to increase visibility and sightlines. This evaluation did not consider these mitigating factors.

- Ramp access locations. Higher scores were assigned to ramp access locations in areas where people naturally pass by, which provide more opportunities for natural surveillance. For example, Alternative A would lead to a parking lot and the crossing itself would also have higher demand (2,600 total pedestrian and bike trips), as shown in Table 4. Ramp access locations at isolated or less-traveled paths would have less activity to support natural surveillance. For example, the tunnel entrance of Alternative F would be between two residential parcels and therefore pedestrians on Park Boulevard and Whitclem Drive may not be able to directly see activities in the tunnel. In addition, Alternative F would also have the second to lowest demand among all alternatives (680 total pedestrian and bike trips), which may limit natural surveillance.

A High score was assigned to unobstructed and well-connected alternatives with more opportunities for natural surveillance. A Low score was assigned to alternatives with sightline obstructions and less opportunities for natural surveillance. Table 11 illustrates how the Personal Security criterion was scored.

Table 11: Scoring Personal Security

Personal Security Character	Score
Higher visibility, connectivity, and opportunities for natural surveillance	High (most desirable)
Lower visibility, connectivity, and opportunities for natural surveillance	Low (least desirable)

MAXIMIZE EASE OF CONSTRUCTION

Design Priority: Minimize potential for disruption during construction and complexity of design, while ensuring that construction costs and maintenance costs would be feasible to implement given reasonably expected project funding.

UTILITY IMPACTS

Criteria Goal: Prioritize alternatives that would minimize potential conflicts with existing utilities to reduce construction risk, cost, and schedule delays. Alternatives that avoid major utility corridors or require minimal relocation were preferred, as utility conflicts could introduce significant complexity and require extensive coordination with utility owners.

Process: Each alternative was qualitatively evaluated based on site observations and general utility information available at each location. A High score was assigned to alternatives that largely avoid known utility corridors and are expected to require minimal utility relocations. A Low score was assigned to alternatives that intersect with major utility lines (transmission) or are located in dense utility zones where significant relocations would likely be required. Intermediate scores were assigned to alternatives with minor or localized conflicts.

For this analysis, conventional utilities such as gas, water, sewer, telephone, fiber optic, electrical distribution/transmission were the focus based on site investigations and limited available information at

this stage. Items such as street lighting were not considered, as they fall outside the conventional utility definition and represent comparatively minor relocations relative to moving more significant distribution/transmission lines. Table 12 illustrates how the Utility Impacts criterion was scored.

Table 12: Scoring Utility Impacts

Utility Impacts	Score
Lower potential for utility impacts	High (most desirable)
	
Higher potential for utility impacts	Low (least desirable)

CONSTRUCTION COST

Criteria Goal: Prioritize alternatives that would be cost-effective to construct. Alternatives that minimized the need for complex structural features, extensive utility relocation, or right-of-way acquisition would be preferred, provided that they would still meet Project objectives and accessibility requirements.

Process: At this early feasibility stage, detailed construction cost estimates are not yet reliable because the concepts are schematic and subject to change as the design advances. These concepts have been developed specifically to help narrow down a preferred alternative location within the broader evaluation—not to define exact scope or quantities. Providing dollar figures or even ranges at this stage could create a false sense of precision and misrepresent the true variability of costs. Instead, the evaluation uses a qualitative, side-by-side comparison based on the key cost drivers for each alternative. This approach ensures that differences in the relative costs are captured in a consistent and defensible way without overstating accuracy at this stage of the planning process.

The evaluation considered factors such as the overall footprint for each alternative, anticipated site impacts, and general staging and traffic handling needs during construction. Parcel acquisition considerations were not included in this criterion, as they were evaluated separately under the "Parcel Impacts" category. This section focuses exclusively on construction cost factors. In general, tunnels passing underneath only the railroad tracks are shorter—estimated at 85 to 110 feet in length depending on the crossing location and ramp configurations. Structure costs for these shorter tunnels are expected to be similar regardless of the alternative, with construction likely achieved by jacking the tunnel box beneath the tracks to minimize disruption to train operations.

Longer tunnels passing underneath both Alma Street and the railroad tracks are estimated at 160 to 220 feet in length. Because of the increased length, structure costs will be higher. In addition, potential staged construction in Alma Street and adjacent local streets would add to the overall construction cost.

Alternatives that require use of Caltrain right-of-way will also carry added cost implications. Any such use will require additional coordination with Caltrain, including obtaining variances that must be approved by the Caltrain Board. These requirements introduce additional permitting steps, review cycles, and potential design modifications, which can increase both the complexity and cost of the alternative.

Several of the evaluated alternatives are also located within areas proposed for construction as part of the Rail Grade Separation Project at Meadow Drive and Charleston Road[8]. In June 2024, Council advanced the Hybrid Alternative (including a mixed wall/column approach) and Underpass Alternative for Meadow Drive and Charleston Road—with only one expected to advance following the City's decision process. Alternatives D, E, and F are located within proposed construction limits (subject to change) for rail grade separation at Meadow Drive and Charleston Road and would require close coordination to address potential changes in site conditions, available staging areas, and construction sequencing. This coordination could add cost and schedule risks, depending on how the two projects interface.

For both shorter and longer tunnel options—and those overlapping with rail grade separation at Meadow Drive and Charleston Road—the overall cost will also be influenced by factors such as the number and geometry of ramps, presence of existing underground utilities, subsurface soil conditions, and the contractor's means and methods.

These cost considerations are preliminary planning-level assumptions intended for relative comparison only and will be refined as design advances and more detailed engineering, utility coordination, and staging plans are developed.

A High score was assigned to alternatives that would be expected to have lower estimated construction costs. A Low score was assigned to alternatives that would be expected to have higher estimated construction costs. Table 13 illustrates how the Construction Costs criterion was scored.

Table 13: Scoring Construction Costs

Construction Costs	Score
Lower estimated construction costs	High (most desirable)
↕	
Higher estimated construction costs	Low (least desirable)

CONSTRUCTION DURATION

Criteria Goal: Minimize overall construction duration to reduce disruptions to the surrounding community, minimize adverse effects on nearby transportation corridors/systems, and reduce project delivery risks. Alternatives that allowed for more streamlined construction coordination, staging, and fewer complex construction elements were preferred.

Process: This criterion was evaluated qualitatively based on the relative complexity of construction activities, including construction coordination, structural components, staging requirements, and potential constraints related to site access or active transportation detours. A High score was assigned to alternatives expected to have shorter construction durations and sooner construction start dates. This would include alternatives with shorter tunnel lengths, fewer ramps and stairs, fewer utility conflicts, fewer

[8] https://www.paloalto.gov/Departments/Transportation/Transportation-Projects/Rail-Grade-Separation

right-of-way conflicts, and more streamlined construction coordination with other projects and/or agencies. A Low score was assigned to alternatives with prolonged construction activities and construction start dates. This would include alternatives with longer tunnels (grade separating Alma Street and the Caltrain corridor), known overhead/underground utility impacts, right-of-way impacts, and known factors that could influence construction start date. Mid-range scores were assigned to alternatives with moderate construction durations and start times.

Most alternatives, with the exception of Alternative H, would require similar construction activities given they involve grade separating the Caltrain corridor. The approximate construction duration to complete these activities is assumed to be about 18 months. For alternatives that also grade separate Alma Street, construction becomes far more involved due to the need to navigate more utilities within Alma Street and maintain traffic along the corridor during construction. These alternatives—scoring lower under this criterion—would likely require approximately 24 months to complete.

Alternatives G and H extend into City of Mountain View right-of-way, requiring additional coordination that may introduce further permitting steps, review cycles, and staging considerations, potentially extending the overall duration.

As discussed earlier, Alternatives D, E, and F are located within proposed construction limits (subject to change) for rail grade separation at Meadow Drive and Charleston Road for the Hybrid Alternative (including a mixed wall/column approach) and Underpass Alternative at Meadow Drive and Charleston and would require close coordination to address potential changes in site conditions, available staging areas, and construction sequencing. This coordination could extend construction duration and start time, depending on how the two projects interface. If the Hybrid Alternative is advanced, any bike/pedestrian undercrossing construction at these locations would need to wait until Meadow/Charleston construction is completed, given the overlap in work areas. This dependency could delay the start of construction and extend overall delivery time for these alternatives. These durations are preliminary planning-level assumptions intended for relative comparison only and will be refined as design advances and more detailed staging, permitting, and phasing plans are developed.

A High score was assigned to alternatives that would be expected to have shorter anticipated construction durations and earlier start dates. A Low score was assigned to alternatives that would be expected to have longer anticipated construction duration and later start date. Table 14 illustrates how the Construction Costs criterion was scored.

Table 14: Scoring Construction Duration

Construction Duration	Score
Shorter anticipated construction duration and start date	High (most desirable)
↕	
Longer anticipated construction duration and start date	Low (least desirable)

OPERATIONS AND MAINTENANCE COST

Criteria Goal: Prioritize alternatives that would minimize long-term operations and maintenance needs for the City. Designs with a smaller physical footprint and fewer infrastructure elements requiring ongoing upkeep – such as the tunnel, ramp structures, at-grade pathways, traffic signals/pedestrian hybrid beacons – were preferred, as they would naturally reduce long-term maintenance responsibilities and associated costs.

Process: This criterion was evaluated qualitatively by reviewing key design features likely to influence operations and maintenance responsibilities. A High score was assigned to alternatives with low anticipated maintenance demands, such as common roadway at-grade features. A Low score was assigned to alternatives with high anticipated operations and maintenance demands, such as structures, pump stations, and traffic signals or pedestrian hybrid beacons. Table 15 illustrates how the Operations and Maintenance Cost criterion was scored.

Table 15: Scoring Operations and Maintenance Cost

Operations and Maintenance Costs	Score
Relatively lower anticipated operations and maintenance costs	High (most desirable)
Low to moderate anticipated operations and maintenance costs	
Moderate anticipated operations and maintenance costs	
High to moderate anticipated operations and maintenance costs	
Relatively higher anticipated operations and maintenance costs	Low (least desirable)

ENHANCE VISUAL APPEAL

Design Priority: Ensure that newly constructed facilities would enhance the sense of community by incorporating public art, public spaces, and attractive structures.

PUBLIC SPACE AND GREEN INFRASTRUCTURE

Criteria Goal: Prioritize alternatives with greater potential to improve existing public space or provide new public space and green infrastructure.

Process: A High score was assigned to alternatives that created the most opportunities for landscaping, benches, and bio-retention in new plaza areas and enhanced connections to existing public space. A Low score was assigned to alternatives with constrained site plan that would limit opportunities to create new public spaces and implement green infrastructure. Table 16 illustrates how the Public Space and Green Infrastructure criterion was scored.

Table 16: Scoring Public Space and Green Infrastructure

Public Space and Green Infrastructure Impact	Score
Directly connects to park or other public space	High (most desirable)
Improves visual appeal of local context	
Neutral effects on local context	
Potential limited opportunities to create public space and green infrastructure	
Limited opportunities to create public space and green infrastructure	Low (least desirable)

MINIMIZE COMMUNITY IMPACTS

Design Priority: Limit potential adverse effects on existing neighborhoods, including the amount of space needed (parking spaces, roads, and buildings are minimally affected) and adverse effects on the environment.

ENVIRONMENTAL IMPACTS

Criteria Goal: Prioritize alternatives that would avoid or reduce environmental impacts to the built and natural environment.

Process: Alternatives were evaluated to identify the degree to which an alternative would avoid or reduce adverse effects to both the built and natural environments, as well as what level of environmental compliance may be required pursuant to the California Environmental Quality Act (CEQA), and potentially the National Environmental Policy Act (NEPA) if federal funding is used for the Project. With the exception of Alternative H, which would not build a new tunnel, each alternative would result in a similar level of impacts under CEQA and NEPA for a variety of environmental topics based on the environmental setting and characteristics of each alternative. Such environmental topics included but were not limited to geology and soils, hydrology and water quality, biological resources, cultural resources, hazards and hazardous materials. Regarding biological resources, none of the alternatives would impact creeks, and any tree removal would be replaced pursuant to City policy). As such, these topics would not help to differentiate the alternatives and were not evaluated.

Pursuant to CEQA and NEPA, and based on the environmental setting and characteristics of each alternative, The primary environmental impact considered for the evaluation of each alternative includes short-term construction impacts to residential uses (i.e., air quality, noise, vibration, and traffic which is discussed under Traffic, Parking, and Driveway Impacts).

A High score was assigned to alternatives that did not require tunneling adjacent to residences and thus would require less environmental review pursuant to CEQA, likely in the form of a Categorical Exemption. A Low score was assigned to alternatives requiring tunneling adjacent to residences, which would not likely qualify for a CEQA Categorical Exemption and instead may require an Initial Study/Mitigated Negative Declaration. Table 17 illustrates how the Environmental Impacts criterion was scored.

Table 17: Scoring Environmental Impacts

Environmental Impact	Score
Lower level of environmental impacts and required environmental compliance	High (most desirable)
Higher level of environmental impacts and required environmental compliance	Low (least desirable)

PARCEL IMPACTS

Criteria Goal: Minimize adverse effects on private property or publicly owned parcels not currently dedicated to transportation use. Alternatives that would fit within existing public right-of-way or affect only publicly owned land designated for transportation purposes were preferred, as they would help avoid displacing existing uses, reduce property acquisition costs, and minimize community disruption.

Process: This criterion was evaluated qualitatively using the conceptual design layouts and assessing whether alternatives directly affect private property and buildings within parcels. A High score was assigned to alternatives that did not require full or partial parcel acquisition. A Low score was assigned to alternatives requiring full or partial acquisition of two or more parcels. Table 18 illustrates how the Parcel Impacts criterion was scored.

Table 18: Scoring Parcel Impacts

Parcel Impact	Score
No parcel impact	High (most desirable)
Partial parcel impact (no impact on existing buildings)	
Full parcel impact on 1 parcel	
Full parcel impacts on 2 parcels	
Full parcel impact on more than 2 parcels	Low (least desirable)

The concept design alternatives are very high-level and schematic, developed solely to help narrow down preferred rail crossing locations and basic conceptual designs. They are intended for decision-making purposes only and represent conceptual, planning-level designs that will be refined and are subject to change during subsequent design phases. Throughout the evaluation, an emphasis was placed on avoiding and minimizing potential adverse effects to private property wherever feasible. Any potential parcel impacts identified are preliminary and will be subject to further study and refinement.

Importantly, no decision has yet been made by the City to acquire any property. Before that decision can be made, the law requires that properties to be acquired first be appraised. If the City continues to consider the acquisition of property after completion of an appraisal, then representatives of the City will contact the owner and make a formal written offer to purchase. The offer will be for an amount determined by the City to be just compensation and in no event will be less than the value reported in an appraisal approved by the City. Without authority from the City Council, staff has no authority to commit the City to the acquisition of any property that might be affected by the bicycle and pedestrian grade separation alternatives.

TRAFFIC, PARKING, AND DRIVEWAY IMPACTS

Criteria Goal: Prioritize alternatives with less potential to increase vehicle delay, modify existing driveway access, and reduce the amount of on- and off-street parking.

Process: The criterion was evaluated qualitatively by referencing the conceptual design layouts.

Potential for vehicle delay considered how alternatives would impact motor vehicle travel on Alma Street. Under existing conditions, there is no intersection delay for vehicles traveling on Alma Street at the proposed crossing locations (one-way stop controlled crossing for Alternatives A through G), except Alternative H which has an existing signal. Specifically, the scoring made the following considerations (ranked from highest to lowest weight):

- Traffic control delays were given higher weight in consideration as new intersection controls would introduce delays to all drivers traveling on Alma Street, while changes in driveway access and reductions in on- and off-street parking would affect fewer people. [9]
    - Alternatives B, D, and H would not install new signals or PHBs and, therefore, would not introduce traffic control delay.
    - Alternative F proposed installing a pedestrian hybrid beacons (PHB) which would introduce some vehicle delays, as drivers would need to stop when a pedestrian or bicyclist activated the crossing signal.
    - All other conceptual design alternatives proposed installing new signals and would introduce higher delays as drivers traveling along Alma Street would need to stop for red lights.

A High score was assigned to alternatives that would not change existing driveway access or reduce parking and had less potential to result in increases in vehicle delay. A Low score was assigned to alternatives that would affect existing driveway access and parking and could result in increased vehicle delays.

Table 19: Scoring Traffic, Parking, and Driveway Impacts

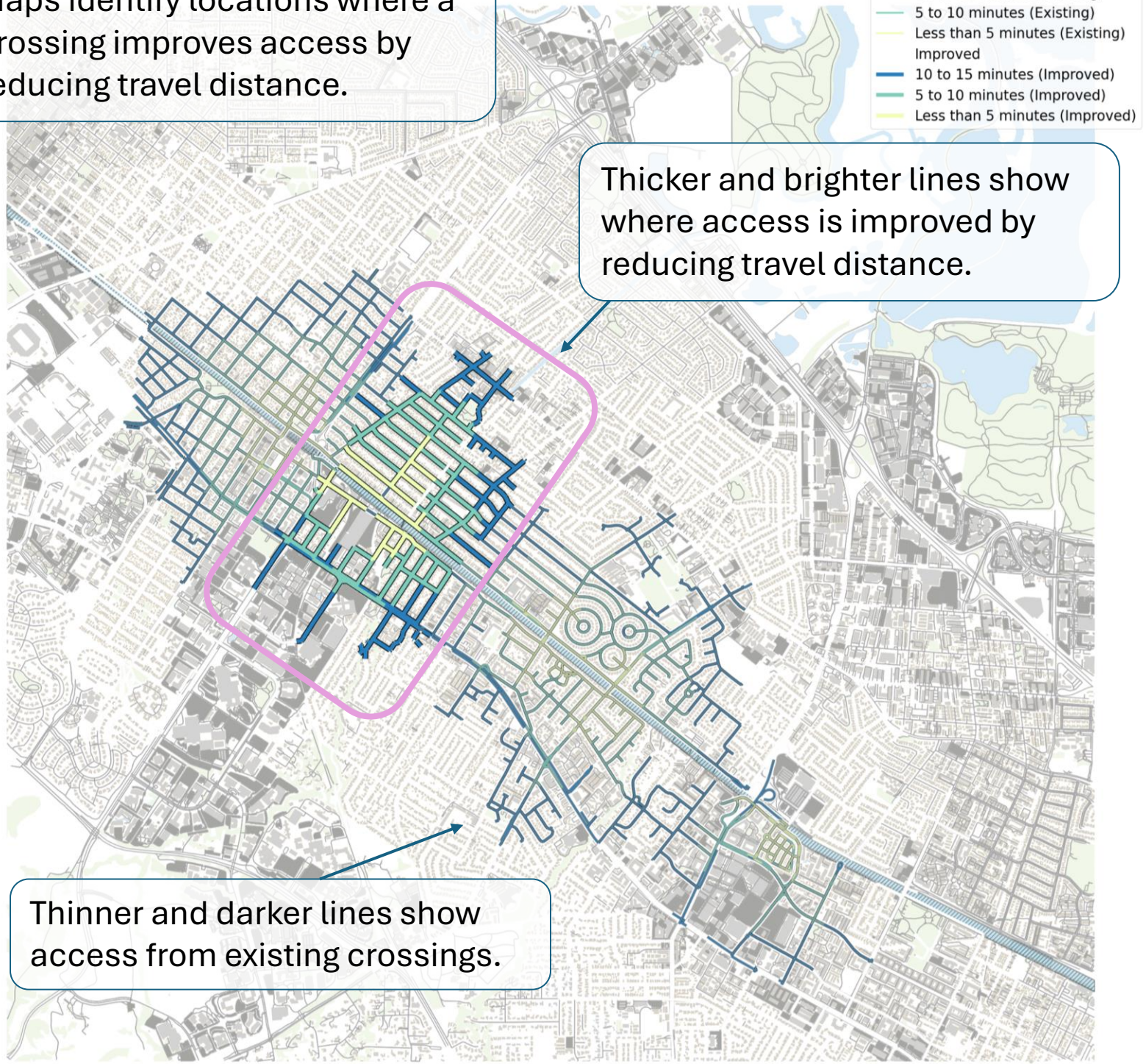
Traffic, Parking, and Driveway Impacts	Score
No changes to existing traffic control, driveway access, or parking	High (most desirable)
Some reconfigurations of driveways and/or loss of parking	
Most potential to increase traffic delay, change driveway access and/or reduce parking	Low (least desirable)

[9] Signal treatments, such as signal timing optimization, pre-detection, and adaptive phases, can be used to reduce vehicle delays at signalized intersections. This evaluation did not consider these mitigating factors.

ATTACHMENT C. ACCESSIBILITY ANALYSIS MAPS

Reading Maps

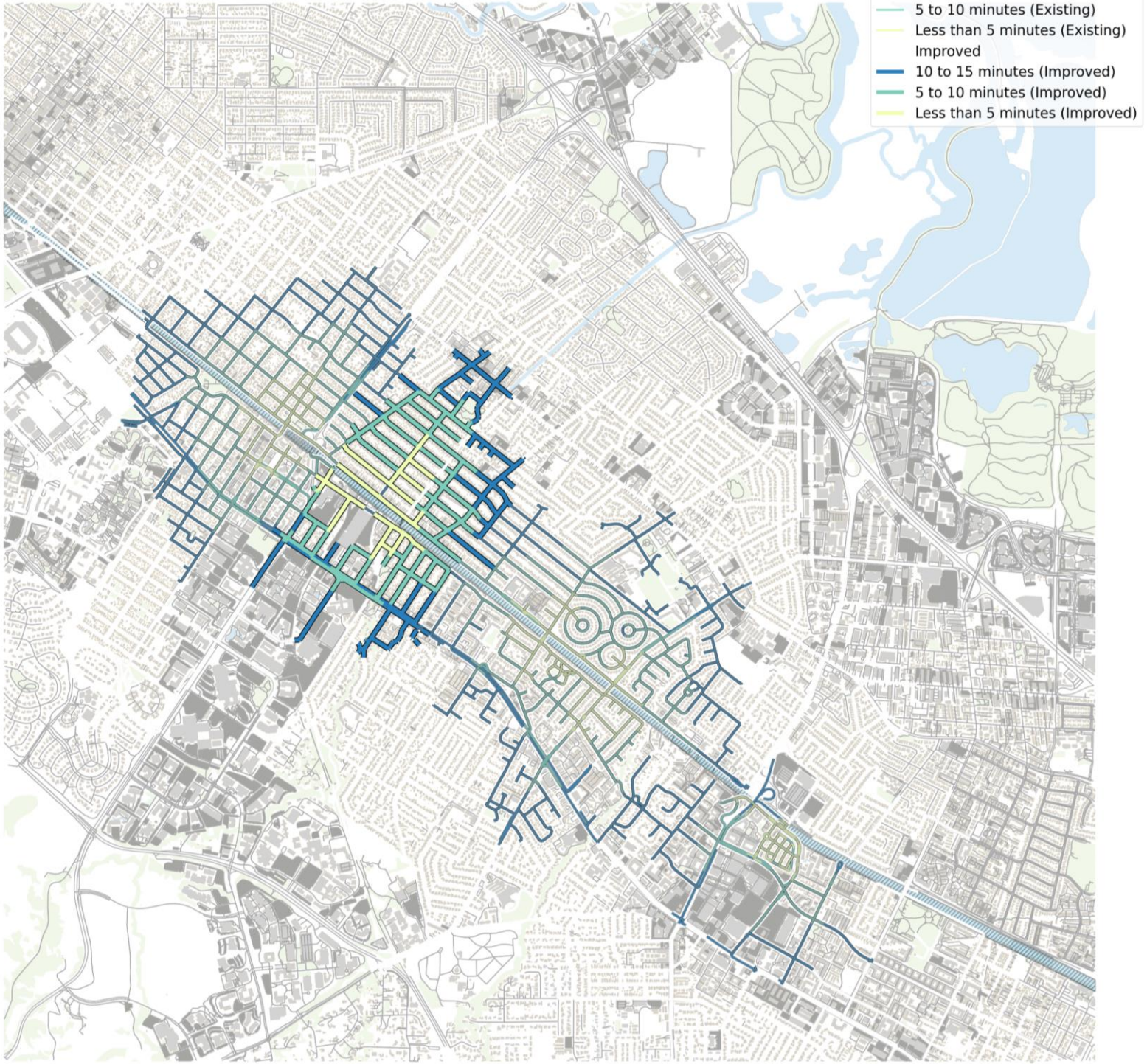
Maps identify locations where a crossing improves access by reducing travel distance.



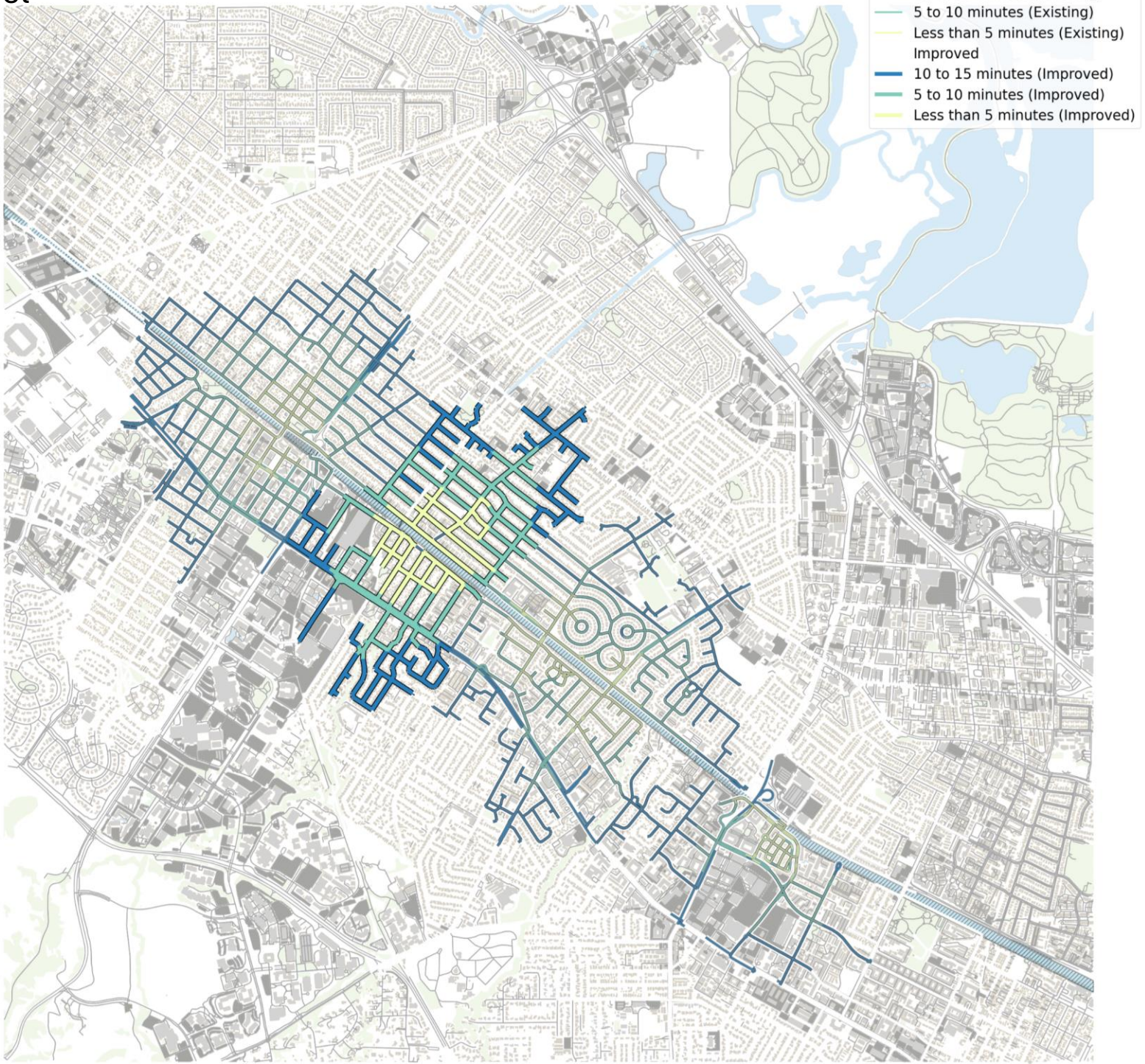
Thicker and brighter lines show where access is improved by reducing travel distance.

Thinner and darker lines show access from existing crossings.

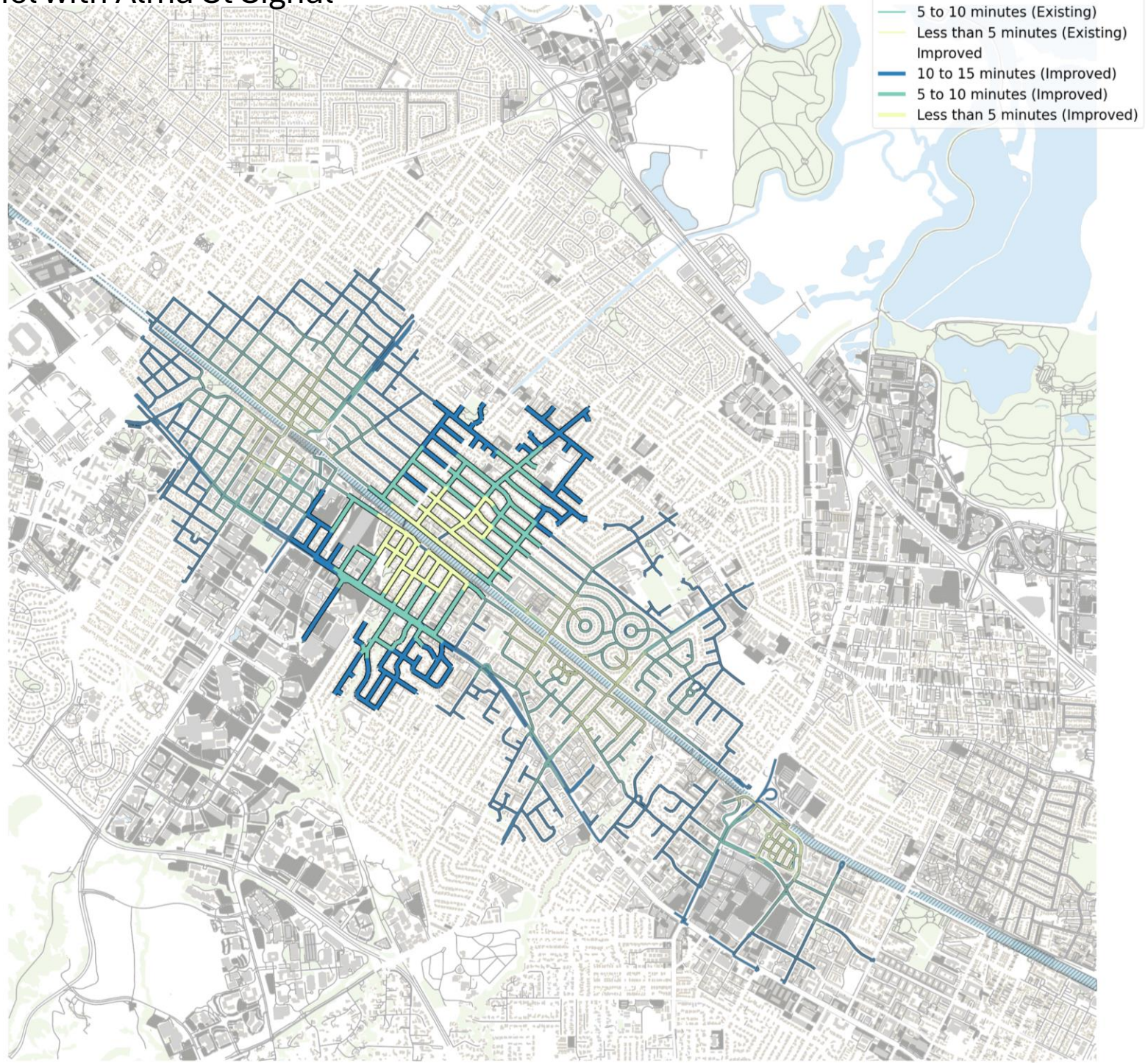
A. El Dorado Ave Tunnel



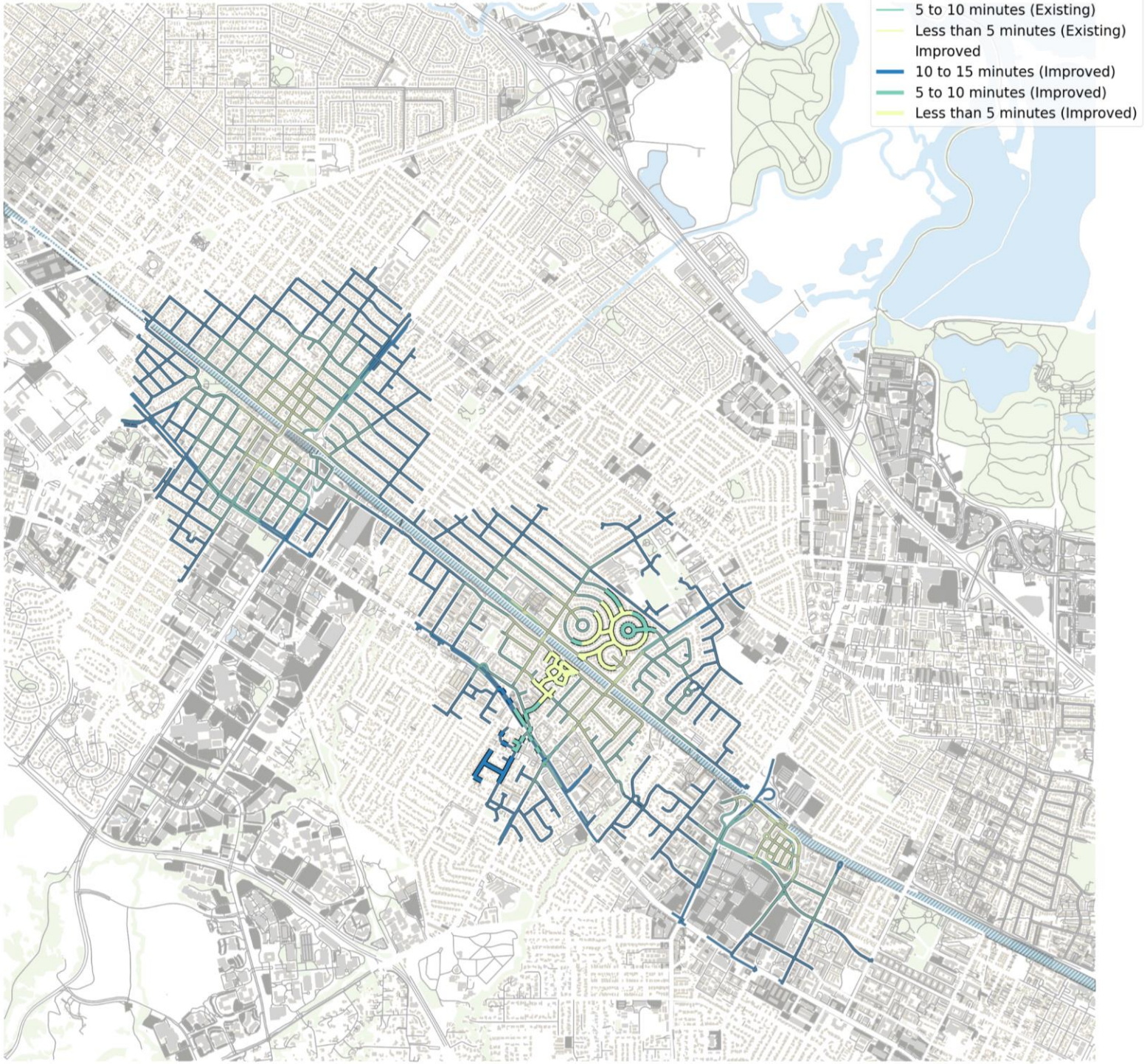
B. Loma Verde Ave Tunnel



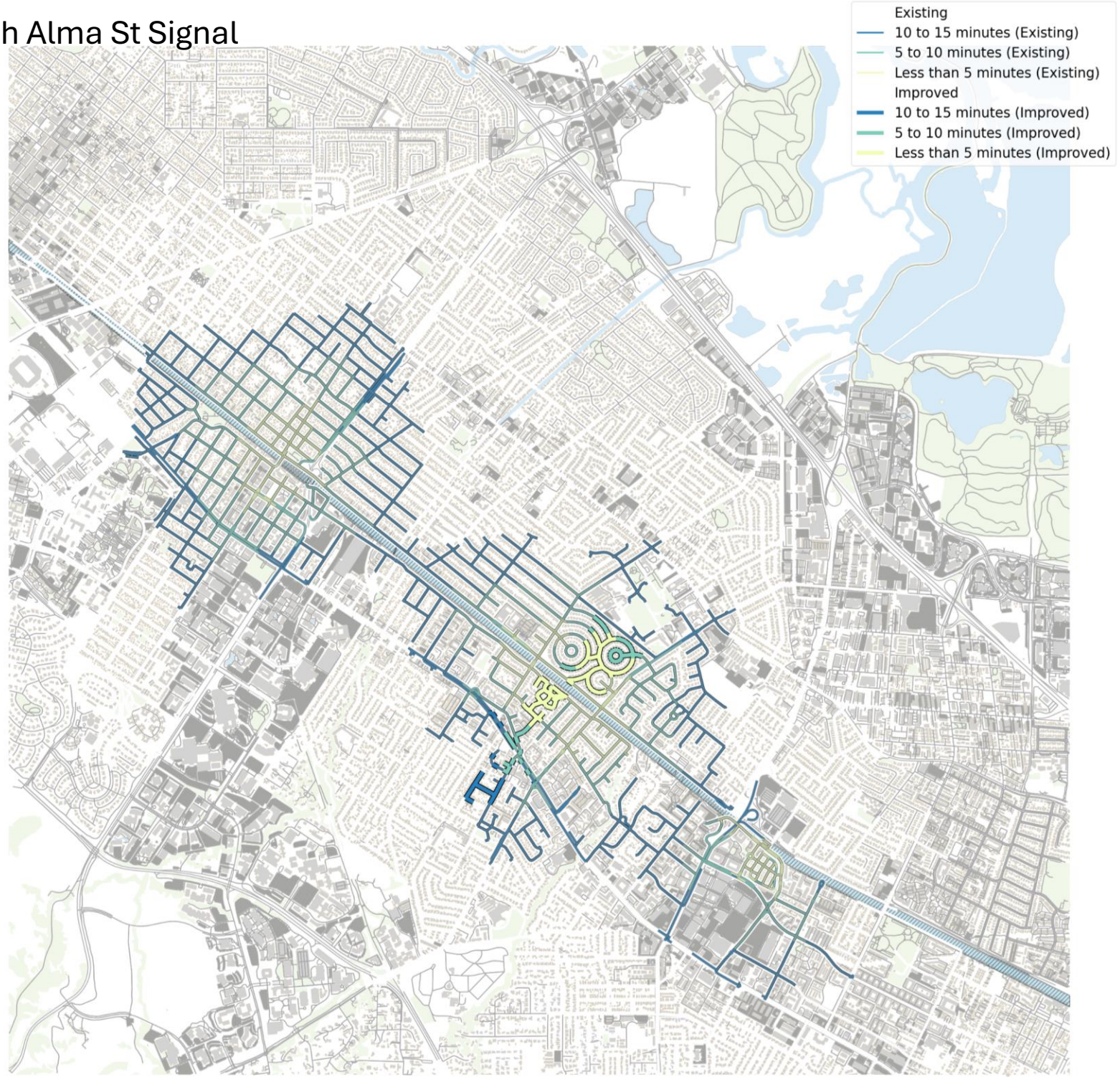
C. Loma Verde Ave Tunnel with Alma St Signal



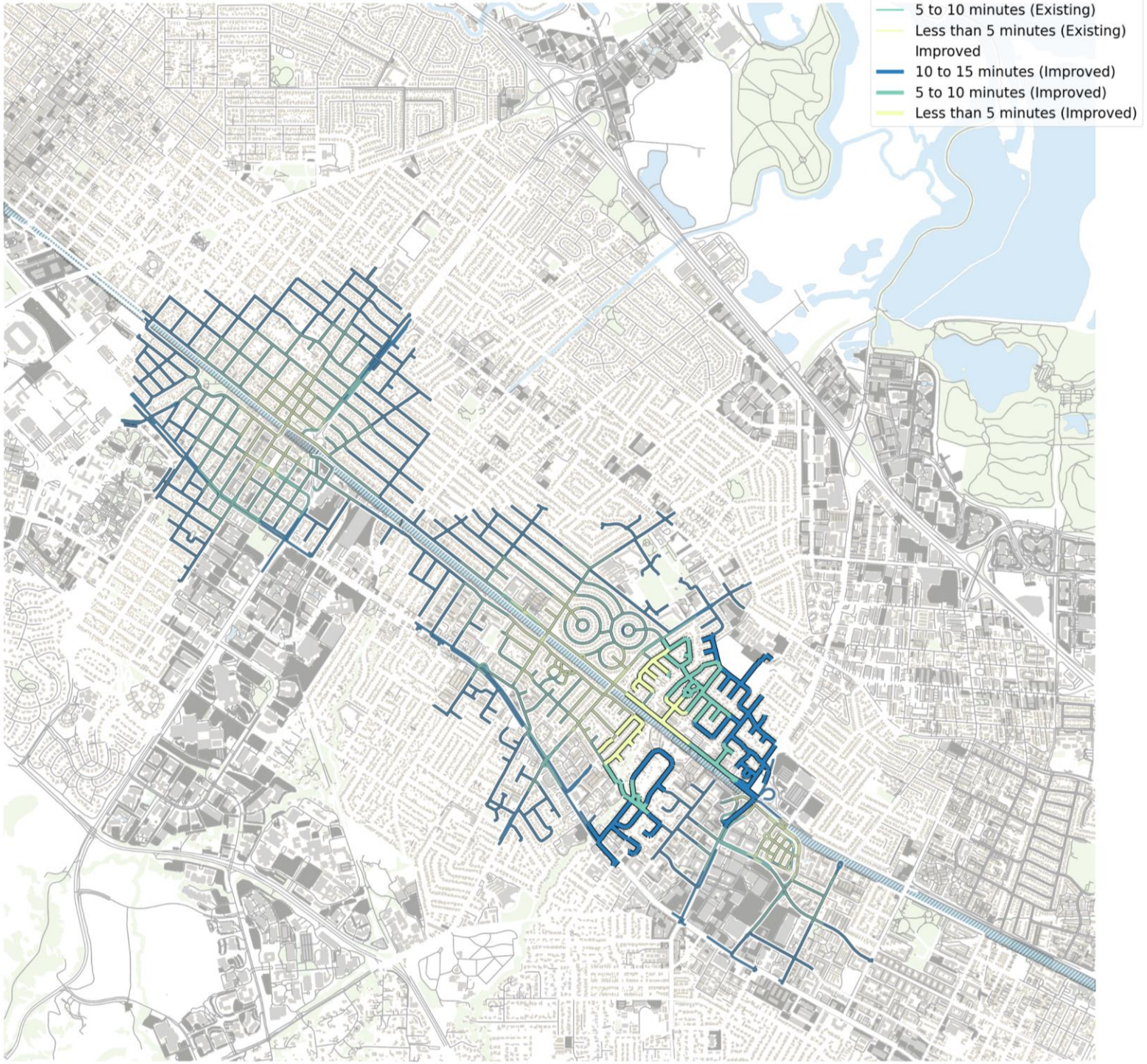
D. Lindero Dr Tunnel



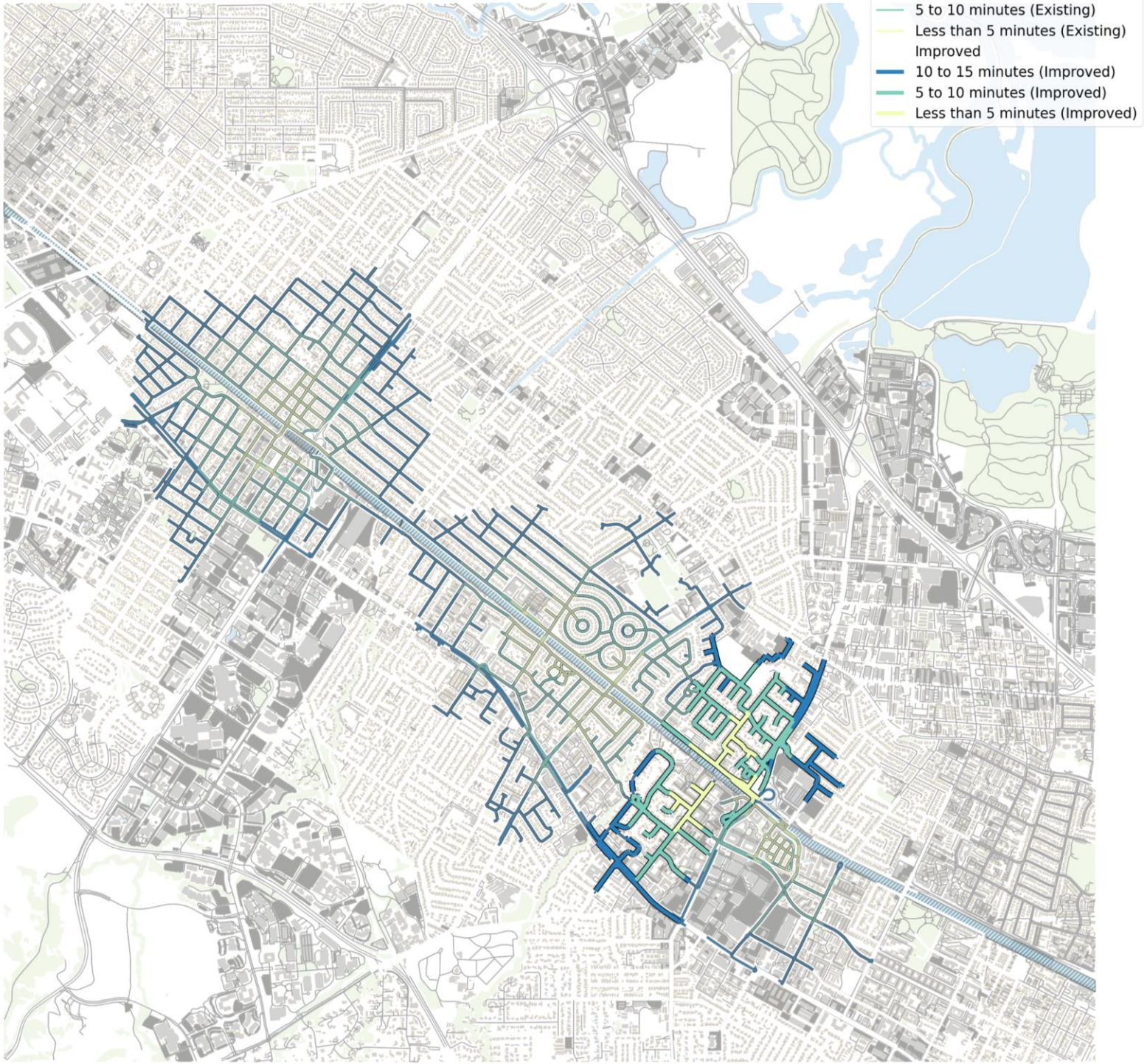
E. Lindero Dr Tunnel with Alma St Signal



F. Ely Pl Tunnel

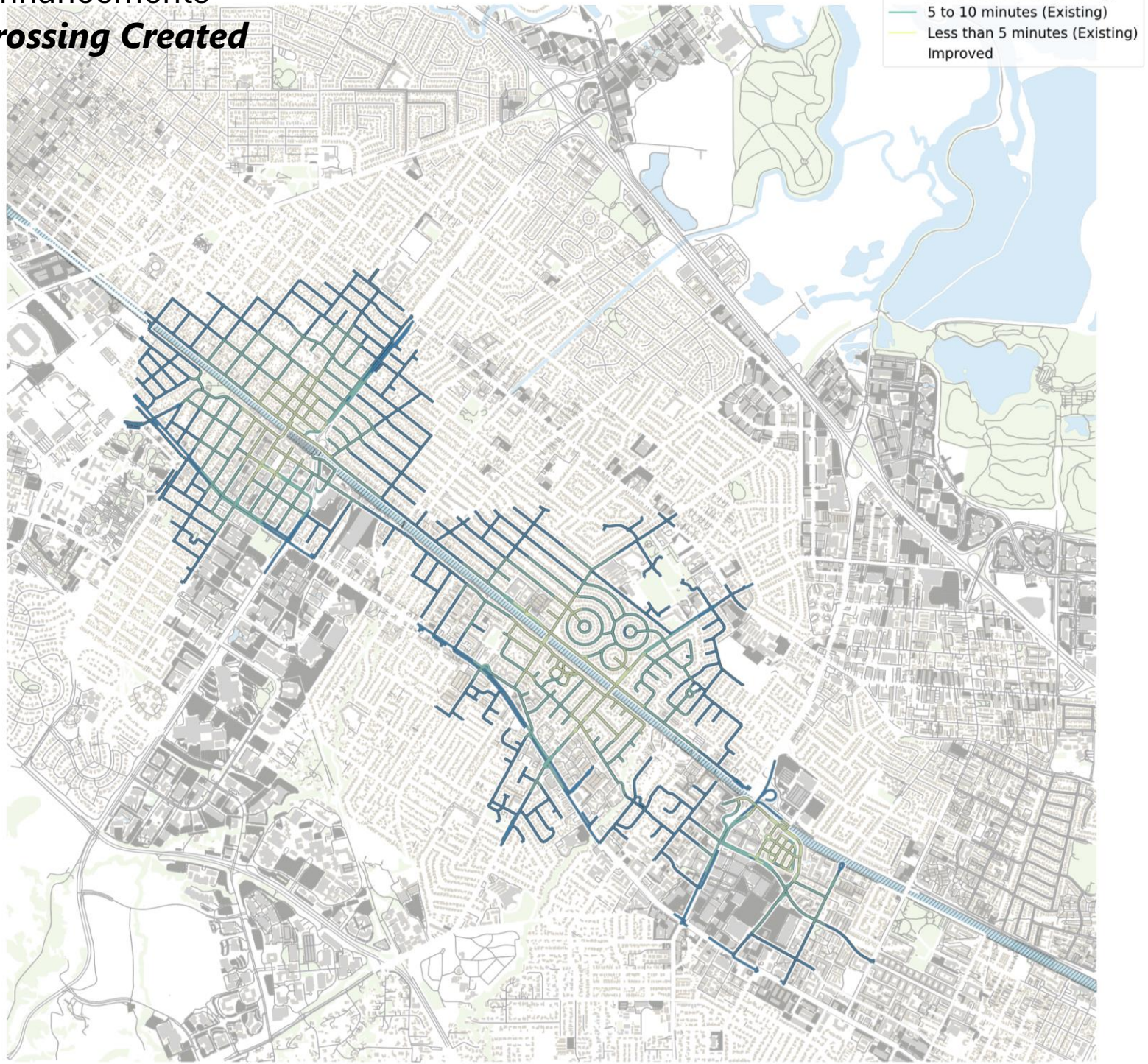


G. Ferne Ave Tunnel

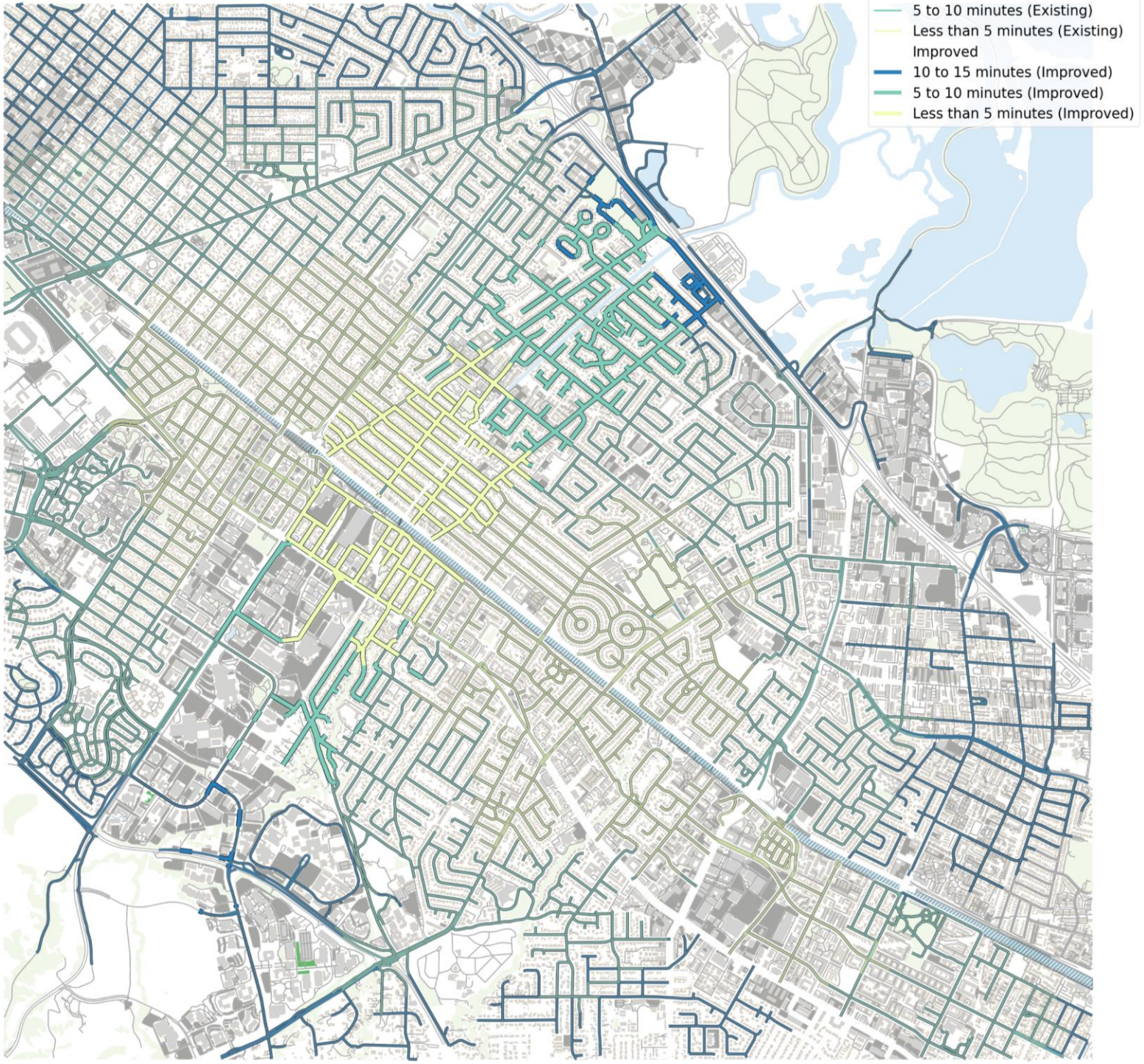


H. San Antonio Bridge Enhancements

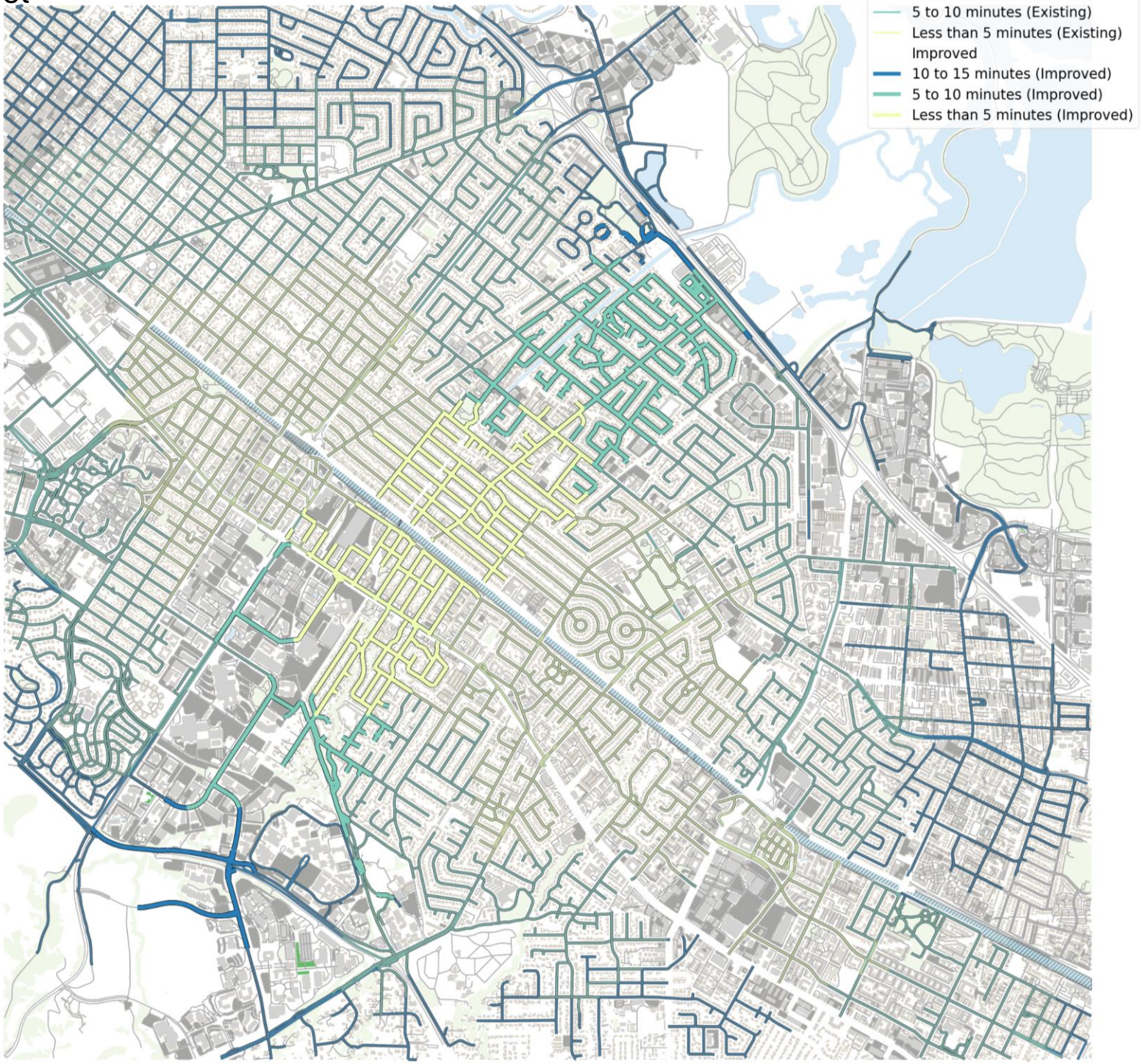
No New Pedestrian Crossing Created



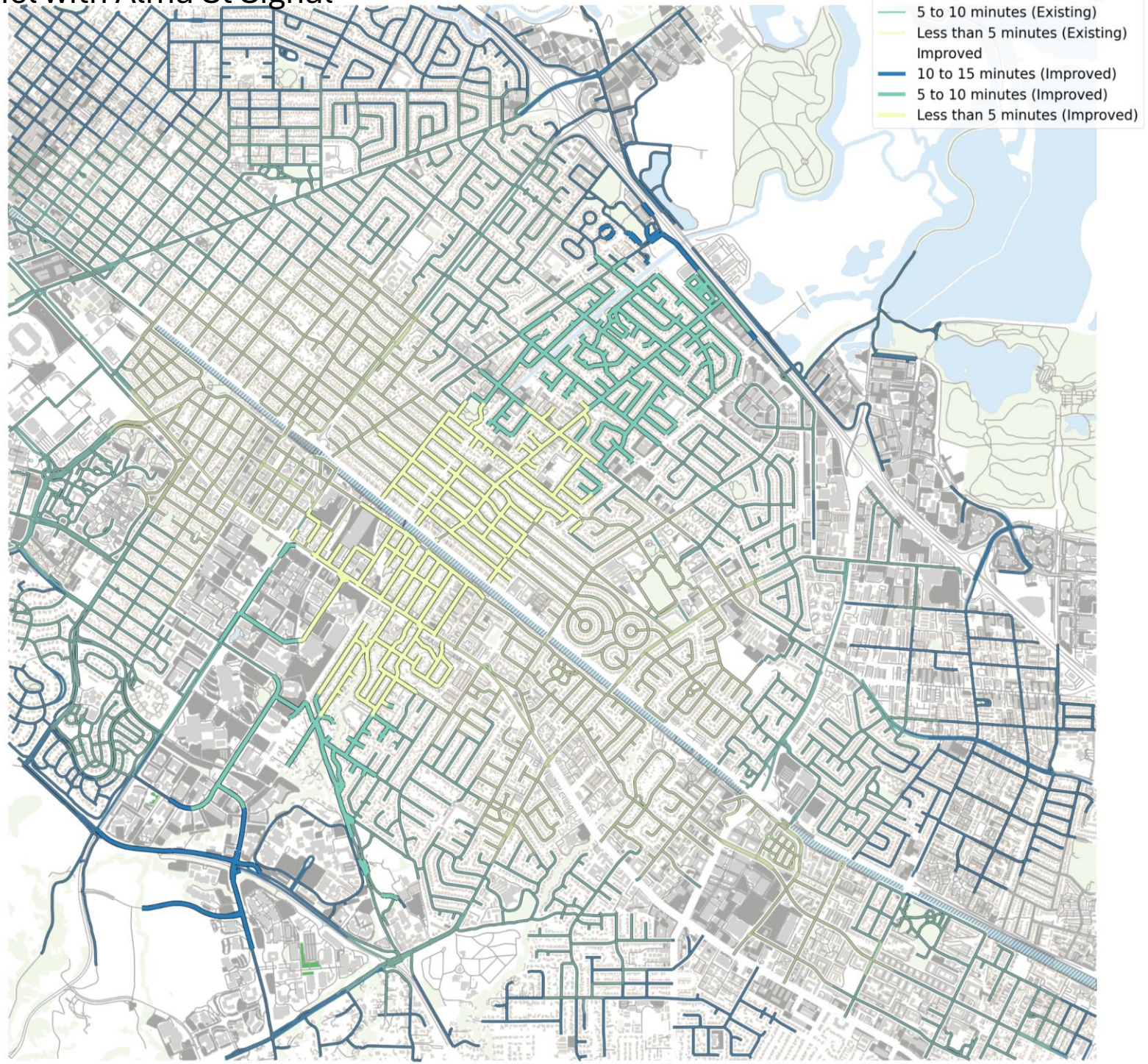
A. El Dorado Ave Tunnel



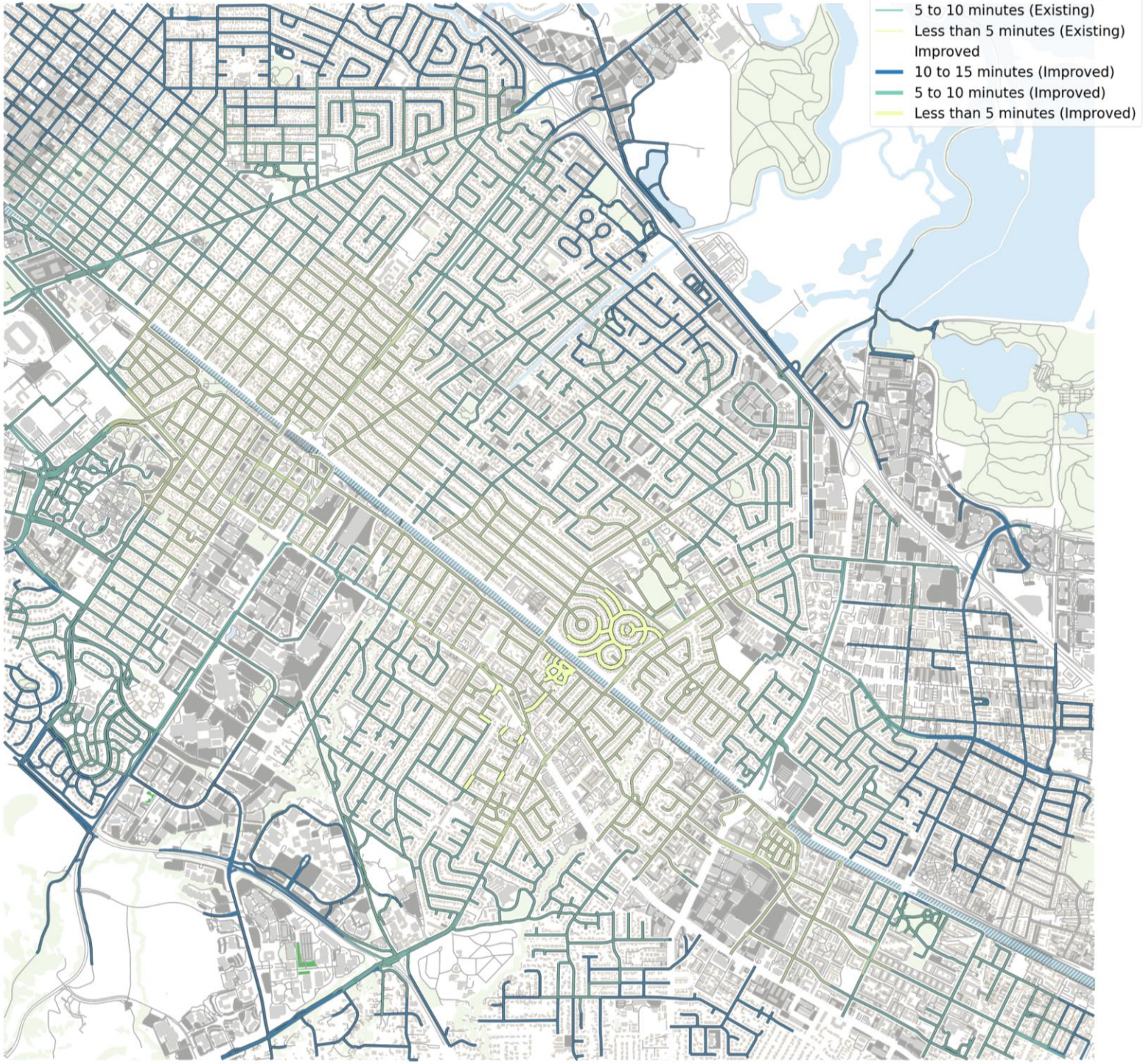
B. Loma Verde Ave Tunnel



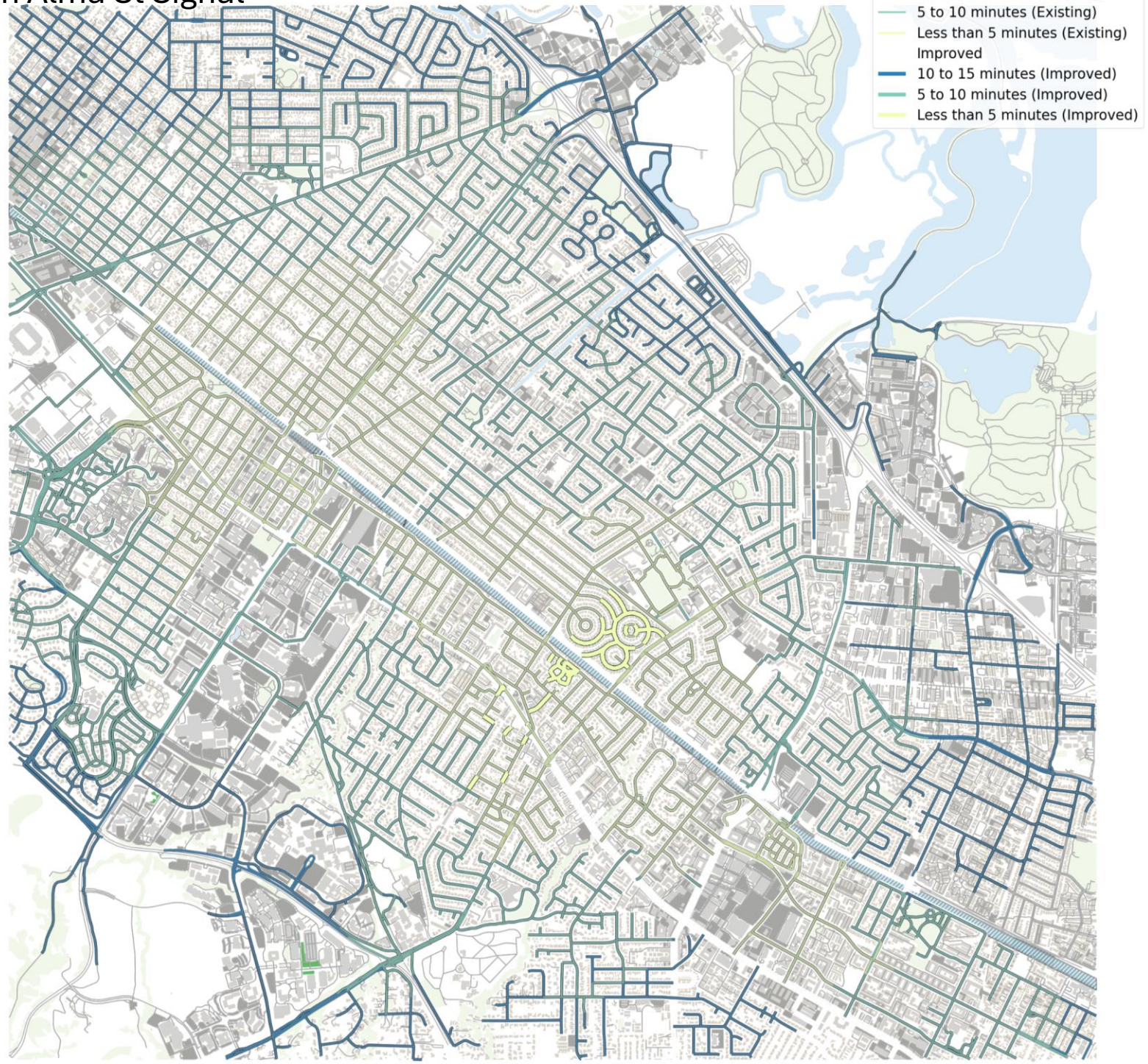
C. Loma Verde Ave Tunnel with Alma St Signal



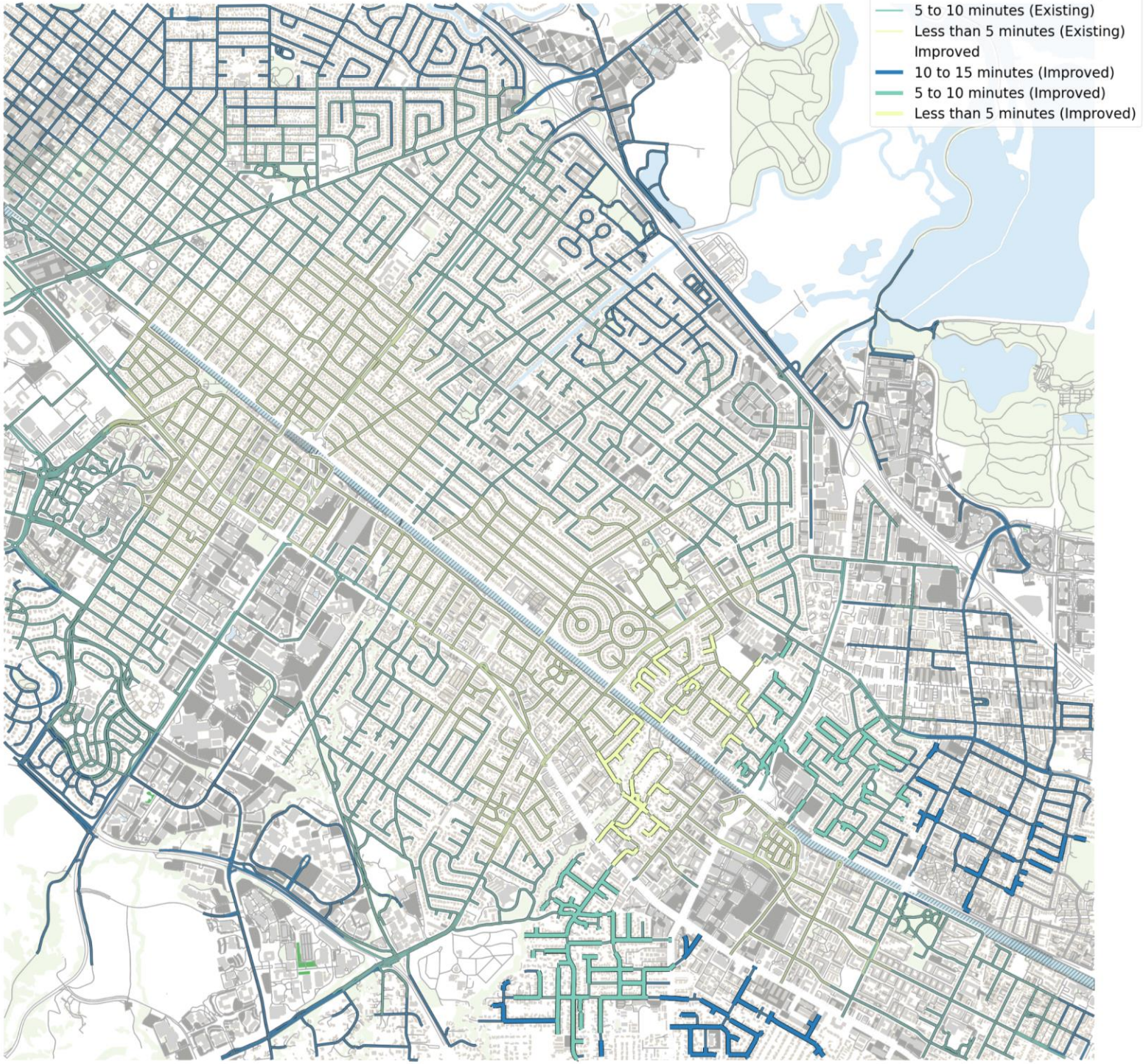
D. Lindero Dr Tunnel



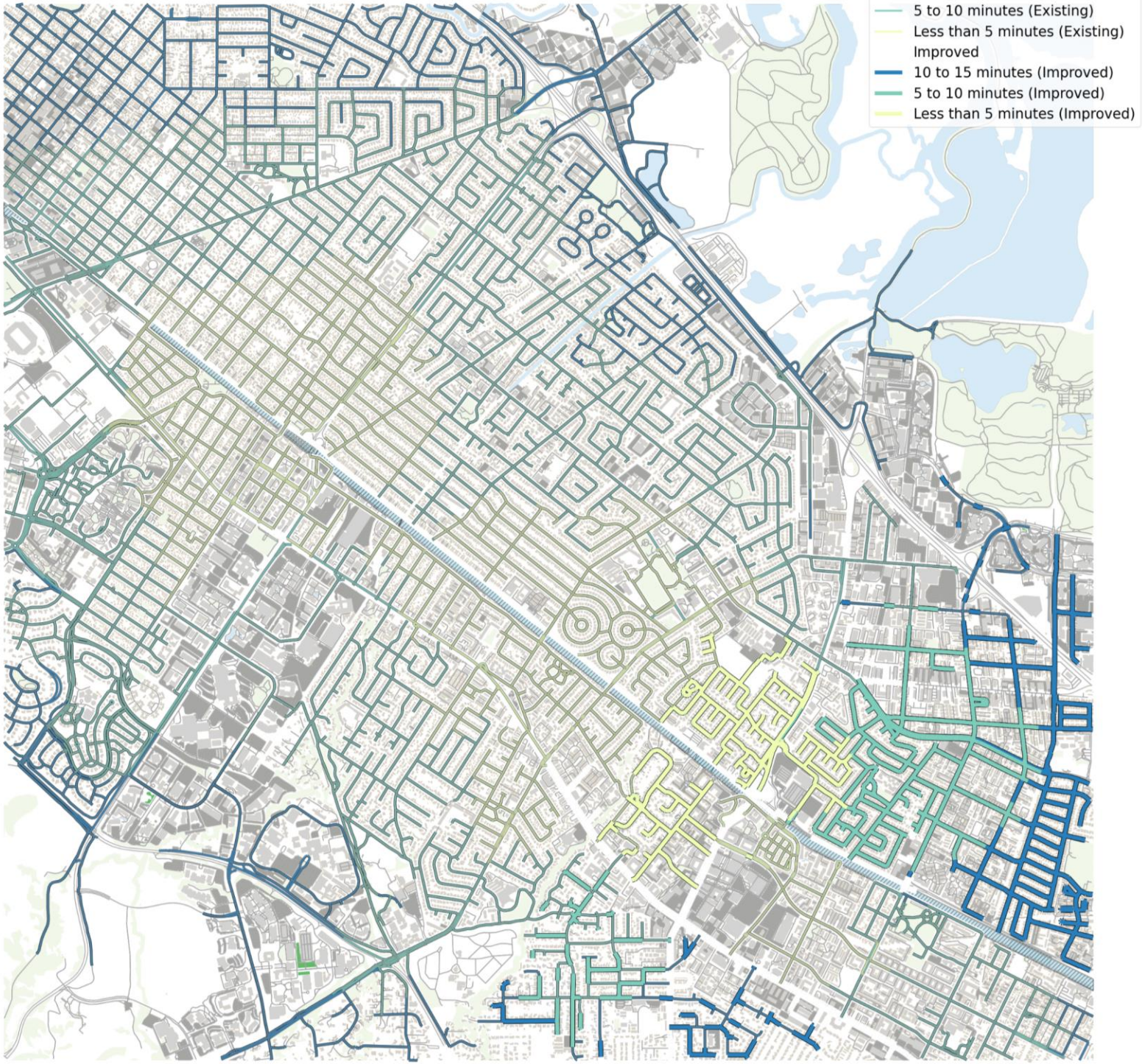
E. Lindero Dr Tunnel with Alma St Signal



F. Ely Pl Tunnel



G. Ferne Ave Tunnel



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