



# Santa Cruz Avenue and Alameda de las Pulgas

## IMPROVEMENTS STUDY

FINAL REPORT - AUGUST 2020

## Acknowledgements

The Santa Cruz Avenue and Alameda de las Pulgas Roadway Improvements project was completed with considerable input and work performed by the community. The County of San Mateo would like to acknowledge the following individuals for their contributions to the project.

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## Executive Summary

The Santa Cruz Avenue and Alameda de las Pulgas corridor serves as a key connection between communities in unincorporated San Mateo County, the City of Palo Alto, Stanford University, and the City of Menlo Park. It also provides local access to the West Menlo Park area, including several schools. The corridor is currently auto-oriented with sharrows, and both school and local bus routes. It is one of the few north/south arterial roadways near I-280 in this area. The community identified the need for this study to increase road safety and accessibility for a variety of modes. Funded primarily by Measure K funds allocated to County Supervisorial District 3, the Santa Cruz Avenue and Alameda de las Pulgas Improvements Study identified and assessed potential improvement measures consistent with goals and objectives identified through a robust community outreach effort led by members of the immediate community and primary users of the corridor. The project was guided by a community Task Force that reviewed technical materials and engaged the broader community for input and feedback that then directed project recommendations.

This study focused on a portion of Santa Cruz Avenue (between Sand Hill Road and Sharon Road) and Alameda de las Pulgas (between Santa Cruz Avenue and Avy Avenue), located in unincorporated San Mateo County and in the City of Menlo Park. The study area is divided into four sections based on the existing lane configurations and the user needs:

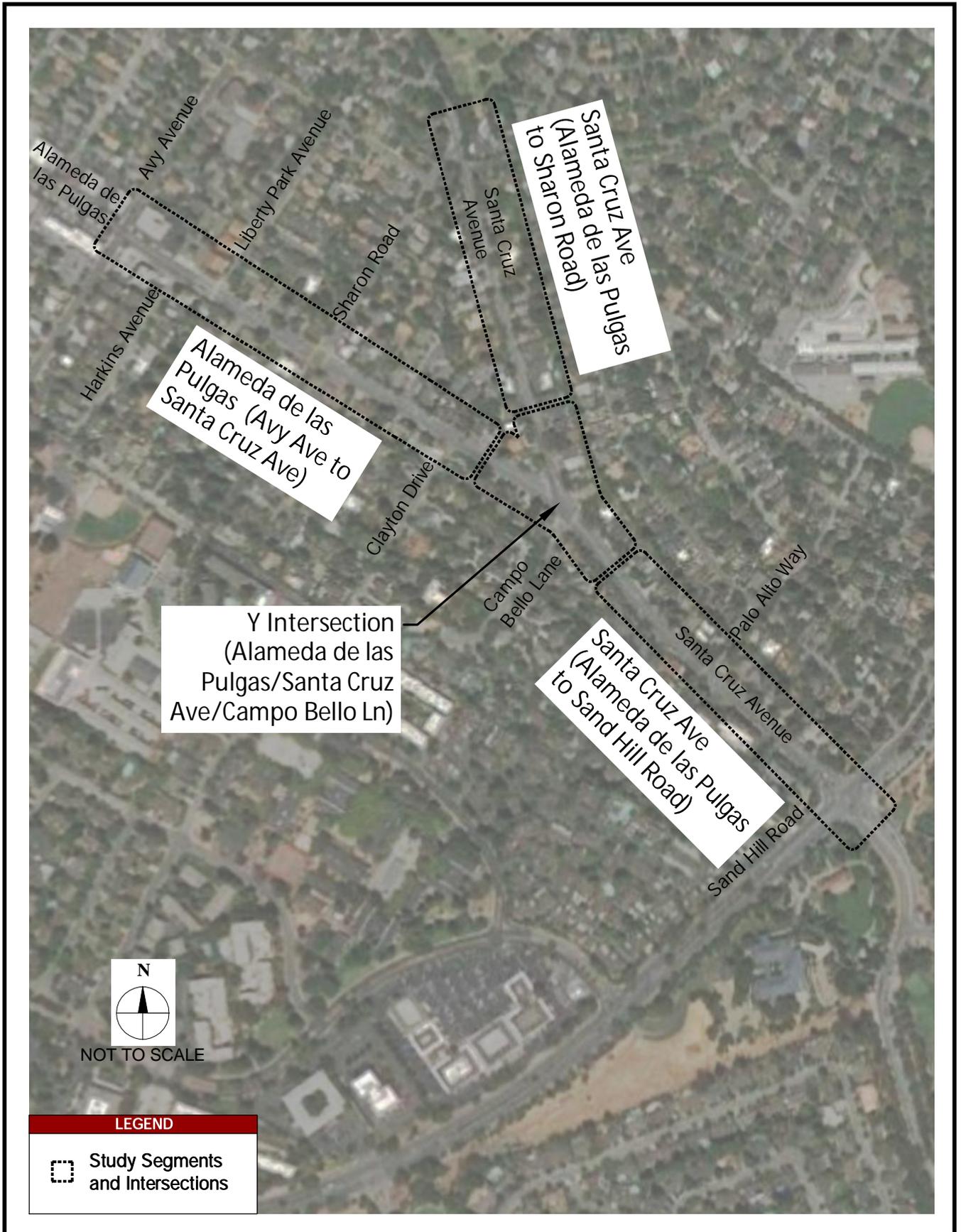
- 1) Santa Cruz Avenue between Sand Hill Road and Alameda de las Pulgas
- 2) Santa Cruz Avenue between Alameda de las Pulgas and Sharon Road
- 3) Alameda de las Pulgas between Santa Cruz Avenue and Avy Avenue
- 4) The “Y” intersection, which is the intersection of Santa Cruz Avenue, Alameda de las Pulgas, and Campo Bello Lane

The study area is shown in Figure E-1.

## Corridor Challenges

Currently, the study corridor serves approximately 21,000 vehicles per weekday along Santa Cruz Avenue to the south of the Y intersection and approximately 11,000 vehicles per weekday along Alameda de las Pulgas to the north of the Y intersection. High traffic volumes combined with higher speeds and the lack of dedicated space results in lower quality bicycle and pedestrian facilities along Santa Cruz Avenue. The roadway is designated as a Class III bicycle route with green-backed sharrows. In addition, the corridor’s on-street parking results in additional friction and conflict points for cyclists.

The proximity of several schools results in frequent use of the corridor or crossings of the corridor by school children, primarily at Sharon Road (which is signalized), at Liberty Park Avenue (which is a side-street stop-control), and at Avy Avenue (which is signalized). The sidewalks along the corridor are less than five feet in most locations and do not meet Americans with Disability Act (ADA) standards in some of those sections. There are also locations where there are utility poles or obstructions in the sidewalk, forcing pedestrians to walk on the street to avoid the obstructions and locations, such as the northwest corner at the Y intersection, where there are sight distance issues due to the curvature of the roadway and existing foliage.





One of the project corridor constraints is the limited roadway right-of-way. The project is not considering solutions that would require taking additional right-of-way from fronting residential uses because of both the excessive cost of land purchases and the significant impacts to individual property owners that would be associated with extending improvements onto current private property. As a result, the space available to enhance bicycle and pedestrian facilities is very limited. In light of these limitations, the project obtained community prioritization of improvement needs since potential pedestrian and bicycle access improvements must ultimately compete for a constrained space.

Based on input from the project stakeholders and the community, the following goals were identified for improvements along this corridor:

- Improve overall safety along Santa Cruz Avenue and Alameda de las Pulgas;
- Support safe and efficient bicycle and pedestrian facilities; and
- Identify cost-effective solutions to address identified problems along the corridor.

### Community-Driven Process

Public outreach and community involvement was extensive, sustained, and integral in shaping this project.

Working with bicycle advocacy groups, the County proposed on-street parking restrictions in 2016, which would have allowed for overnight parking while creating additional space for cyclists during the day. The proposal was rejected by local residents. Subsequent to the proposal, members of the community created the Santa Cruz/Alameda for Everyone (SAFE) community group. The group developed specific corridor recommendations and requested that the County review the corridor to address some of the group's concerns. The County agreed to study the corridor and hired a consultant team, Kimley Horn to initiate a corridor study and develop concepts that would be presented to the community at the first community meeting forum.

The first community meeting was held in August 2017. Approximately 120 community members, including members of SAFE, local law enforcement, and city and county officials attended the meeting. The purpose of this first community meeting was to get input from the community on corridor usage, challenges, and priorities of types of improvements that could be implemented. The meeting included a presentation by the SAFE group on corridor needs. An outcome of the meeting was the convening of a community Task Force to guide project development going forward.

Since the corridor differed considerably from block to block, members of the community wanted to have fair representation to serve on the Task Force. Issues of concern for some on one block may not have been an issue for someone on another block. In order to include a representation of all stakeholders, 16 voting members were chosen for the Task Force. Each person represented a segment of the population in this community or a group with a specific interest in the corridor. Consultation with the Task Force has been on-going since the first community meeting in 2017 and through the development of this Final Report.

An extensive survey of the local community was conducted from September 4, 2018 to September 23, 2018. A total of 701 responses were collected. There was consensus by all respondent groups to the



survey for safety improvements along the study corridor. In light of the constrained roadway widths, respondents were willing to reduce the number of travel lanes in exchange for general safety improvements.

Several Task Force meetings were held during the concept development and review process. The Task Force recognized the need for trade-offs in the final design that were necessary in order to achieve many of the desired improvements. They thoroughly considered these trade-offs and the community feedback that was received through various public input processes, in developing the four alternative designs (including a do-nothing option) that were presented to the community for consideration in January 2020.

### Concept Development and Analysis

Based on input from the first community meeting, and subsequent input from the Task Force, the project team (Kimley Horn and Associates, traffic consultants hired by the County and County staff), developed a series of concept alternatives for the study corridor. Improvements were organized in the following alternatives by geographic segment:

- Santa Cruz Ave between Sand Hill Road and the Y intersection
  - Alternative A – Two Lanes in Each Direction with limited pedestrian improvements
  - Alternative B – One Lane in Each Direction with bicycle lanes and pedestrian improvements
  - Alternative C – Two Lanes in the Northbound Direction and One Lane in the Southbound Direction with new bicycle lanes and pedestrian improvements
  - No-Build
- Santa Cruz Avenue between the Y intersection and Sharon Road
  - No Improvements recommended at this time due right-of-way constraints
- Alameda de las Pulgas between the Y intersection and Avy Avenue
  - Alternative – Road Diet (One Lane in Each Direction with new bike lanes and wider sidewalks)
  - No-Build
- Y intersection (Santa Cruz Avenue/Alameda de las Pulgas/Campo Bello Lane)
  - Alternative A – Removal of south leg crosswalk, and bicycle lanes and pedestrian improvements
  - Alternative B – Northbound right turn channelization, and bicycle lanes and pedestrian improvements
  - Alternative C – Smaller intersection with northeast corner pork chop, and bicycle lanes and pedestrian improvements
  - No-Build

All alternatives that included a build concept included on-street bicycle and pedestrian facilities. Conceptual layouts were developed for each of the alternatives. The project team identified changes in roadway circulation and capacity associated with each of the alternatives and developed micro-



simulation models to analyze intersection delay and corridor travel time. This information was then presented to the Task Force for their input and refinement of the alternatives.

### Community-Selected Preferred Alternative

The second community meeting was held in January 2020. The purpose of the meeting was to inform the public about the project alternatives and elicit feedback from the meeting participants to help determine which improvements they would like to see for the project corridor. Approximately 100 community members attended this meeting.

At the meeting, attendees were encouraged to take an online survey and vote for which alternatives they preferred. The online survey garnered 537 responses. In addition, the County of San Mateo Bicycle and Pedestrian Advisory Committee (BPAC) provided a response letter. There was consensus by all respondent groups of the survey for a change along the study corridor. Approximately 80 percent of the survey respondents felt the subject corridor should be modified. After receiving the survey responses, the project team met with the Task Force to review the responses and select the recommended solutions for the corridor. During the meeting, the Task Force reviewed the responses, and it was clear to them that there was a consensus across different types of users. The Task Force voted and approved the following conceptual improvements:

- Alternative C for Santa Cruz Avenue between Sand Hill Road and the Y intersection
- Road diet for Alameda de las Pulgas between the Y intersection and Avy Avenue
- Alternative C for the “Y” intersection
- “No right turns on red” signal configuration at the “Y” intersection

The Task Force also requested a review copy of this Final Report and an opportunity to provide comments to the Final Report before it is submitted to the County Board of Supervisors for their consideration. Consistent with this request, the report and its contents were made available to Task Force members prior to the finalization of the report.

### Preferred Alternative

Based on the community input, the following improvements shown in Tables E-1 through E-3 summarize the preferred alternative for the study corridor and are shown in the conceptual plan in Figure E-2. Based on the conceptual design of the Preferred Alternative, opinions of probable cost were prepared. The total construction cost of improvements for the entire study corridor is estimated to be \$3.7 Million (2020 dollars). Inclusive of engineering, design and permitting costs, the total cost is estimated to be \$5.4 Million (2020 dollars).



Table E-1: Santa Cruz Avenue between Sand Hill Road and the Y Intersection Improvements

Location	Improvement	Benefit
Entire segment	Install 5-foot or 6-foot bicycle lane Provide dashed green striping in bike lanes within conflict areas	Improved bicycle safety
Entire segment	Reconstruct/widen sidewalk where feasible to a maximum of 5 feet and 6 inches	Improved pedestrian safety
Entire segment	Remove one travel lane in the southbound direction	Allow for other improvements
Entire segment	Restripe travel lanes to be 10 feet wide and the center two-way left-turn lane to be 11 feet	Reduced vehicle speeds
Intersection of Santa Cruz Avenue/Sand Hill Road	Install two-stage turn box for bicyclists making a southbound left turn <sup>a</sup>	Improved bicycle safety
Intersection of Santa Cruz Avenue/Sand Hill Road	Shift crosswalk locations on the north and west legs to be closer to the center of the intersection <sup>a</sup>	Improved pedestrian safety
Intersection of Santa Cruz Avenue/Sand Hill Road	No right turn on red restriction for southbound right turn movement <sup>a</sup>	Improved pedestrian safety
Intersection of Santa Cruz Avenue/Sand Hill Road	Install 2-foot raised median separating southbound traffic and northbound traffic on north leg of intersection	Improved vehicle safety
Intersection of Santa Cruz Avenue/Palo Alto Way	Install new curb ramp and bulb out on northeast corner of intersection Install a rectangular rapid flashing beacon Install yield pavement markings Install a 3-foot raised median island on the north leg of the intersection	Improved pedestrian safety

(a) Improvement to be coordinated with City of Menlo Park



Table E-2: Alameda de las Pulgas between the Y Intersection and Avy Avenue Improvements

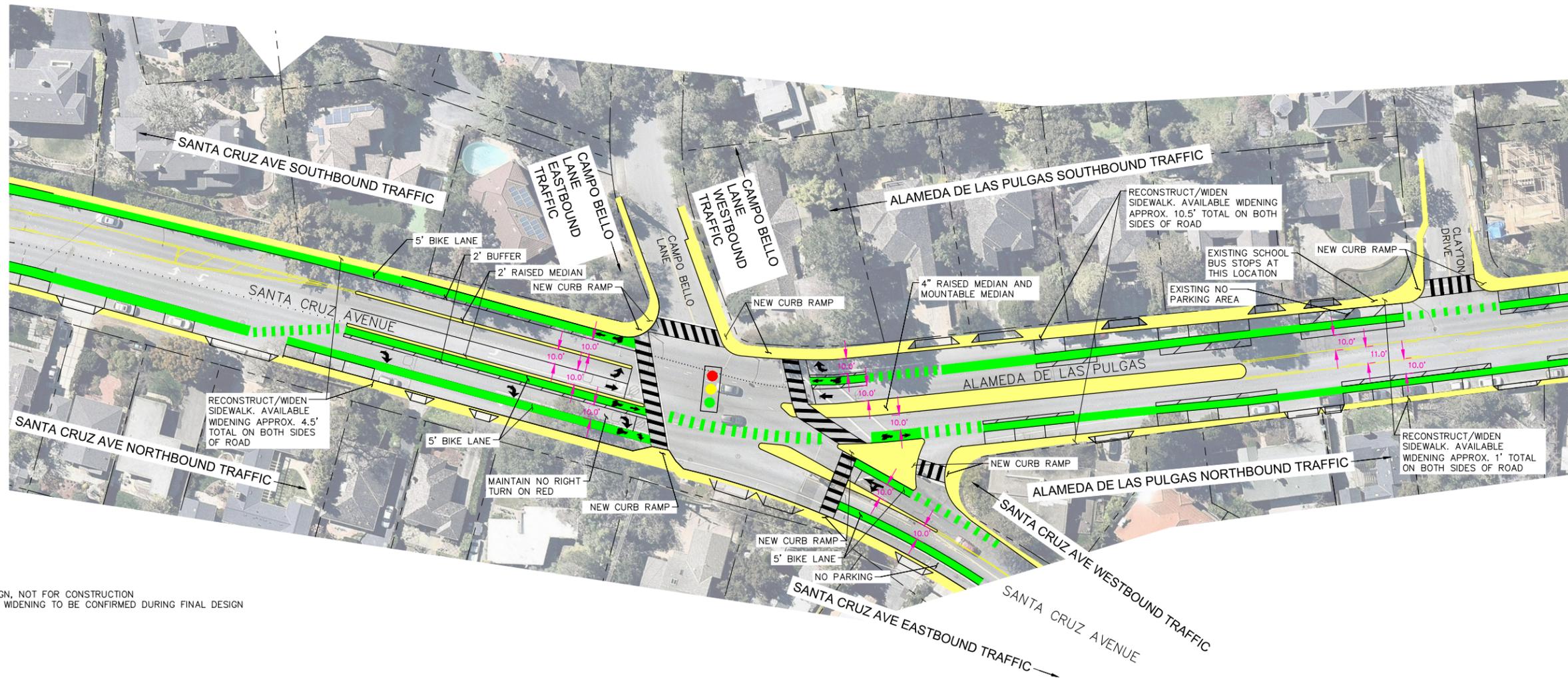
Location	Improvement	Benefit
Entire segment	Install 5-foot or 6-foot bicycle lane with 3-foot buffer Provide dashed green striping in bike lanes within conflict areas	Improved bicycle safety
Entire segment	Reconstruct/widen sidewalk where feasible to a maximum of 5 feet and 6 inches	Improved pedestrian safety
Entire segment	Remove one vehicle travel lane in each direction	Allow for other improvements
Entire segment	Install a center two-way left-turn lane	Improved vehicle safety
Entire segment	Restripe travel lanes to be 10 feet wide and the center two-way left-turn lane to be 11 feet	Reduced vehicle speeds and provide width for bicycle facility
Intersection of Alameda de las Pulgas/Clayton Drive	Install new curb ramps Install new crosswalk on Clayton Drive	Improved pedestrian safety
Intersection of Alameda de las Pulgas/Sharon Road	Install new bus stop on southwest corner	Improved safety
Intersection of Alameda de las Pulgas/Sharon Road	Install new curb ramps Install bulb outs Modify signal timing to include a leading pedestrian interval	Improved pedestrian safety
Intersection of Alameda de las Pulgas/Prospect Street	Install new curb ramps Install new crosswalk on Prospect Street	Improved pedestrian safety
Intersection of Alameda de las Pulgas/Liberty Park Avenue	Install new curb ramps Install a rectangular rapid flashing beacon Install yield pavement markings Install a raised median island on the north and south legs of the intersection	Improved pedestrian safety and reduced vehicle speeds
Intersection of Alameda de las Pulgas/Harkins Avenue	Install new curb ramps Install new crosswalk on Harkins Avenue	Improved pedestrian safety
Intersection of Alameda de las Pulgas/Avy Avenue	Install bicycle loops on both Avy Avenue approaches	Improved bicycle safety



Table E-3: Y Intersection Improvements

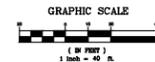
Location	Improvement	Benefit
Entire intersection	Reconstruct/widen sidewalk where feasible to a maximum of 5 feet and 6 inches	Improved pedestrian safety
South leg of intersection	Install a 5-foot bicycle lane and a 2-foot raised median between the northbound through lane and the right turn lane	Improved bicycle safety
South leg of intersection	Install a 5-foot bicycle lane to the right of the northbound right turn lane	Improved bicycle safety
South leg of intersection	Install a buffered 5-foot bicycle lane to the left of the southbound receiving lane	Improved bicycle safety
South leg of intersection	Preserve pilot signal timing to restrict Right Turn on Red movements	Improved safety for all users
East leg of intersection	Install new curb ramps and crosswalk	Improved pedestrian safety
East leg of intersection	Install raised median separating eastbound and westbound vehicle traffic lanes	Improved vehicle safety
East leg of intersection	Construct new sidewalk and raised porkchop island on northeast corner of intersection	Improved pedestrian safety
North leg of intersection	Install raised median separating northbound and southbound vehicle traffic lanes	Improved vehicle safety
North leg of intersection	Install new curb ramps and crosswalk	Improved pedestrian safety

# SANTA CRUZ CORRIDOR IMPROVEMENT STUDY COMMUNITY - PREFERRED ALTERNATIVE



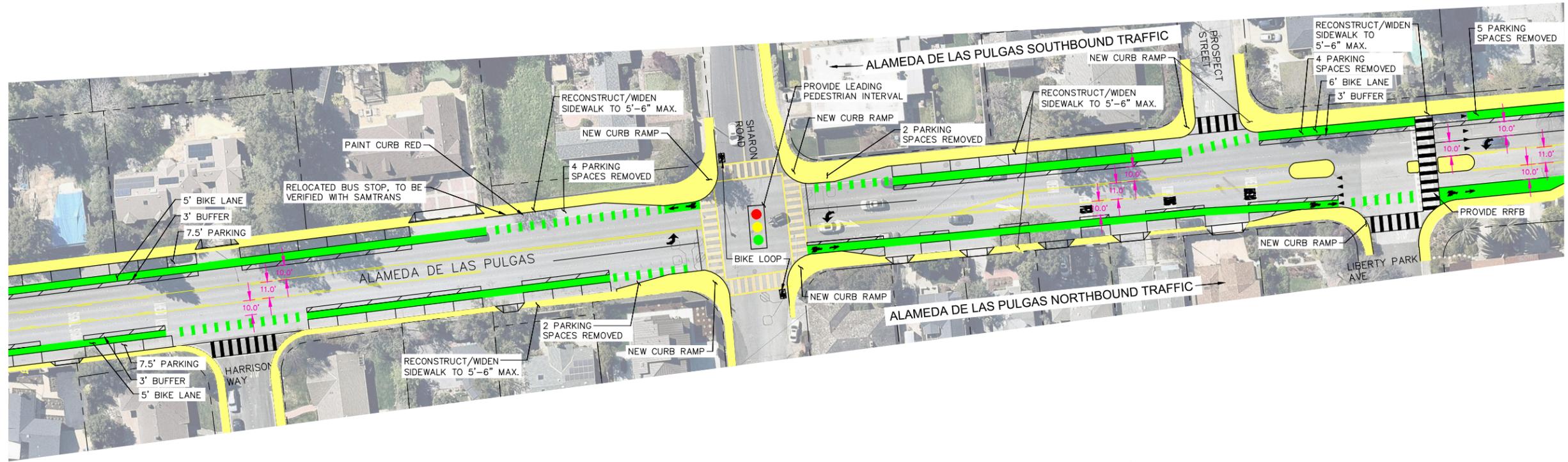
- GENERAL NOTES:  
 1. CONCEPTUAL DESIGN, NOT FOR CONSTRUCTION  
 2. ACTUAL SIDEWALK WIDENING TO BE CONFIRMED DURING FINAL DESIGN

SANTA CRUZ AVENUE FROM PALO ALTO WAY TO CAMPO BELLO LANE/ALAMEDA DE LAS PULGAS  
 ALAMEDA DE LAS PULGAS FROM SANTA CRUZ/CAMPO BELLO LANE TO CLAYTON DRIVE

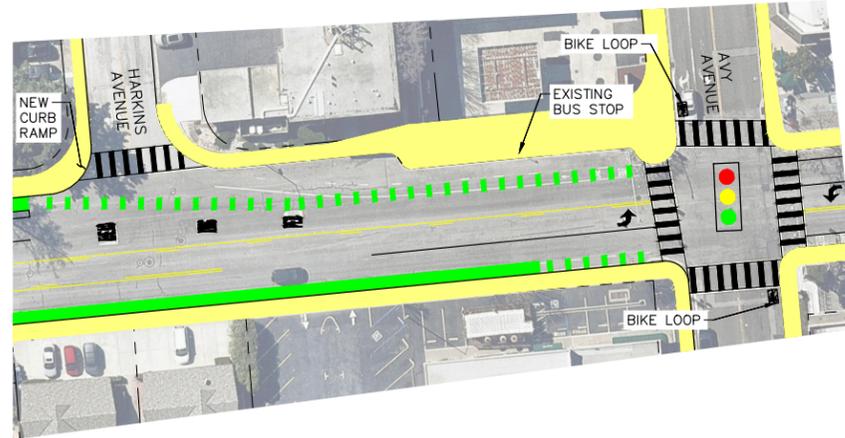


APRIL 2020

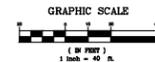
# SANTA CRUZ CORRIDOR IMPROVEMENT STUDY COMMUNITY - PREFERRED ALTERNATIVE



- GENERAL NOTES:
1. CONCEPTUAL DESIGN, NOT FOR CONSTRUCTION
  2. ACTUAL SIDEWALK WIDENING TO BE CONFIRMED DURING FINAL DESIGN



ALAMEDA DE LAS PULGAS FROM CLAYTON DRIVE TO AVY AVENUE

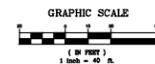


APRIL 2020

# SANTA CRUZ CORRIDOR IMPROVEMENT STUDY COMMUNITY - PREFERRED ALTERNATIVE



GENERAL NOTES:  
 1. CONCEPTUAL DESIGN, NOT FOR CONSTRUCTION  
 2. ACTUAL SIDEWALK WIDENING TO BE CONFIRMED DURING FINAL DESIGN



APRIL 2020

SANTA CRUZ AVENUE FROM SAND HILL ROAD TO PALO ALTO WAY



### Summary and Next Steps

Implementation of the Preferred Alternative, as selected based on community input, addresses many of the key issues identified by the community. It would address pedestrian, bicyclist, and vehicle safety concerns throughout the entire study corridor. If implemented as proposed, pedestrians would have improved sidewalks on both sides of the road within either side of the study corridor including sidewalks widening up to 5 feet and 6 inches in width. Raised pedestrian visibility through RRFB and pedestrian safety islands at unsignalized crosswalks across Santa Cruz Avenue and across Alameda de las Pulgas would improve pedestrian comfort as well. In addition, crosswalks at signalized intersections would be modified to have a shorter crossing distance and reduced blind spots through bulbouts and crosswalk reconfiguration without sacrificing truck turning movements for school buses and fire trucks. Bicyclists would experience a more comfortable ride with the proposed bicycle lanes (and some segments with buffered bike lanes) in each direction along the corridor as well as new bicycle detection at signalized side-streets and two-stage bike turn boxes<sup>1</sup> at the Sand Hill Road intersection. Lastly, vehicle speeds along the corridor would be expected to drop with the reduction in travel lanes and travel lane widths, the implementation of new raised medians and safety islands, and signal operation modifications at the Y. These changes are also likely to increase motor vehicle delay. Further engineering will be required to refine the improvement concepts included in the preferred alternative based on additional survey and utility data collection.

Grant funding will need to be identified for the implementation of improvements. The improvements may be competitive for a variety of grants focusing on improving bicycle and pedestrian connectivity and safety, roadway safety, and complete streets.

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<sup>1</sup> Bike boxes on Sand Hill Road and Santa Cruz would require additional coordination with the City of Menlo Park



## 1. Introduction

### 1.1. Study Area

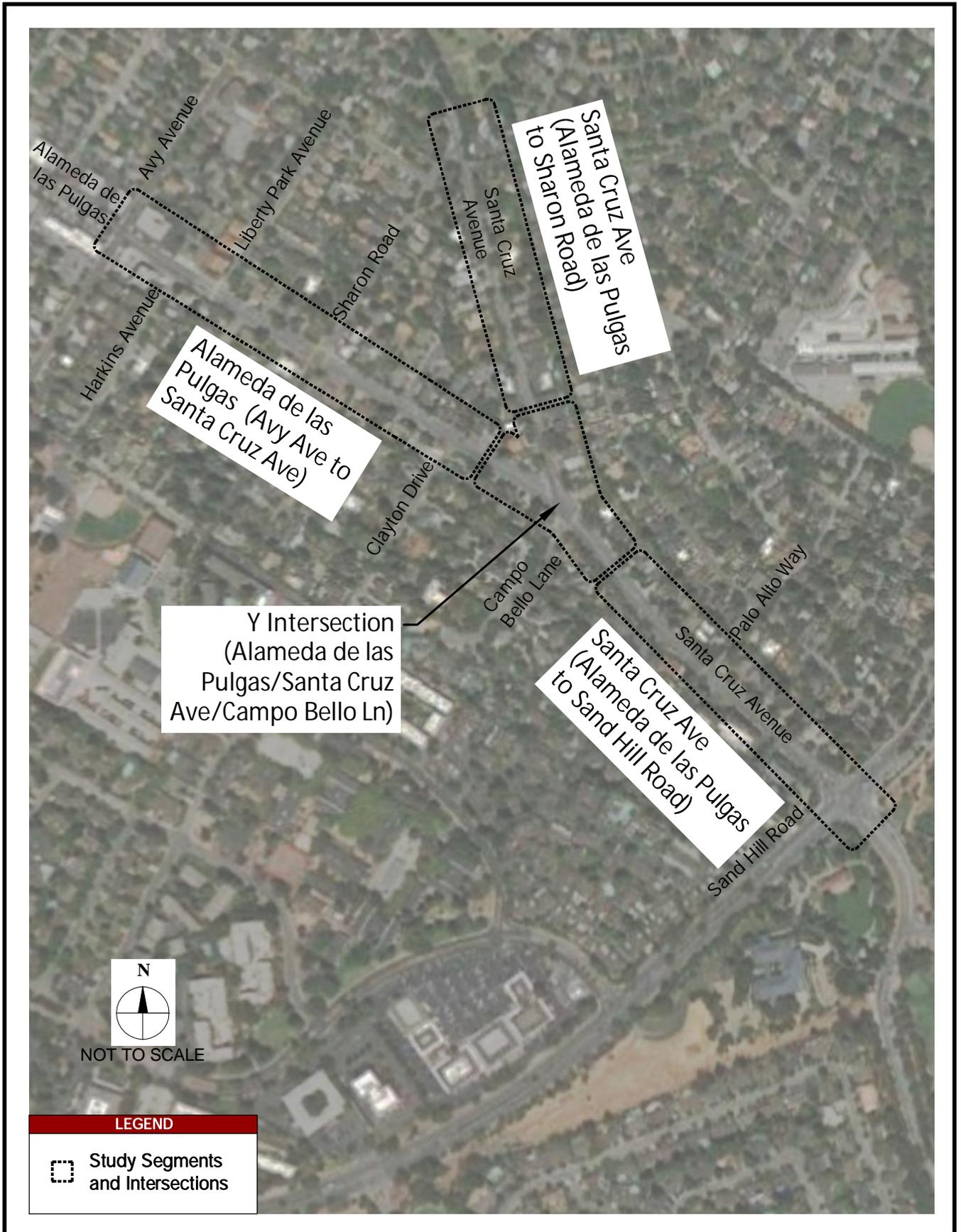
This study focused on a segment of Santa Cruz Avenue (between Sand Hill Road and Sharon Road) and Alameda de las Pulgas (between Santa Cruz Avenue and Avy Avenue), located in unincorporated San Mateo County. The study area is divided into four sections based on the existing lane configurations and the user needs:

- 1) Santa Cruz Avenue between Sand Hill Road and Alameda de las Pulgas
- 2) Santa Cruz Avenue between Alameda de las Pulgas and Sharon Road
- 3) Alameda de las Pulgas between Santa Cruz Avenue and Avy Avenue
- 4) The “Y” intersection, which is the intersection of Santa Cruz Avenue, Alameda de las Pulgas, and Campo Bello Lane

The study area is shown in Figure 1-1. Within the study area, Santa Cruz Avenue and Alameda de las Pulgas provide several different transportation uses, including auto commuters, local community access, access to local schools, and recreational and commute cyclists. Santa Cruz Avenue to the south of the study area connects to Alpine Road and Sand Hill Road, which are arterials that connect to Interstate 280. To the north of the study area, Santa Cruz Avenue connects to Downtown Menlo Park and Alameda de las Pulgas connects to Atherton, Menlo College, Sacred Heart Schools, and Stanford off campus facilities. Adjacent to the study corridor are primarily residential homes, including Menlo Commons, a senior community. Also located near the corridor are several schools, including Las Lomitas Elementary School, La Entrada Middle School, Philip Brooks School, Oak Knoll School and a shopping strip.

Santa Cruz Avenue between Sand Hill Road and Alameda de las Pulgas is two lanes in each direction, with a two-way left-turn lane (TWLTL) separating the opposing lanes. The posted speed limit is 25 miles per hour (mph) in both directions, while noting that there is a senior citizen facility located nearby. The speed limit was reduced as part of this study in response to early community input. This portion of the study corridor is designated as a Class III bike route on both sides of the roadway. During the process of this study, green-backed sharrows were added to the roadway. There is also existing parking on the east side of Santa Cruz Avenue.

Santa Cruz Avenue between Alameda de las Pulgas and Sharon Road is one lane in each direction with a striped shoulder on each side that is used for parking. The posted speed limit is 30 mph in both directions. This portion of the study corridor is designated as a Class III bike route on both sides of the roadway. Because of right-of-way constraints, limited improvements can be made to this section. Minor bicycle improvements such as “Share the Road” bicycle pavement markings are possible.





Alameda de las Pulgas between Santa Cruz Avenue and just north of Liberty Park Avenue is two lanes in each direction. North of Liberty Park Avenue, the roadway narrows to one lane in each direction with a striped Class II bike lane. The posted speed limit is 25 mph in both directions for most of the study segment, except the portion north of Liberty Park Avenue in the northbound direction is posted as 30 mph. Alameda de las Pulgas south of Liberty Park is signed as a Class III bike route with green-backed sharrows. There is also on-street parking on the both sides of Alameda de las Pulgas between Liberty Park Avenue and Santa Cruz Avenue.

### 1.2. Project Need & Objectives

This corridor is used by the local community, as well as commuters to get to and from West Menlo Park, Downtown Menlo Park, I-280, Stanford University and Medical Center, and Palo Alto. Currently, the study corridor serves approximately 21,000 vehicles per weekday along Santa Cruz Avenue to the south of the Y intersection and approximately 11,000 vehicles per weekday along Alameda de las Pulgas to the north of the Y intersection. Automobile speeds were observed to exceed the speed limit during non-congested periods in several locations.

As the entire study area (except for the short segment on Alameda de las Pulgas north of Liberty Park Avenue) is a Class III bike route, bicyclists share the roadway with motorists. Due to high automobile speeds, parked vehicles, and high-volume turning movements at the Y, this results in a bicycle environment that is not comfortable for most users. It represents a critical gap in the bicycle network, as bicycle lanes are provided to the north along Alameda de las Pulgas and to the south along Alpine Road and via Alpine Trail, a roadway-adjacent shared-use trail.

There is moderate pedestrian activity in this corridor, primarily consisting of school children using the corridor to access nearby school and bus stops along Alameda de las Pulgas/Santa Cruz Avenue. Pedestrian activity is likely somewhat dampened by very narrow and uncomfortable sidewalks. Along most of this corridor, pathways are less than five feet and, in many locations, do not meet Americans with Disability Act (ADA) standards. At several locations within the study area, there are utility poles or obstructions in the sidewalk that force pedestrians to walk on the street to avoid the obstructions. There are also locations, such as the northwest corner at the Y intersection where there are sight distance issues due to the curvature of the roadway and existing foliage.

One of the project corridor constraints is the limited roadway right-of-way. The project is not considering solutions that would require taking additional right-of-way from fronting residential uses. As a result, the space available to enhance bicycle and pedestrian facilities is very limited. Therefore, the project obtained community prioritization of improvement needs since not all the improvements can be constructed within the constrained area.

Based on input from the project stakeholders and the community, the following goals were identified for improvements to Santa Cruz Avenue and Alameda de las Pulgas:

- Improve safety along Santa Cruz Avenue and Alameda de las Pulgas;
- Support safe and efficient bicycle and pedestrian facilities; and
- Identify cost-effective solutions to address identified problems along the corridor.



## 2. Project Methodology

### 2.1. Prior Community Input

The project was initiated based on community requests for County consideration of improvements within the study area. The community was interested in improvements to reduce vehicle speeds, improve vehicle safety, improve pedestrian safety and comfort, and provide improved bicycle facilities. Several community members formed the group Santa Cruz/Alameda for Everyone (SAFE) and they prepared a report, *Santa Cruz Avenue/Alameda de las Pulgas – Safety Issues and Options Proposal*<sup>2</sup>, documenting their concerns, safety issues, and potential solutions for the corridor. The following summarizes their concerns:

- Lane inconsistency along Alameda de las Pulgas within Study limits and to the north
  - Alameda de las Pulgas should be one lane in each direction with Two-Way Left-Turn Lane (TWLTL) and bicycle lanes to match the existing configuration to the north of the study area
- High speeds along Santa Cruz Avenue between Sand Hill Road and the Y intersection
- Challenging crosswalk at Santa Cruz Avenue/Sharon Road
  - The current location of the crosswalk has visibility issues leading to rear-end collisions
- High speeds along Alameda de las Pulgas between Avy Avenue and the Y intersection
- Safety concerns for residents using the driveways in the Y intersection
- Challenging crosswalk at Santa Cruz Avenue/Palo Alto Way
- Challenging crosswalk at Alameda de las Pulgas/Sharon Road
- Request for bicycle lanes along Santa Cruz Avenue between Sand Hill Road and the Y intersection
- Request for bicycle lanes along Santa Cruz Avenue between the Y intersection and Avy Avenue
- Less than ideal conditions at the Y intersection:
  - Crosswalks are long, have poor visibility, and lack stop limit lines
  - Northwest corner has sight distance issues for southbound right turning vehicles
  - High speeds for northbound right turning vehicles to Downtown Menlo Park
  - Driveway access issues near the Y intersection
  - Lack of bicycle lane guidance through confusing intersection
  - Lack of proper sidewalks to the north and east of the Y intersection, including poles and obstructions in the middle of walkways
- Narrow sidewalks and obstructions in walkway
- Narrow walkways accessing the bus stop at Clayton Drive
- High volumes, safety, and limited transit along the corridor
- Unsafe crosswalks at the intersection of Santa Cruz Avenue and Sand Hill Road
- TWLTL on Santa Cruz Avenue used as a traffic lane for southbound direction approaching Sand Hill Road

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<sup>2</sup> *Santa Cruz Avenue/Alameda de las Pulgas – Safety Issues and Option Proposals*, SAFE Committee, August 23, 2017.



Following review of the SAFE report and the formation of the Task Force, the County evaluated potential modifications that could be implemented in the short term consistent with community desires, while the study proceeded. Modifications installed during the corridor study period included the following:

- Reduced speeds along Santa Cruz Avenue from Sand Hill Road to Prospect Ave through the installation of a 25 mile per hour speed zone due to nearby senior housing, the installation of speed radar feedback units, and requests for enhanced speed limit law enforcement.
- Restriping and the strategic installation of delineators in front of the Menlo Commons facility to discourage the use of the two-way left turn lane as a through lane from Santa Cruz Avenue to Sand Hill Road.
- Bicycle sharrows on both legs of this corridor to promote bicycle safety
- Additional vegetation trimming to keep sight distances clear
- Removal of one lane from northbound Santa Cruz Avenue before the Y intersection and prohibiting right turns on red towards downtown Menlo Park

## 2.2. Project Process

The project was completed following the general process shown in Figure 2-1. Technical analysis and community input were used to identify the various issues along the corridor, and then provide recommended improvement alternatives. A community-led Task Force was created after initiation of this project to assist the project team in identifying critical issues and review proposed improvements.

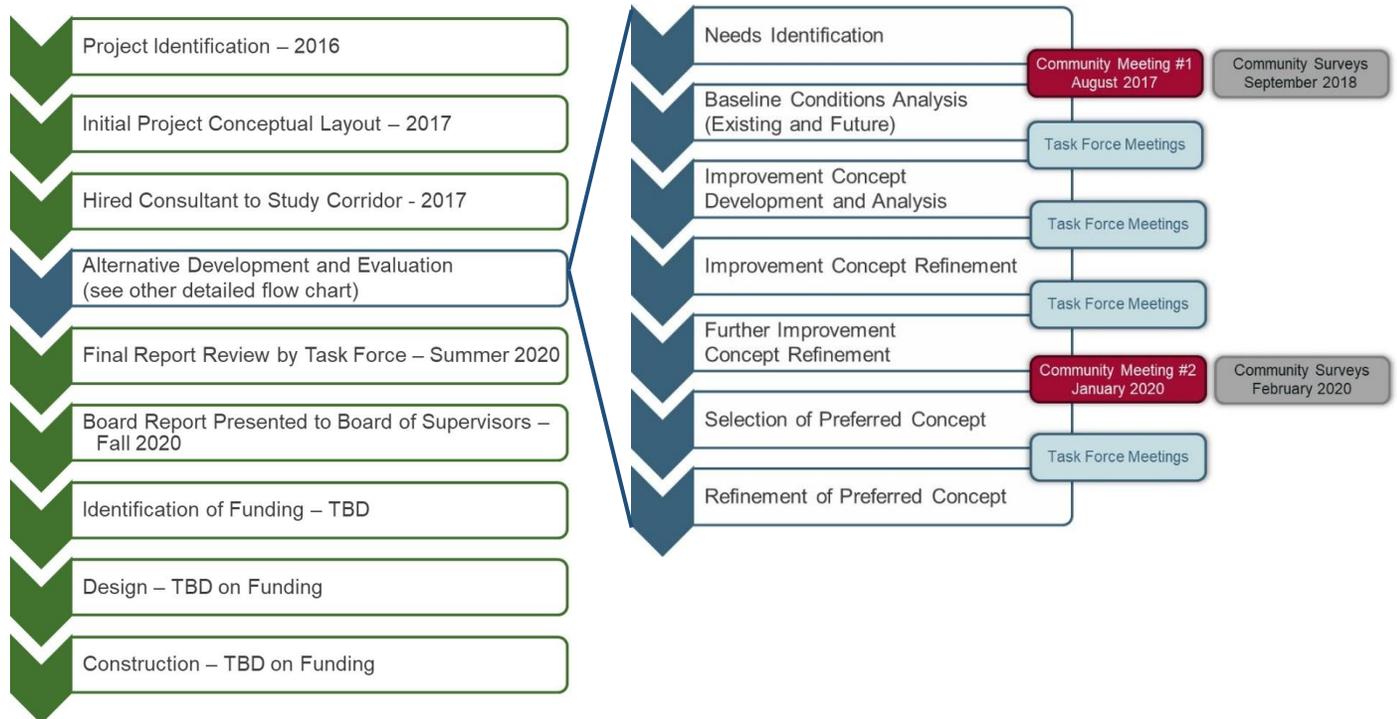
The project team analyzed existing and projected future conditions along the corridor to determine corridor needs and potential areas of improvement.

Based on this initial input on project needs and potential types of improvements, an initial set of two improvement concept alternatives were developed. Conceptual layouts drawn over aerial imagery were prepared for each alternative to assess feasibility and define the configuration of the improvement alternatives. Improvement concepts were analyzed using a micro-simulation model of the entire study area. The micro-simulation model fully accounted for the several modes that utilize the corridor, as well as upstream and downstream congestion. It discretely modeled each user and each intersection, allowing for a real-world evaluation of the complex multi-modal interactions occurring throughout the corridor. The first step was to build a model that was calibrated to existing conditions and included existing traffic signal parameters. To represent future conditions, traffic volumes were increased to match future projected volumes from the Countywide travel demand forecast model. Finally, each of the proposed improvement alternatives were modeled to understand the ramifications of the alternatives on congestion, delay, and queues.

In addition to the direct interaction with the public at the Task Force and community meetings, the project team developed a website for the project (<http://publicworks.smcgov.org/projects/santa-cruz-avenue-corridor-study>). This website was used to post announcements for public meetings, provide the community with all materials shown at the meetings (including PowerPoint presentations, information boards and videos), and post project deliverables.



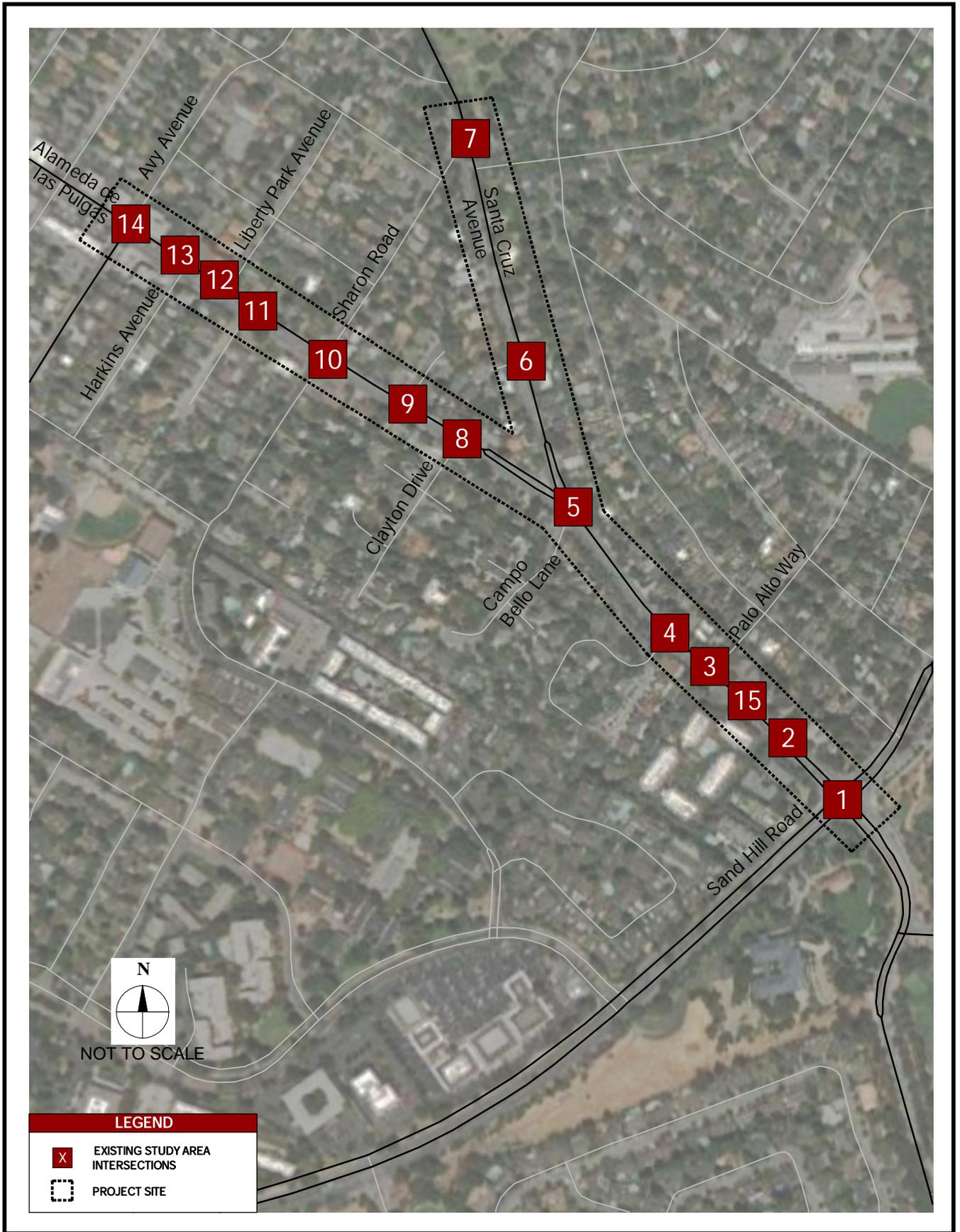
Figure 2-1: Project Flow Chart



Kimley-Horn presented the improvement alternatives, along with the analysis results, to the Task Force in August 2019. At that meeting, the Task Force provided feedback on the improvement concepts. After subsequent Task Force meetings, a third improvement concept alternative was developed. Following additional Task Force input, and subsequent technical evaluation, the improvement alternatives were presented to the community. A community meeting was held on January 30, 2020 to present the three improvement alternatives to the public. The community indicated its preferences for the corridor through an online survey. The Task Force used the survey results to identify a preferred set of improvements which are reflected in this report.

### 2.3. Data Collection

To evaluate the project alternatives, 15 study intersections were selected within the study corridor. Figure 2-2 shows the locations of the study intersections. The County of San Mateo provided intersection turning movement volume data for the study intersections collected in January 2019. Automobile, bike, and pedestrian counts were collected for all project study intersections during AM (7:00-9:00 AM) and afternoon/PM (2:00-6:00 PM) peak periods. The County also provided arterial speed, vehicle classification, and volume data along the study corridor collected in January 2019. The arterial data was collected over 24-hours for seven (7) days using mechanical tubes. Raw intersection turning movement counts and 24-hour volumes can be found in Appendix A. It should be noted that the directions in the raw counts may show Santa Cruz Avenue as the east/west directions, whereas the analysis and concepts rotated the directions along Santa Cruz Avenue to be north/south to better align with the commonly inferred directionality of the corridor.





The County of San Mateo (County) provided Kimley-Horn with current traffic signal timing sheets for use in the analysis models. Santa Clara Valley Transportation Authority (VTA) modeling staff utilized the joint VTA-City/County Association of Governments (C/CAG) travel demand model to provide AM and PM peak hour forecast plots of the study area for the baseline and horizon year (2040) scenarios. The models were reviewed and refined and interpolated to reflect 2030 conditions to reflect reasonably expected roadway geometrics in the vicinity of the study area.

The County provided historical collision data from the Statewide Integrated Traffic Records System (SWITRS) for the study corridor between January 1, 2009 and December 31, 2019. The community also provided their own collision data that was reported by witnesses and the Menlo Park Fire Department (MPFD) between October 2016 and December 2017.

Kimley-Horn performed site visits to observe corridor conditions in the morning and evening peak hours, documented existing intersection and roadway geometrics, and collected arterial travel time data.

### 2.4. Analysis and Evaluation of Improvements

Traffic analysis of the improvement concept alternatives developed for this study was performed for three scenarios: Existing (2019), Medium-Term (2030), and Long-Term (2040). Within each analysis scenario, conditions were analyzed for peak hours during the AM (7:00-9:00 AM) and PM (2:00-6:00 PM) periods. The PM period from 2:00-6:00 PM includes the school PM peak period to reflect activity generated by school-related traffic.

Traffic analysis of the alternatives was performed using the VISSIM micro-simulation platform, which allows for modeling of individual vehicle movements as they travel through the roadway network. This micro-simulation model allows the operations of the entire study area network to be considered in an integrated fashion, providing for the detailed evaluation of upstream and downstream effects of a set of solutions. A critical component of the analysis was understanding how treatments at the individual intersections interact and affect upstream and downstream locations.

VISSIM is a sophisticated and detailed analysis tool that provides the ability to model complex multimodal traffic interactions, including merge, weave, pedestrian, and bicycle movements. Existing auto, transit, bicycle, and pedestrian activity data was utilized in the micro-simulation model.

The VISSIM analysis calculated metrics such as intersection delay, queuing, and corridor travel time for the baseline scenario and each alternative. Videos created from the VISSIM model allowed for visual demonstration of conditions with the baseline scenario and each improvement alternative. These videos—utilized in the second community meeting—enhanced community understanding of the alternatives and feedback.

Intersection operations are described using a level of service grade, as defined by the Highway Capacity Manual (HCM) 6<sup>th</sup> Edition. The level of service ranges from A to F, with A representing little to no delay and F representing failing conditions with excessive delay.

Intersection delay was obtained from the VISSIM model in the form of seconds of delay. This was converted to a level of service using HCM thresholds for delay (shown in Table 2-1). It is noted that the



VISSIM model does not rely on HCM methodologies and thus the level of service grade provided should be used as a comparative tool only and may not match the findings of an HCM-based analysis.

Table 2-1: Intersection Level of Service Definitions

Level of Service	Description	Signalized (Avg. control delay per vehicle, sec/veh.)	Unsignalized (Avg. control delay per vehicle, sec/veh.)
A	Free flow with no delays. Users are virtually unaffected by others in the traffic stream	≤ 10	≤ 10
B	Stable traffic. Traffic flows smoothly with few delays.	10 – 20	10 – 15
C	Stable flow but the operation of individual users becomes affected by other vehicles. Modest delays.	20 – 35	15 – 25
D	Approaching unstable flow. Operation of individual users becomes significantly affected by other vehicles. Delays may be more than one cycle during peak hours.	35 – 55	25 – 35
E	Unstable flow with operating conditions at or near the capacity level. Long delays and vehicle queuing.	55 – 80	35 – 50
F	Forced or breakdown flow that causes reduced capacity. Stop and go traffic conditions. Excessive long delays and vehicle queuing.	> 80	> 50

Sources: Transportation Research Board, *Highway Capacity Manual 6<sup>th</sup> Edition*, National Research Council, 2016

## 2.5. Improvement Scenarios

After gathering background information, reviewing Task Force and community suggestions, and performing a baseline analysis, Kimley-Horn identified a list of potential corridor improvements. The list included a variety of solutions that could be feasible for implementation along Santa Cruz Avenue and Alameda de las Pulgas. Kimley-Horn consulted recent research, recent projects in the region, and experience in developing the potential improvement list. Kimley-Horn evaluated the list of potential improvements based on their applicability to the unique environment and constraints in the project area and identified the improvements that would be most appropriate and consistent with project goals; these improvements were then compiled into four corridor areas.

Kimley-Horn produced graphic layouts of each of the segments and alternatives to help obtain Task Force and community input on the characteristics of the alternatives. The alternatives were evaluated on a corridor-wide basis to understand the effectiveness of a set of solutions at achieving the project goals.



### 3. Community Input on Needs and Priorities

The Santa Cruz Avenue and Alameda de las Pulgas corridor is a main thoroughfare for many motorists, pedestrians, transit riders, and cyclists living and working in and around the West Menlo Park area of the unincorporated County of San Mateo. This corridor has seen a steady increase in the volume of traffic from Stanford University and Hospital, expansion of nearby schools, increases in density of housing units, and increasing number of businesses in nearby cities. The County initiated discussions with the adjacent communities in 2017 on possible improvements within the corridor, ultimately hosting a community meeting in August 2017 with parties who had a specific interest in the corridor, including nearby residents. Through these discussions, safety improvements were established as a priority, though there was no consensus on how these should be achieved, in light of the limited existing right of way and trade-offs associated with individual improvements. A Task Force representing a variety of stakeholders was formed to identify critical issues, trade-offs and guide the development of public surveys and concept alternatives.

#### 3.1. August 2017 Community Meeting

The San Mateo County Public Works Department hosted a community meeting on Monday, August 28, 2017, from 7:00-9:20 PM to discuss the Santa Cruz Avenue corridor between Sand Hill Road and Avy Avenue. The meeting was held at the Oak Knoll School in Menlo Park. Approximately 120 community members attended the meeting. The purpose of this first community meeting was to get input from the community on corridor usage, challenges, and priorities of types of improvements that could be implemented.

After a brief welcome and introduction by County Supervisor Don Horsley, the SAFE community group presented suggested improvements for the corridor. The 30-minute presentation was followed by a brief question and answer period. Immediately following this, the Kimley-Horn project manager presented information on the project via a PowerPoint presentation. Kimley Horn's presentation was given to orient the attendees to the purpose of the project, project objectives, proposed evaluation criteria, and potential project improvement concepts. During and after the presentation, many questions, suggestions, and opinions were offered to the staff and project team.

The original agenda for the community meeting contemplated having some table exercises related to priority setting and specific feedback in the most-narrow part of the corridor. Many attendees expressed a desire to instead extend the question/comment and answer period. The agenda was modified to accommodate this request.

An outcome of the meeting was the convening of a community Task Force to guide project development going forward. County staff worked with community leaders present at the meeting to identify Task Force members and a community-driven process.

#### 3.2. Task Force Members

Since the corridor differed considerably from block to block, members of the community wanted to have fair representation to serve on the Task Force. Issues of concern for some on one block may not have been an issue for someone on another block. Bicyclists wanted to have representation on this Task



Force as this corridor is a major link for cyclists in the nearby areas. Pedestrians wanted to be represented so that they could have input into the kinds of pedestrian improvements needed on this corridor. Since most people drove, they wanted to find a way to improve the road so that they could reduce their travel time, reduce speeds and reduce lengthy queues during morning and afternoon peak hours.

In order to include a representation of all stakeholders, 16 voting members were chosen for the Task Force. The names of Task Force members are listed in Table 3-1. Each person represented a segment of the population in this community or a group with a specific interest in the corridor. Consultation with the Task Force has been on-going since the first community meeting in 2017 and through the development of this Final Report.

The Task Force recognized the need for trade-offs in the final design that were necessary in order to achieve many of the desired improvements and thoroughly considered these trade-offs and the community feedback that was received through various public input processes, in developing the four alternative designs (including a do-nothing option) that were presented to the community for consideration in January 2020.



Table 3-1: Task Force Members

Group Representing	Voting Member	Name / Alternate
Alameda de las Pulgas	1	Hillary Stevenson
CHP	2	Jason Ivey
cyclist with Silicon Valley Bicycle Coalition	3	John Langbein
Department of Public Works		Diana Shu
Department of Public Works	4	Joe LoCoco
Department of Public Works		Jim Porter
Department of Public Works		Harry Yip
Fire District	5	Virginia Chang Kiraly
member at large - University Park Inner	6	Ron Snow
Menlo Commons	7	Gwen Leonard
Menlo Fire District		Harold Schapelhouman
Menlo Fire District		Tom Calvert
Menlo Fire District	8	Jon Johnston
Menlo Park Police Department		William Dixon
Menlo Park resident	9	Troy Hayes
Menlo Park, Department of Public Works	10	Kevin Chen
Motorists	11	Janet Davis
Pedestrians/Menlo Commons	12	John Loughlin
Safe Routes to Schools	13	Jen Wolosin
Santa Cruz from Sandhill Rd to Y	14	Cheryl Phan
Santa Cruz from the Y to the City limits	15	Alex Komoroske (resigned)
Sheriff's Office		Todd Finato (reassigned)
Sheriff's Office		Chad Buck
the Y	16	Molly Glennen
Supervisor Horsley's Office		Don Horsley
Supervisor Horsley's Office		Jazzalyn Lamadora
Supervisor Horsley's Office		Carrie Dallman
Department of Public Works		Hanieh Houshmandi
CHP		Chris Barshini
CHP		Anthony Ruiz
Deputy County Manager		Iliana Rodriguez
Office of Sustainability		Julia Malmo-Laycock



### 3.3. Community Survey Responses

An extensive survey of the local community was conducted from September 4, 2018 to September 23, 2018. The County provided a summary of the survey results (see Appendix B). A total of 701 responses were collected. There was consensus by all respondent groups of the survey for safety improvements along the study corridor. Due to the constrained roadway widths, respondents were willing to reduce the number of travel lanes in exchange for safety improvements. The following summarizes highlights of the survey responses:

- 69% of survey respondents wanted vehicle travel speeds to be reduced
- Survey respondents identified safer flow of traffic as the most important outcome
- Of the 283 residents that responded to the survey, 62% would prioritize sidewalk enhancements and 38% would prioritize bicycle enhancements
- Residents preferred pedestrian and bicycle safety over vehicle travel lanes, and 47% preferred sidewalks over no bike lane, but 29% preferred bike lanes over no sidewalks
- Residents ranked pedestrian crossings as most important and bicycle lanes as least important
- Of the 188 non-residents that responded to the survey, 89% wanted some road improvements
- Of the 225 commuters that responded to the survey, 90% wanted some road improvements
- Non-residents and commuters preferred bike lanes over no sidewalks



## 4. Baseline Conditions

### 4.1. Traffic Circulation

Within the study area, Santa Cruz Avenue and Alameda de las Pulgas are often-used roadways connecting West Menlo Park and Downtown Menlo Park to Stanford University and Sand Hill Road and Interstate 280. Santa Cruz Avenue south of the Y intersection is two lanes in each direction with a TWLTL. It has a posted speed limit of 25 miles per hour in both directions. Warning signs indicate senior crossings in the area. Santa Cruz Avenue north of the Y intersection is one lane in each direction. It has a posted speed limit of 30 miles per hour in both directions. Alameda de las Pulgas north of the Y intersection is two lanes in each direction until Liberty Park Avenue. It has a posted speed limit of 25 miles per hour in both directions between Liberty Park Avenue and the Y. The existing conditions intersection geometry and traffic control is shown in Figure 4-1.

Kimley-Horn analyzed the existing (2019), Medium-term (2030), and Long-term (2040) baseline traffic conditions at the project study intersections (identified in Figure 2-2) using collected count data and the regional travel demand forecast model. In general, southbound traffic is greater in the AM peak hour, while northbound traffic is greater during the PM peak hour, which is consistent with a pattern of commuters driving towards employment centers at Stanford University, Stanford Medical Center, Sand Hill Road, and Palo Alto in the morning then returning in the evening.

Kimley-Horn used C/CAG's travel demand model to determine a yearly annual traffic growth rate and applied that yearly growth rate to existing volumes to determine future volumes. The travel demand model incorporates socioeconomic data, such as number of households, population in households, average vehicles per household, and employment data to estimate current and future volumes. It is calibrated and validated based on current mode choice and trip making behavior. Future projections reflect continuation of those socioeconomic trends and decision-making. It is recognized that populations and their preferences may change over time, which would affect travel choice and thus future volumes. The travel demand model is an industry-standard that reflects the best projection available at this time, but actual conditions may vary in the future. Model inputs provided by VTA were reviewed and refined to reflect reasonably expected roadway geometrics in the study area. The regional travel demand model forecasts an overall increase in traffic volumes in the study area. This forecast reflected a scenario analysis specifically completed by VTA for this project to include the then-proposed Stanford General Use Permit (GUP), which included an additional 600 in population, 2,000 jobs, and enrollment increase of 3,000 students. This was a future travel demand scenario and does not reflect an update to the regional travel demand forecast model.

Table 4-1 summarizes the growth in volumes along the corridor between 2019 and 2040. The existing, medium-term, and long-term turning movement volumes are shown in Figure 4-2, Figure 4-3, and Figure 4-4, respectively.

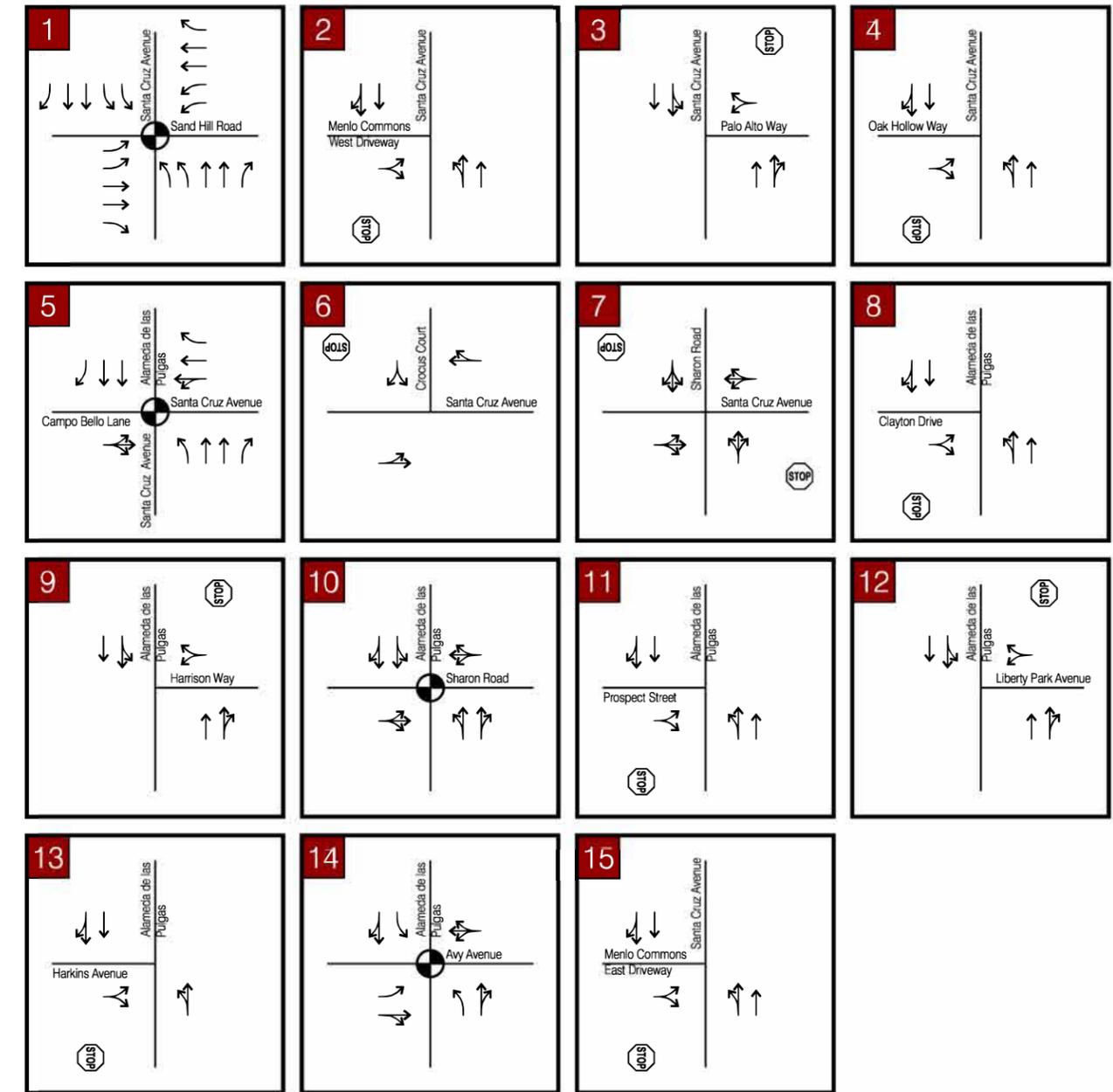
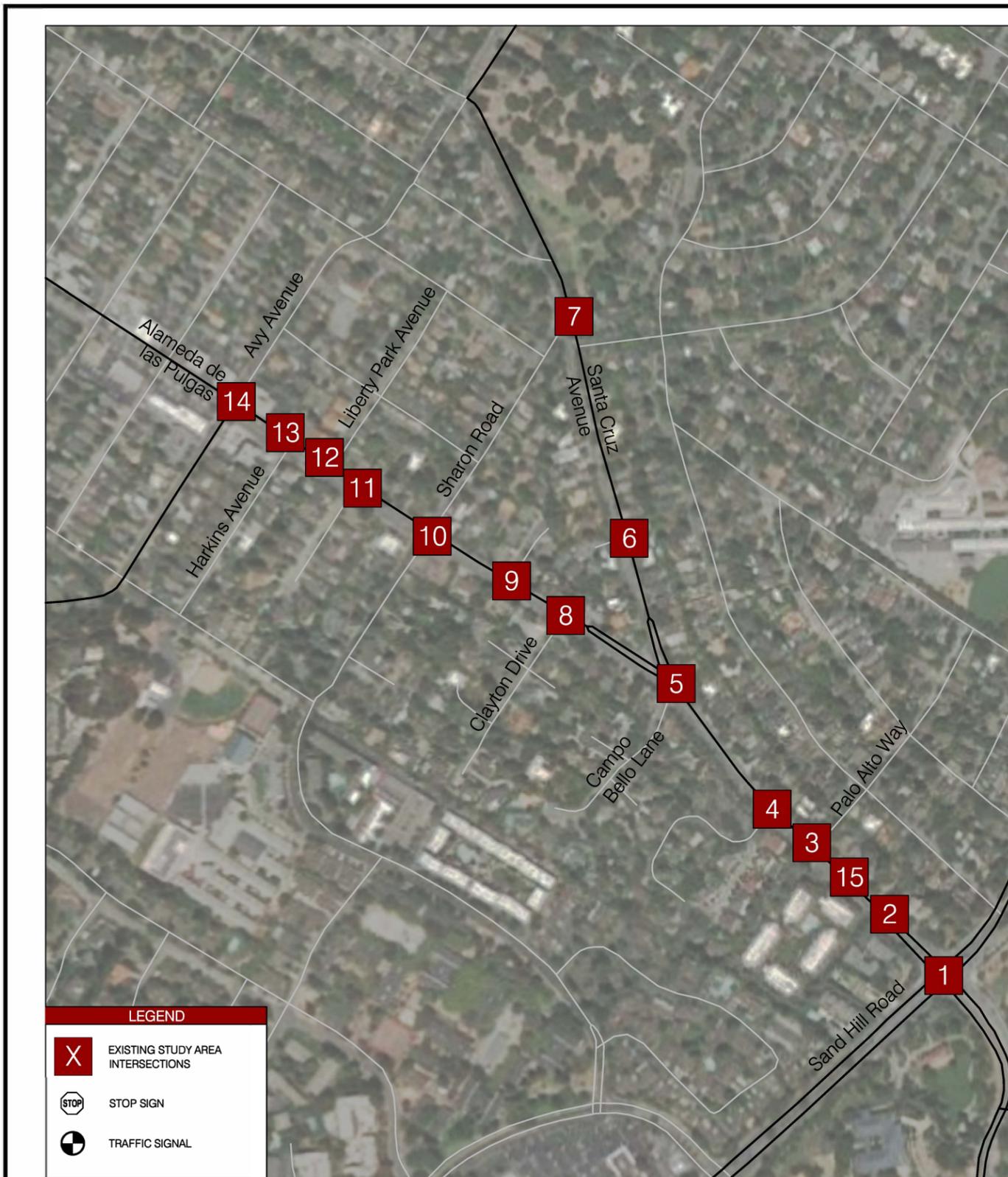


FIGURE 4-1  
EXISTING INTERSECTION TRAFFIC CONTROL AND LANE GEOMETRICS  
SANTA CRUZ AVENUE / ALAMEDA DE LAS PULGAS ROAD SAFETY IMPROVEMENTS



Table 4-1: Corridor Volume Growth, 2019-2040

Alpine Road Segment		Existing 2019 (vehicles)	Long-Term 2040 (vehicles)	Annual Percent Growth (%)
AM Peak Hour				
Santa Cruz Avenue (between Sand Hill Road and Y Intersection)	NB	931	1,236	1.6%
	SB	1,127	1,293	0.7%
Santa Cruz Avenue (between Y Intersection and Sharon Road)	NB	546	661	1.0%
	SB	442	537	1.0%
Alameda de las Pulgas (between Y Intersection and Avy Avenue)	NB	399	617	2.6%
	SB	687	767	0.6%
PM Peak Hour				
Santa Cruz Avenue (between Sand Hill Road and Y Intersection)	NB	1,399	2,029	2.1%
	SB	823	982	0.9%
Santa Cruz Avenue (between Y Intersection and Sharon Road)	NB	645	827	1.3%
	SB	467	475	0.1%
Alameda de las Pulgas (between Y Intersection and Avy Avenue)	NB	760	1,208	2.8%
	SB	387	546	2.0%

Source: C/CAG travel demand forecast model, VTA, April 2019.

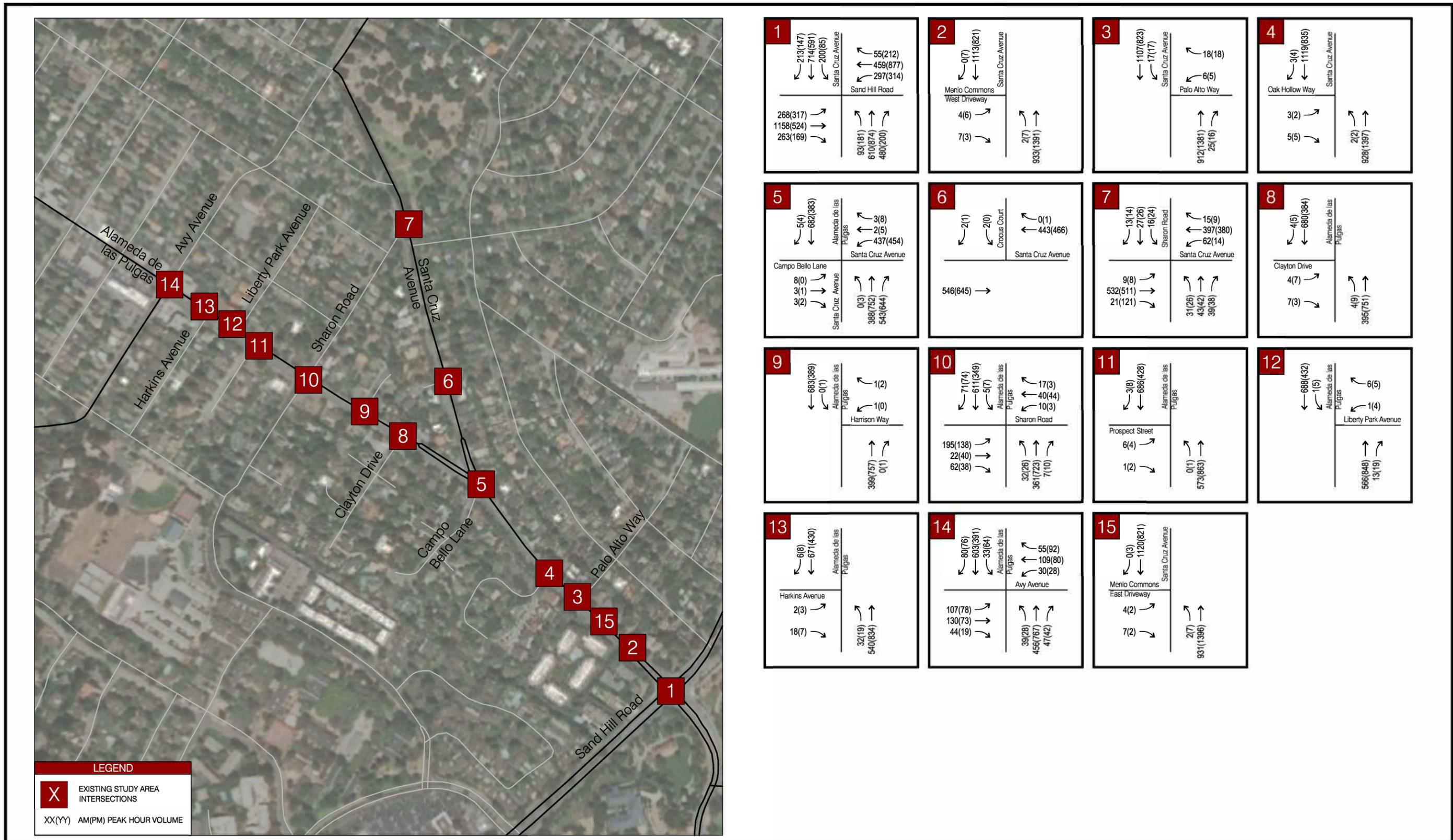
### Speed

A speed survey was conducted in three locations along the study corridor in January 2019. The results of the survey are shown in Table 4-2. The speed survey was conducted after the speed limits were reduced on Santa Cruz Avenue between the Y and Sand Hill Road. Speed data provided by the County of San Mateo shows that the 85<sup>th</sup> percentile speeds are five or more miles per hour above the posted speed limit for all segments. Prior to the speed limit change, the 85<sup>th</sup> percentile speed was 40 mph in this corridor.

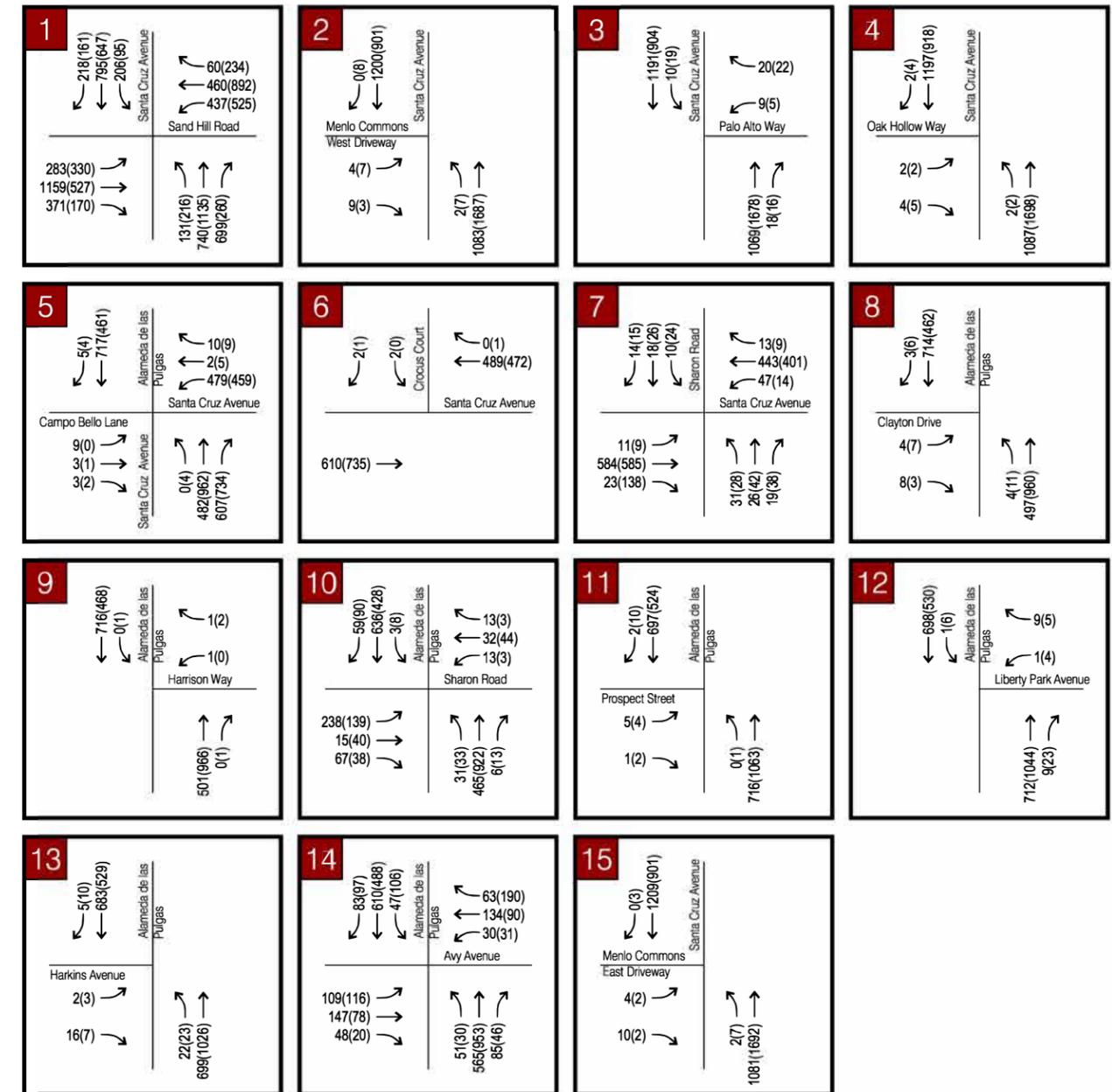
Table 4-2: Speed Survey Summary

Segment	Posted Speed Limit (mph)	85th Percentile Speed (mph)	
		Before Speed Limit Change	After Speed Limit Change
Santa Cruz Avenue (Between Sand Hill Road and the Y Intersection)	25	37	34
Santa Cruz Avenue (Between the Y Intersection and Sharon Road)	30	39	35
Alameda de las Pulgas (Between the Y Intersection and Avy Avenue)	25	38	34

Source: County of San Mateo, January 2019.



**FIGURE 4-2**  
**EXISTING (2019) INTERSECTION TURNING MOVEMENT VOLUMES**  
**SANTA CRUZ AVENUE / ALAMEDA DE LAS PULGAS ROAD SAFETY IMPROVEMENTS**



**FIGURE 4-3**  
**MEDIUM-TERM (2030) INTERSECTION TURNING MOVEMENT VOLUMES**  
**SANTA CRUZ AVENUE / ALAMEDA DE LAS PULGAS ROAD SAFETY IMPROVEMENTS**

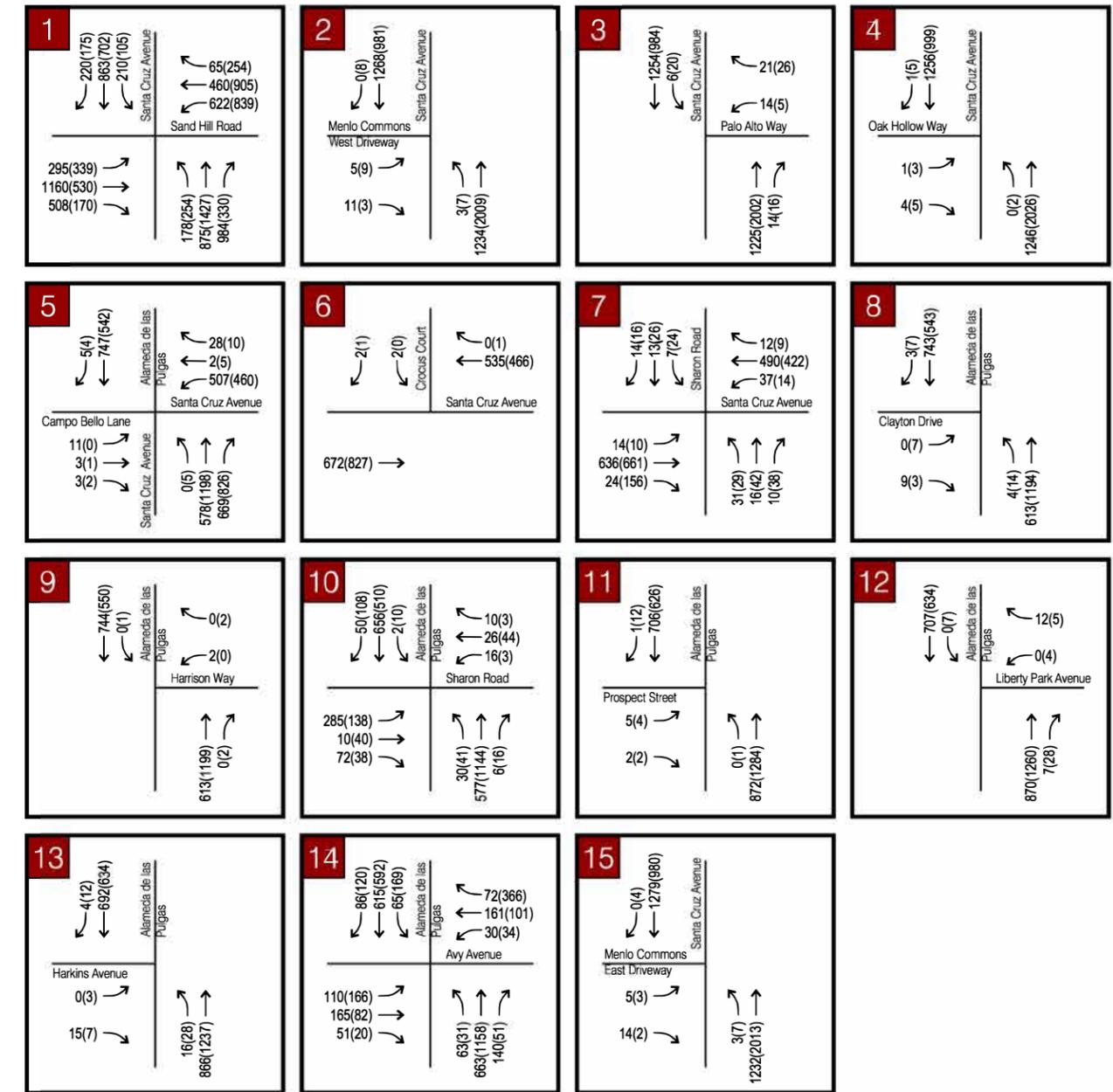
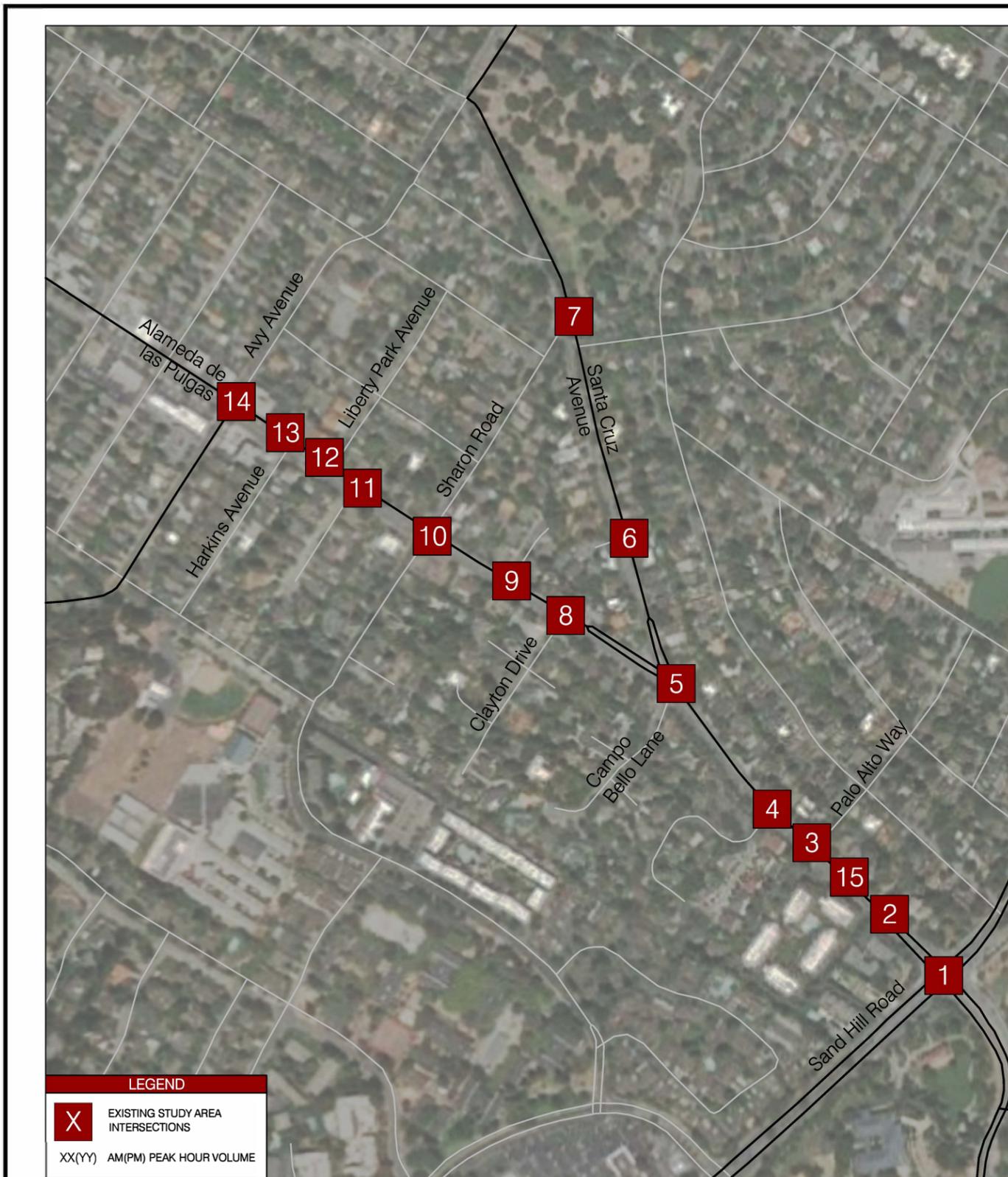


FIGURE 4-4  
 LONG-TERM (2040) INTERSECTION TURNING MOVEMENT VOLUMES  
 SANTA CRUZ AVENUE / ALAMEDA DE LAS PULGAS ROAD SAFETY IMPROVEMENTS



### Intersection LOS and Delay

Existing conditions intersection delay and level of service are provided in Table 4-3. Table 4-3 only shows the LOS and delay for the signalized study intersections. For the unsignalized intersections, the LOS, delay, and queues are shown in Appendix C.

The analysis indicates that all intersections operate at LOS C or better, except for the intersection of Sand Hill Road / Santa Cruz Avenue in the AM and PM peak hours. The intersection of Sand Hill Road / Santa Cruz Avenue has a high amount of traffic along the Sand Hill Road approaches, causing the high delays.

Table 4-3: Existing Intersection Delay and Level of Service (VISSIM model results)

#	Intersection	Existing (2019) Conditions				
		Control <sup>(a)</sup>	AM Peak		PM Peak	
			Delay (sec)	LOS	Delay (sec)	LOS
1	Sand Hill Rd / Santa Cruz Ave	Signal	48.7	D	57.3	E
5	Santa Cruz Ave / Alameda de las Pulgas / Campo Bello Ln	Signal	13.1	B	13.2	B
10	Alameda de las Pulgas / Sharon Rd	Signal	11.6	B	9.3	A
14	Alameda de las Pulgas / Avy Ave	Signal	24.1	C	19.0	B

Notes:

(a) Signal = Signalized

Table 4-4 and Table 4-5 show intersection delay and level of service results for the Medium-term (2030) and Long-term (2040) scenarios, respectively. For the unsignalized intersections, the LOS and delay are shown in Appendix C. Queues were not estimated for 2030.

Table 4-4: Medium-Term (2030) Baseline Intersection Delay and Level of Service

#	Intersection	Medium-term (2030) Conditions				
		Control <sup>(a)</sup>	AM Peak		PM Peak	
			Delay (sec)	LOS	Delay (sec)	LOS
1	Sand Hill Rd / Santa Cruz Ave	Signal	68.9	E	63.5	E
5	Santa Cruz Ave / Alameda de las Pulgas / Campo Bello Ln	Signal	21.0	C	13.5	B
10	Alameda de las Pulgas / Sharon Rd	Signal	11.9	B	11.1	B
14	Alameda de las Pulgas / Avy Ave	Signal	29.8	C	35.7	D

Notes:

(a) Signal = Signalized



Table 4-5: Long-Term (2040) Baseline Intersection Delay and Level of Service (VISSIM model results)

#	Intersection	Long-term (2040) Conditions				
		Control <sup>(a)</sup>	AM Peak		PM Peak	
			Delay (sec)	LOS	Delay (sec)	LOS
1	Sand Hill Rd / Santa Cruz Ave	Signal	109.3	F	100.5	F
5	Santa Cruz Ave / Alameda de las Pulgas / Campo Bello Ln	Signal	25.6	C	14.5	B
10	Alameda de las Pulgas / Sharon Rd	Signal	12.4	B	15.8	B
14	Alameda de las Pulgas / Avy Ave	Signal	40.4	D	86.4	F

Notes:

(a) Signal = Signalized

As shown in Table 4-4 and Table 4-5, the Medium-term (2030) and Long-term (2040) baseline scenarios show a deterioration in traffic conditions at many locations. The more notable intersections that are projected to experience increased congestion are the intersections of Sand Hill Road / Santa Cruz Avenue and Alameda de las Pulgas / Avy Avenue. The intersection of Sand Hill Road / Santa Cruz Avenue would operate at LOS F in the AM and PM peak hours in the Long-term (2040) scenario. This is due to the increase in volumes on Sand Hill Road approaching this intersection. The intersection of Alameda de las Pulgas / Avy Avenue would operate at LOS F in the Long-term (2040) scenario PM peak hour only. This is due to the increase in volume in the southbound direction and only having one lane of capacity to serve these vehicles.

### Arterial Travel Times

The corridor travel times are outputs from the VISSIM model that was developed. Travel time results for the existing, near-term, and long-term scenarios are shown in Table 4-6.

Travel times deteriorate as the corridor experiences additional congestion in future scenarios. In the Long-term scenario, AM peak southbound travel time increases to four minutes, compared to the travel time of 2.85 minutes in the Existing (2019) scenario. In the PM peak hour, the travel times increase slightly in the Long-term (2040) scenario compared to the Existing (2019) scenario. In general, the northbound travel time is more consistent and less prone to congestion than the southbound travel time as a result of conditions at the Sand Hill Road intersection.



Table 4-6: Existing (2019), Medium-Term (2030), and Long-Term (2040) Corridor Travel Times (VISSIM model results)

Direction	Roadway	From	To	AM Peak (minutes)	PM Peak (minutes)
Existing (2019) Conditions					
Northbound	Santa Cruz Avenue	Sand Hill Road	Sharon Road	1.53	1.50
Southbound	Santa Cruz Avenue	Sharon Road	Sand Hill Road	2.85	2.75
Northbound	Alameda de las Pulgas <sup>(1)</sup>	Sand Hill Road	Avy Avenue	2.22	2.28
Southbound	Alameda de las Pulgas <sup>(1)</sup>	Avy Avenue	Sand Hill Road	2.90	2.68
Medium-Term (2030) No Improvements					
Northbound	Santa Cruz Avenue	Sand Hill Road	Sharon Road	1.53	1.50
Southbound	Santa Cruz Avenue	Sharon Road	Sand Hill Road	3.57	2.68
Northbound	Alameda de las Pulgas <sup>(1)</sup>	Sand Hill Road	Avy Avenue	2.25	2.52
Southbound	Alameda de las Pulgas <sup>(1)</sup>	Avy Avenue	Sand Hill Road	4.00	2.68
Long-Term (2040) No Improvements					
Northbound	Santa Cruz Avenue	Sand Hill Road	Sharon Road	1.53	1.50
Southbound	Santa Cruz Avenue	Sharon Road	Sand Hill Road	4.00	2.80
Northbound	Alameda de las Pulgas <sup>(1)</sup>	Sand Hill Road	Avy Avenue	2.32	2.98
Southbound	Alameda de las Pulgas <sup>(1)</sup>	Avy Avenue	Sand Hill Road	4.00	2.88

Notes:

Travel times represent the average travel time per vehicle driving between the limits shown in the indicated peak hour.

(1) Alameda de las Pulgas is from the intersection of Santa Cruz Avenue/Sand Hill Road to Alameda de las Pulgas/Avy Avenue.

#### 4.2. Bicycle/Pedestrian Facilities

Existing Santa Cruz Avenue is a Class III bicycle route with green-backed sharrows on both sides of the corridor between Sand Hill Road and Sharon Road. Alameda de las Pulgas is also a Class III bicycle route with green-backed sharrows on both sides of the corridor between Santa Cruz Avenue and Liberty Park Avenue. There are Class II bicycle lanes in the southbound direction between Harkins Avenue and Avy Avenue and in the northbound direction between Liberty Park Avenue and Avy Avenue.

Santa Cruz Avenue and Alameda de las Pulgas were moderately utilized during weekday peak hours by cyclists with approximately 30 cyclists per hour traveling in the southbound direction and 10 cyclists traveling in the northbound direction in the AM peak hour through the Y intersection. In the PM peak hour, there were less than 5 cyclists per hour traveling in the southbound direction and 30 cyclists

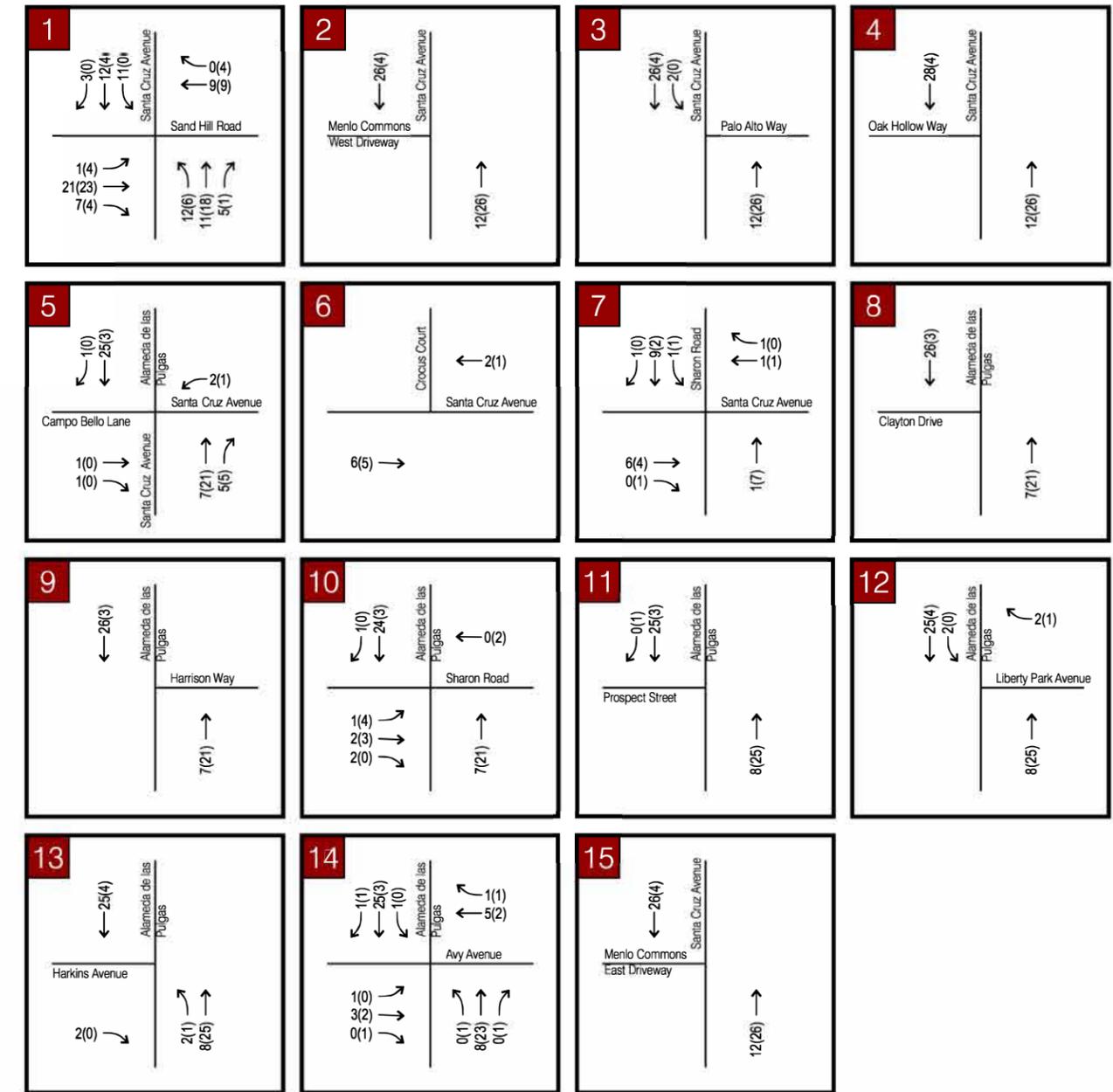
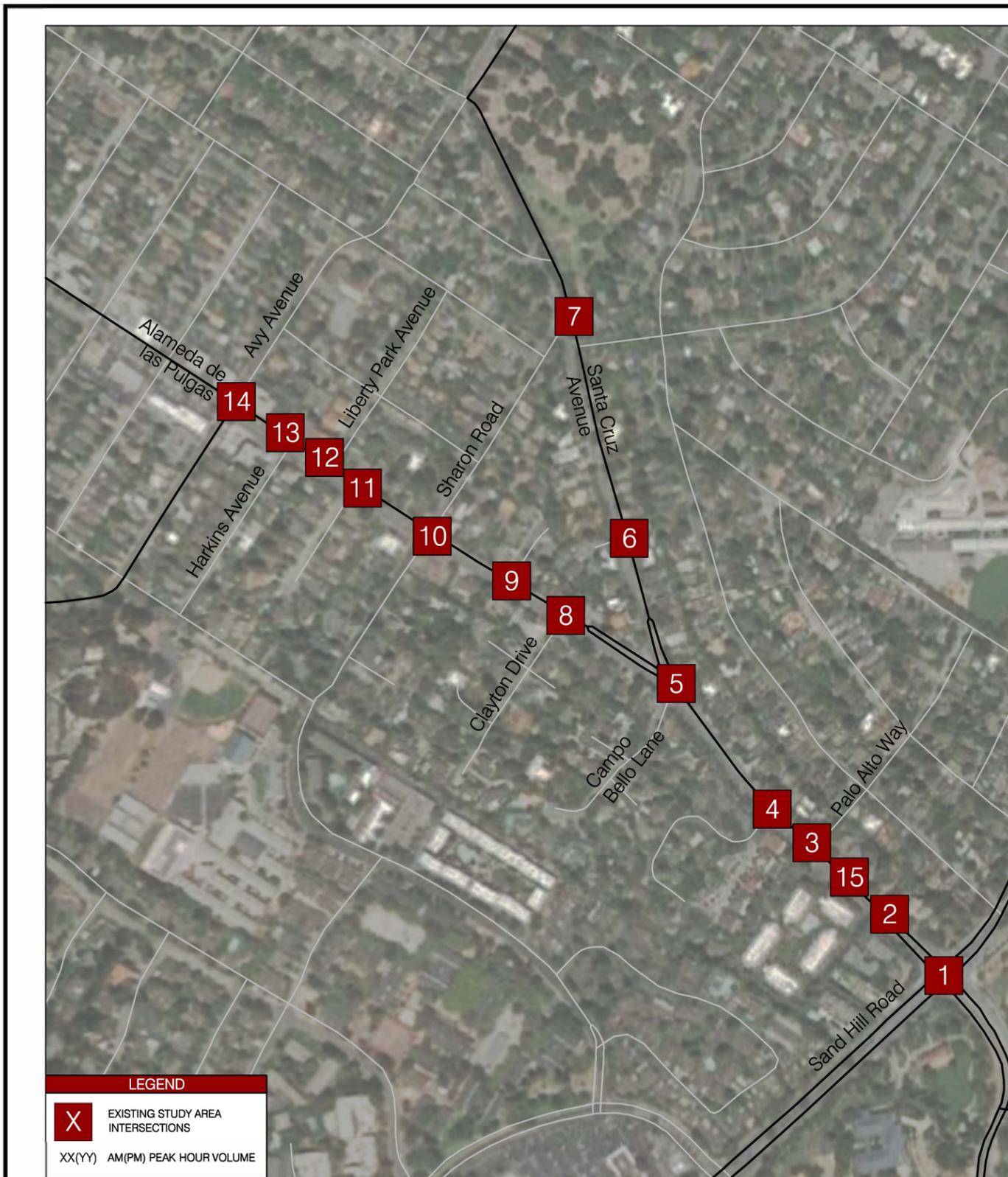


traveling in the northbound direction through the Y intersection. The peak hour for the cyclists aligned with the peak hour for automobiles in the PM period.

Figure 4-5 and Figure 4-6 show existing bicycle and pedestrian turning movement volumes for weekday automobile peak hours, respectively. It should be noted that the PM peak hour pedestrian volumes did not occur during the automobile PM peak hour.

Both sides of Alameda de las Pulgas between Avy Avenue and the Y and Santa Cruz Avenue between the Y and Sand Hill Road have sidewalks along the study corridor. Many of these sidewalks are less than five feet in width and include poles or obstructions in the walkway. There are striped crosswalks at each of the signalized intersections to allow for pedestrian accessibility in the area. The crosswalks at the intersection of Alameda de las Pulgas / Sharon Road are striped yellow to indicate a school crossing. There is also an unsignalized crosswalk on the north leg of Liberty Park Avenue for pedestrians to cross Alameda de las Pulgas. There is another unsignalized crosswalk on the north leg of Palo Alto Way for pedestrians to cross Santa Cruz Avenue.

In the AM peak hour, many of the pedestrians on this corridor are crossing at the intersection of Alameda de las Pulgas / Sharon Road and at the intersection of Alameda de las Pulgas / Avy Avenue. 31 pedestrians were counted in the AM peak hour crossing Alameda de las Pulgas on the north and south legs at Sharon Road. 31 pedestrians were also counted in the AM peak hour crossing Alameda de las Pulgas on the north and south legs at Avy Avenue. In the PM peak hour for automobiles, the majority of the pedestrians on this corridor were observed to cross at the intersection of Alameda de las Pulgas / Avy Avenue. 21 pedestrians were counted in the automobile PM peak hour crossing Alameda de las Pulgas on the north and south legs at Avy Avenue. It should be noted that the automobile PM peak hour occurred at approximately 5:00 PM, which is after the peak school traffic period. The peak of pedestrian activity in the study area occurred during peak school traffic from 2:55 PM to 3:55 PM. During this time, there were 59 pedestrians counted crossing Alameda de las Pulgas on the north and south legs at Avy Avenue.



NOT TO SCALE

**FIGURE 4-5**  
**EXISTING BICYCLE TURNING MOVEMENT VOLUMES - WEEKDAY PEAK HOURS**  
**SANTA CRUZ AVENUE / ALAMEDA DE LAS PULGAS ROAD SAFETY IMPROVEMENTS**



Note: Pedestrian volumes shown are for the automobile PM peak hour and not the pedestrian PM peak hour.

FIGURE 4-6  
EXISTING PEDESTRIAN TURNING MOVEMENT VOLUMES - WEEKDAY PEAK HOURS  
SANTA CRUZ AVENUE / ALAMEDA DE LAS PULGAS ROAD SAFETY IMPROVEMENTS



### 4.3. Collision History

Table 4-7 summarizes the collision history of the study corridor for a recent five-year period (2014-2018). A total of 27 collisions were documented over this period, with over half (15) occurring at the intersection of Alameda de las Pulgas / Avy Avenue. 13 documented collisions involved a bicycle while no documented incidents involved a pedestrian. The most common type of collision was rear end collisions (8) followed by broadside collisions (5). Rear-end collisions most commonly occur at approaches to intersections and are generally associated with unexpected queuing or limited sight distance. Broadside collisions commonly occur at unsignalized intersections and are associated with improper turning movements, such as a vehicle turning where there is an insufficient gap in crossing traffic.

It is noted that residents have notified the County of collisions which were not reported or logged in the Statewide Integrated Traffic Records System (SWITRS) database for various reasons. While the SWITRS database generally does not include all collisions that occur on the corridor, it is more likely to include higher severity collisions. Table 4-8 shows the collisions noted by local residents from 2016 to 2017.

The study corridor’s collision history per SWITRS is visualized in Figure 4-7.

Table 4-7: Corridor Collision History (2014-2018)

Location <sup>(1)</sup>	Number of Accidents by Type (2014-2018)								Total
	Head-On	Side-swipe	Rear End	Broad-side	Hit Object	Ped	Bicycle	Other	
Intersection of Santa Cruz Avenue / Sand Hill Road			1				1		2
Intersection of Santa Cruz Avenue / Palo Alto Way			1	2					3
Intersection of Santa Cruz Avenue / Oak Hollow Way				1			2		3
Y Intersection		1	1						2
Intersection of Alameda de las Pulgas / Clayton Drive			1						1
Intersection of Alameda de las Pulgas / Sharon Road				1					1
Intersection of Alameda de las Pulgas / Avy Avenue			4	1			10		15
Total	0	1	8	5	0	0	13	0	27

Source: SWITRS database, 2014-2018.]

Table 4-8: Corridor Collision History as Experienced by local residents (2014-2018)

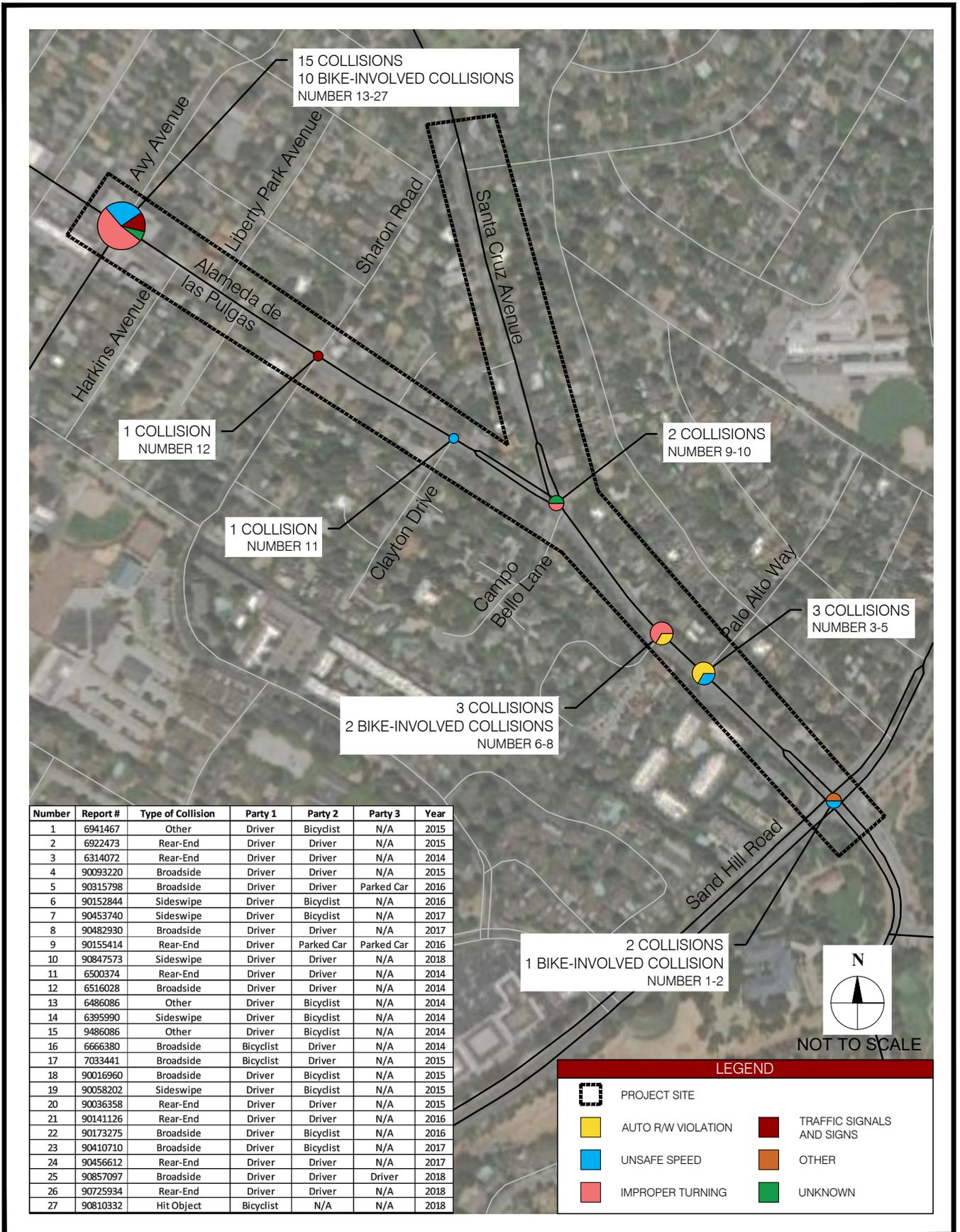


# Santa Cruz Avenue and Alameda de las Pulgas

## IMPROVEMENTS STUDY

FINAL REPORT - AUGUST 2020

Date	Location	Remarks	Reported by
10/26/16	2080 Santa Cruz Ave	Property damage, injury	Witness photos, MPFD
10/31/16	2125 Santa Cruz Ave	Swerved, landed in property	Witness photos
12/7/16	Santa Cruz Av/Sand Hill Rd	Unsafe speed	SWITRS
12/16/16	Alameda de Las Pulgas/Sharon Rd	Hit object, damage	SWITRS
1/2/17	Santa Cruz Av/Sand Hill Rd	1 injured, unsafe speed	MPFD, Switrs
1/6/17	Santa Cruz Av/Sand Hill Rd	2 injured	MPFD, SWITRS
1/26/17	Alameda de Las Pulgas/Avy Av	Sideswipe, improper turn	SWITRS
2/21/17	Santa Cruz Av/Sand Hill Rd	Collision	MPFD
3/11/17	Alameda de Las Pulgas (3863)	Property damage, injury	Witness photos, MPFD
3/23/17	Santa Cruz Av/Sharon Rd	Collision	MPFD
3/30/17	Alameda de Las Pulgas/Sharon Rd	Collision, injury	Witness photos
3/31/17	Alameda de Las Pulgas/Sharon Rd	Collision	MPFD
4/3/17	Santa Cruz Ave/Sharon Rd	Collision	Witness photos, MPFD
4/29/17	Santa Cruz Ave/Oak Hollow	Collision:Cyclist/car	MPFD
5/19/17	Santa Cruz Ave/Near MP Commons	Collision	MPFD
5/28/17	Santa Cruz Ave/Sand Hill Rd	Collision	Witness photos, MPPD (injuries)
6/8/17	Santa Cruz Ave/ near Sand Hill Rd	Collision	MPPD
6/14/17	Santa Cruz @ Oak Hollow	Collision	Witness Photos, MPPD/FD(Injuries)
6/28/17	Santa Cruz Av/Sand Hill Rd	Collision	MPFD, Witness photos
7/20/17	Santa Cruz @ Avy Ave	Collision	Witness/MPPD called and reported
9/ 11/ 17	Santa Cruz @ Oakdell	Collision:Car/Cyclist	MPPD/FD Injuries
9/11/17	Santa Cruz @ Sherman	Collision:Rear-end	MPPD/FD Injury
11/28/17	Santa Cruz @ Y	Minor fender bender	unreported, witness reported
11/29/17	Santa Cruz @ Y	Collision - Total	MPPD/FD
12/7/17	Santa Cruz @ Alpine	Collision	MPPD/FD
12/11/17	Alameda @ Harkens	Collision- Sun angle factor	Sheriff, MPFD





#### 4.4. Key Challenges & Constraints

The baseline conditions analysis yielded the following set of key challenges and constraints that served as a basis for the improvement alternatives identified:

- Existing sidewalks are narrow and, in several cases, do not meet current standards;
- Existing auto speeds exceed the posted speed limit;
- There is a high level of bicycle activity despite the lack of dedicated facilities;
- Bicycle collision propensity in the corridor is much higher than auto collision propensity;
- Pedestrian activity across the corridor is motivated by school access, but also includes other non-school related movements. That activity is currently focused at signalized crossings of the corridor; and
- There are a couple of congestion points located along the corridor (Sand Hill Road and Avy Avenue) that are projected to deteriorate further in future conditions.



## 5. Improvement Alternatives

The project team developed a set of three initial concept alternatives for the study corridor based on input received from the Task Force and the needs identified for the corridor. Improvements were organized into four groups based on four geographic locations:

- Santa Cruz Ave between Sand Hill Road and the Y intersection
- Santa Cruz Avenue between the Y intersection and Sharon Road
- Alameda de las Pulgas between the Y intersection and Avy Avenue
- Y intersection (Santa Cruz Avenue/Alameda de las Pulgas/Campo Bello Lane)

Listed below are some explanations of some of the more technical improvements that were included in the concept alternatives.

- Rapid Rectangular Flashing Beacon (RRFB) – RRFBs are flashing lights which accompany pedestrian crossings (pictured at right). They can be activated by a push button or a pedestrian detection system. RRFBs can be used at crosswalks as an alternative to a traffic signal to provide enhanced pedestrian visibility and increase driver yielding.
- Bike slot – at intersection approaches, a bike slot is the provision of a bike lane on the left side of a right-turn pocket. This allows bicyclists to make through movements through an intersection without fear of right-turning vehicles crossing in front of them and causing a collision (also known as “right-hook movements”).
- Green striping in conflict areas – providing dashed green striping in locations where bicycle and vehicle traffic conflict increases the visibility of bicyclists to drivers and raises driver and bicyclist awareness of the conflict area.
- Two-way Left-turn Lane – a lane provided in the median of a roadway which provides vehicles a refuge to complete a two-stage left-turn movement without obstructing traffic in either direction.



The improvements for each alternative and geographic area are detailed in the following sections.



### 5.1. Development of Alternatives

Kimley-Horn developed a list of potential corridor improvements based on a variety of sources including the SAFE report on *Santa Cruz Avenue/Alameda de las Pulgas – Safety Issues and Options Proposal*, the technical existing conditions and future baseline conditions data analysis summarized in Chapter 4 of this report, the 2018 Community survey results, and input from the County.

Kimley-Horn developed a series of cross-sections indicating potential corridor configurations. The Task Force provided input to the County and Kimley-Horn on the cross-sections that merited further development as corridor alternatives. The Task Force also provided guidance on additional improvements beneficial to the corridor, including sidewalk widening, crosswalk enhancements, and Y intersection modifications.

The SAFE report highlighted a multitude of issues and proposed solutions along Santa Cruz Avenue, Alameda de las Pulgas, and the Y intersection. The proposed solutions would evolve throughout the process based upon feedback from the Task Force and the County. Each of these solutions were considered when developing the improvement alternatives.

The improvements proposed in the following section incorporate many of the recommendations proposed by SAFE. Improvements are consistent with the SAFE recommendations in providing a safer and more comfortable pedestrian and bicycle environment and encouraging lower vehicle speeds. However, not all SAFE-proposed recommendations were incorporated into the design alternatives. As a general guideline, improvements that extended beyond the existing right-of-way were not considered. This ultimately ruled out the option in the SAFE report (and subsequently revised by SAFE as “Concept 10.5”) for the Y intersection was to realign the northeast leg of Santa Cruz Avenue approach to enter the intersection at a 90-degree angle. After a design feasibility review, this was ultimately determined to be not feasible due to multiple factors including constrained right-of-way, the need to maintain vehicle turning paths, design standards for horizontal curvature, and required sight distance to the traffic signal at the Y for signal and queuing visibility. In addition, the crosswalk and bike lane placement as shown in Concept 10.5 would cause significant operational issues for the intersection, resulting in substantially increased congestion and queuing. However, the goals of this proposed solution were addressed in the concepts prepared as part of this project, including reducing vehicle speeds for the northbound right turn movement and shortening the pedestrian crosswalks. Elements of the SAFE proposals at the Y incorporated into design concepts include:

- Reducing the east-west width of the Y by modifying the sidewalk on the east side of Santa Cruz Avenue;
- Channelizing turning movements to reduce perceived width and tightening turn radii, thereby decreasing vehicle speeds;
- Shortening crosswalk lengths through enlargement of sidewalks, provision of bulbouts, and providing raised pedestrian safety islands; and
- Providing separate bike lanes for northbound cyclists going to Alameda de las Pulgas and going to Santa Cruz Avenue (to Downtown Menlo Park)



Kimley-Horn also considered the responses from the 2018 Community survey to determine which improvements to prioritize. The survey informed the team on which types of roadway improvements (i.e. pedestrian, bicyclist, or vehicular improvements) were deemed most critical by survey respondents. The County provided guidance on improvements in the corridor based on local knowledge and meetings with the Task Force.

With the understanding of the community desires and the local constraints, the team developed the conceptual plans for each segment of the study corridor. The following describes these improvements, by location, in more detail.

## 5.2. Santa Cruz Avenue between Sand Hill Road and Y Intersection

### Alternative A – Two Lanes in Each Direction

A key component of Alternative A is to provide two vehicle travel lanes in each direction and have a center two-way left-turn lane, similar to the existing condition. There are no proposed bicycle lanes for this alternative. The Santa Cruz Avenue improvements between Sand Hill Road and the Y intersection for Alternative A are listed below in Table 5-1. The preliminary designs for this alternative are provided in Appendix D.

Table 5-1: Santa Cruz Avenue Improvements – Alternative A

Location	Improvement	Benefit
Entire segment	Reconstruct/widen sidewalk where feasible to a maximum of 5 feet and 6 inches <sup>3</sup>	Improved pedestrian safety
Intersection of Santa Cruz Avenue/Sand Hill Road	Install two-stage turn box for bicyclists making a southbound left turn <sup>a</sup>	Improved bicycle safety
Intersection of Santa Cruz Avenue/Sand Hill Road	Shift crosswalk locations on the north and west legs to be closer to center of intersection <sup>a</sup>	Improved pedestrian safety
Intersection of Santa Cruz Avenue/Sand Hill Road	No right turn on red restriction for southbound right turn movement <sup>a</sup>	Improved pedestrian safety
Intersection of Santa Cruz Avenue/Palo Alto Way	Install new curb ramp and bulb out on northeast corner of intersection Install a rectangular rapidly flashing beacon Install yield pavement markings	Improved pedestrian safety

(a) Improvement to be coordinated with City of Menlo Park

### Alternative B – One Lane in Each Direction

A key component of Alternative B is to provide one vehicle travel lane in each direction, a center two-way left-turn lane, and a buffered bicycle lane in each direction. The Santa Cruz Avenue improvements between Sand Hill Road and the Y intersection for Alternative B are listed below in Table 5-2. The preliminary designs for this alternative are provided in Appendix D.

<sup>3</sup> Sidewalk width of 5'-6" is standard for the county, however because of property lines and existing grades, not all locations can accommodate this standard. In order to do so would require either removal of travel lanes or parking lanes. Alternative B and C explored these options.



Table 5-2: Santa Cruz Avenue Improvements – Alternative B

Location	Improvement	Benefit
Entire segment	Install 5-foot or 6-foot bicycle lane with 3- to 4-foot buffer Provide dashed green striping in bike lanes within conflict areas	Improved bicycle safety
Entire segment	Reconstruct/widen sidewalk where feasible to a maximum of 5 feet and 6 inches	Improved pedestrian safety
Entire segment	Remove one vehicle travel lane in each direction	Allow for other improvements
Entire segment	Restripe travel lanes to be 10 feet wide and the center two-way left-turn lane to be 11 feet	Reduced vehicle speeds and allow for other improvements
Intersection of Santa Cruz Avenue/Sand Hill Road	Install two-stage turn box for bicyclists making a southbound left turn <sup>a</sup>	Improved bicycle safety
Intersection of Santa Cruz Avenue/Sand Hill Road	Shift crosswalk locations on the north and west legs to be closer to center of intersection <sup>a</sup>	Improved pedestrian safety
Intersection of Santa Cruz Avenue/Sand Hill Road	No right turn on red restriction for southbound right turn movement <sup>a</sup>	Improved pedestrian safety
Intersection of Santa Cruz Avenue/Sand Hill Road	Install 2-foot raised median separating southbound traffic and northbound traffic on north leg of intersection	Improved vehicle safety
Intersection of Santa Cruz Avenue/Palo Alto Way	Install new curb ramp and bulb out on northeast corner of intersection Install a rectangular rapid flashing beacon Install yield pavement markings Install a 2.5- to 4-foot raised median island on the north leg of the intersection	Improved pedestrian safety

(a) Improvement to be coordinated with City of Menlo Park

### Alternative C – Two Lanes Northbound and One Lane Southbound

A key component of Alternative C is to provide two vehicle travel lanes in the northbound direction, one vehicle travel lane in the southbound direction, and have a center two-way left-turn lane. In addition, a non-buffered bicycle lane in each direction would be provided. This represents a blending of Alternatives A and B. This addresses the concern raised relative to Alternative B associated with the quick merge for northbound traffic lanes immediately north of the Sand Hill Road intersection. The Santa Cruz Avenue improvements between Sand Hill Road and the Y intersection for Alternative C are listed below in Table 5-3. The preliminary designs for this alternative are provided in Appendix D.



Table 5-3: Santa Cruz Avenue Improvements – Alternative C

Location	Improvement	Benefit
Entire segment	Install 5-foot or 6-foot bicycle lane Provide dashed green striping in bike lanes within conflict areas	Improved bicycle safety
Entire segment	Reconstruct/widen sidewalk where feasible to a maximum of 5 feet and 6 inches	Improved pedestrian safety
Entire segment	Remove one travel lane in the southbound direction	Allow for other improvements
Entire segment	Restripe travel lanes to be 10 feet wide and the center two-way left-turn lane to be 11 feet	Reduced vehicle speeds
Intersection of Santa Cruz Avenue/Sand Hill Road	Install two-stage turn box for bicyclists making a southbound left turn <sup>a</sup>	Improved bicycle safety
Intersection of Santa Cruz Avenue/Sand Hill Road	Shift crosswalk locations on the north and west legs to be closer to center of intersection <sup>a</sup>	Improved pedestrian safety
Intersection of Santa Cruz Avenue/Sand Hill Road	No right turn on red restriction for southbound right turn movement <sup>a</sup>	Improved pedestrian safety
Intersection of Santa Cruz Avenue/Sand Hill Road	Install 2-foot raised median separating southbound traffic and northbound traffic on north leg of intersection	Improved vehicle safety
Intersection of Santa Cruz Avenue/Palo Alto Way	Install new curb ramp and bulb out on northeast corner of intersection Install a rectangular rapidly flashing beacon Install yield pavement markings Install a 3-foot raised median island on the north leg of the intersection	Improved pedestrian safety

(a) Improvement to be coordinated with City of Menlo Park

### 5.3. Santa Cruz Avenue between the Y intersection and Sharon Road

#### No Improvements

Improvements were initially assessed for this segment. Geometric analysis found that any improvements to provide a designated bicycle facility while preserving parking, would likely impact the fence-line of some residential properties and may require significant roadway widening. As a result of the challenge in implementing these improvements, no improvements are proposed for this segment of Santa Cruz Avenue as part of this project.



### 5.4. Alameda de las Pulgas between Y Intersection and Avy Avenue

#### Alternative – Road Diet (One Lane in Each Direction)

A key component of Alternative A is to reduce the vehicle travel lanes to one lane in each direction and provide a center two-way left-turn lane. In addition, buffered bicycle lanes would be installed in each direction. Traffic volumes are much lower on Alameda de las Pulgas than on Santa Cruz Avenue, as documented in Chapter 4. Therefore, there was less community and Task Force concern about the road diet in this segment and only one build project alternative was developed for this segment. The Alameda de las Pulgas improvements between the Y intersection and Avy Avenue for Alternative A are listed below in Table 5-4. The preliminary designs for this alternative are provided in Appendix D.

Table 5-4: Alameda de las Pulgas Improvements – Alternative A

Location	Improvement	Benefit
Entire segment	Install 5-foot or 6-foot bicycle lane with 3-foot buffer Provide dashed green striping in bike lanes within conflict areas	Improved bicycle safety
Entire segment	Reconstruct/widen sidewalk where feasible to a maximum of 5 feet and 6 inches	Improved pedestrian safety
Entire segment	Remove one vehicle travel lane in each direction	Allow for other improvements
Entire segment	Install a center two-way left-turn lane	Improved vehicle safety
Entire segment	Restripe travel lanes to be 10 feet wide and the center two-way left-turn lane to be 11 feet	Reduced vehicle speeds and allow for other improvements
Intersection of Alameda de las Pulgas/Clayton Drive	Install new curb ramps Install new crosswalk on Clayton Drive	Improved pedestrian safety
Intersection of Alameda de las Pulgas/Sharon Road	Install new bus stop on southwest corner and retain all existing bus turning movements	Improved safety
Intersection of Alameda de las Pulgas/Sharon Road	Install new curb ramps Install bulb outs Modify signal timing to include a leading pedestrian interval	Improved pedestrian safety
Intersection of Alameda de las Pulgas/Prospect Street	Install new curb ramps Install new crosswalk on Prospect Street	Improved pedestrian safety
Intersection of Alameda de las Pulgas/Liberty Park Avenue	Install new curb ramps Install a rectangular rapidly flashing beacon Install yield pavement markings Install a raised median island on the north leg and south leg of the intersection	Improved pedestrian safety and reduced vehicle speeds
Intersection of Alameda de las Pulgas/Harkins Avenue	Install new curb ramps Install new crosswalk on Harkins Avenue	Improved pedestrian safety
Intersection of Alameda de las Pulgas/Avy Avenue	Install bicycle loops on both Avy Avenue approaches	Improved bicycle safety



### 5.5. Y Intersection

Three alternatives were developed for the Y intersection. These alternatives were initially developed to be consistent and integrate with the three alternatives for the Santa Cruz Avenue segment to the south of the Y. However, the Y configuration can be designed somewhat independent of the Santa Cruz Avenue intersection and thus consideration of the Y was treated as a separate geographic sub-area. All Y intersection configurations assume the road diet noted in Chapter 5.4 for Alameda de las Pulgas.

#### Alternative A – Two Lanes in Each Direction south of Y Intersection

Alternative A provides two vehicle travel lanes in each direction south of this intersection and incorporates a road diet on Alameda de las Pulgas. The Y intersection improvements for Alternative A are listed below in Table 5-5. The preliminary designs for this alternative are provided in Appendix D.

Table 5-5: Y Intersection Improvements – Alternative A

Location	Improvement	Benefit
Entire intersection	Reconstruct/widen sidewalk where feasible to a maximum of 5 feet and 6 inches	Improved pedestrian safety
South leg of intersection	Install a 6-foot bicycle lane between the northbound through lane and the right turn lane	Improved bicycle safety
South leg of intersection	Install a 7-foot bicycle lane to the right of the northbound right turn lane	Improved bicycle safety
South leg of intersection	Preserve pilot signal timing to restrict Right Turn on Red movements	Improved safety for all users
South leg of intersection	Remove crosswalk on south leg	Improved vehicle operations
East leg of intersection	Install new curb ramps and crosswalk	Improved pedestrian safety
East leg of intersection	Install raised median separating new bicycle lane and vehicle traffic lane	Improved bicycle safety
East leg of intersection	Construct new sidewalk on northeast corner of intersection	Improved pedestrian safety
North leg of intersection	Install raised median separating northbound and southbound vehicle traffic lanes	Improved vehicle safety
North leg of intersection	Install new curb ramps and crosswalk	Improved pedestrian safety



**Alternative B – One Lane in Each Direction south of Y Intersection**

Alternative B provides one vehicle travel lane in each direction south of this intersection and incorporates the road diet on Alameda de las Pulgas. The Y intersection improvements for Alternative B are listed below in Table 5-6. The preliminary designs for this alternative are provided in Appendix D.

Table 5-6: Y Intersection Improvements – Alternative B

Location	Improvement	Benefit
Entire intersection	Reconstruct/widen sidewalk where feasible to a maximum of 5 feet and 6 inches	Improved pedestrian safety
South leg of intersection	Install a 6-foot bicycle lane and a 4-foot raised median between the northbound through lane and the right turn lane	Improved bicycle safety
South leg of intersection	Install a 5-foot bicycle lane to the right of the northbound right turn lane	Improved bicycle safety
South leg of intersection	Install a buffered 6-foot bicycle lane to the left of the southbound receiving lane	Improved bicycle safety
South leg of intersection	Preserve pilot signal timing to restrict Right Turn on Red movements	Improved safety for all users
East leg of intersection	Install new curb ramps and crosswalk	Improved pedestrian safety
East leg of intersection	Install raised median separating eastbound and westbound vehicle traffic lanes	Improved vehicle safety
East leg of intersection	Construct new sidewalk on northeast corner of intersection	Improved pedestrian safety
North leg of intersection	Install raised median separating northbound and southbound vehicle traffic lanes	Improved vehicle safety
North leg of intersection	Install new curb ramps and crosswalk	Improved pedestrian safety
West leg of intersection	Restrict eastbound through movement to Santa Cruz Avenue	Improved traffic operations



**Alternative C – Two Lanes NB and One Lane SB south of Y Intersection**

Alternative C provides two vehicle travel lanes in the northbound direction and one vehicle lane in the southbound direction south of this intersection and incorporates a road diet on Alameda de las Pulgas. The Y intersection improvements for Alternative C are listed below in Table 5-7. The preliminary designs for this alternative are provided in Appendix D.

Table 5-7: Y Intersection Improvements – Alternative C

Location	Improvement	Benefit
Entire intersection	Reconstruct/widen sidewalk where feasible to a maximum of 5 feet and 6 inches	Improved pedestrian safety
South leg of intersection	Install a 5-foot bicycle lane and a 2-foot raised median between the northbound through lane and the right turn lane	Improved bicycle safety
South leg of intersection	Install a 5-foot bicycle lane to the right of the northbound right turn lane	Improved bicycle safety
South leg of intersection	Install a buffered 5-foot bicycle lane to the left of the southbound receiving lane	Improved bicycle safety
South leg of intersection	Preserve pilot signal timing to restrict Right Turn on Red movements	Improved safety
East leg of intersection	Install new curb ramps and crosswalk	Improved pedestrian safety
East leg of intersection	Install raised median separating eastbound and westbound vehicle traffic lanes	Improved vehicle safety
East leg of intersection	Construct new sidewalk and porkchop on northeast corner of intersection	Improved pedestrian safety
North leg of intersection	Install raised median separating northbound and southbound vehicle traffic lanes	Improved vehicle safety
North leg of intersection	Install new curb ramps and crosswalk	Improved pedestrian safety



## 6. Alternatives Analysis

Initially, Alternatives A and B were the only two options and were evaluated for its traffic operations. Since the study segments and intersections interact with one another in terms of overall traffic capacity and vehicle flow, the traffic evaluation analyzed the entire corridor. For the traffic analysis, the following alternatives were quantitatively evaluated:

- Alternative A:
  - Santa Cruz Avenue between Sand Hill Road and the Y: Alternative A (two lanes in each direction)
  - Alameda de las Pulgas between the Y and Avy Avenue: Road Diet Alternative (one lane in each direction)
  - Y Intersection: Alternative A
  - Santa Cruz Avenue between the Y and Sharon Road: No changes
- Alternative B
  - Santa Cruz Avenue between Sand Hill Road and the Y: Alternative B (one lane in each direction)
  - Alameda de las Pulgas between the Y and Avy Avenue: Road Diet Alternative (one lane in each direction)
  - Y Intersection: Alternative B
  - Santa Cruz Avenue between the Y and Sharon Road: No changes

It should be noted that the initial traffic analysis only included Alternative A and Alternative B. A third alternative (Alternative C) for each of Santa Cruz Avenue between Sand Hill Road and the Y and the Y intersection was developed later upon request of the Task Force. A traffic analysis was not completed for Alternative C as it would result in a mix of Alternative A and B. Thus, conditions for Alternative C were described qualitatively in presentations to the Task Force and the community. Ultimately a traffic analysis was completed for the preferred alternative, which is similar to Alternative C. This traffic analysis is presented in Section 8 for the Preferred Alternative.

### 6.1. Traffic Metrics

The alternatives were modeled using VISSIM micro-simulation software to analyze their impact on corridor flow, vehicle delay, and queuing. The results of this analysis are presented by alternative in the following section. Screenshots of the VISSIM simulations, as presented at the Community meeting, are included in Appendix E.

#### Alternative A

Improvements included in Alternative A that affect circulation metrics (discussed in greater detail in the preceding chapters) are:

- Modification to signal timing to restrict right turns on red for the southbound right turn movement at the intersection of Santa Cruz Avenue/Sand Hill Road
- Modification to signal timing to add a pedestrian phase for the east leg of the Y intersection. This resulted in a reduction of green time for the northbound right turn movement at the Y intersection
- Removal of one northbound through lane at the Y intersection



- Reduction of one travel lane in each direction and addition of a center two-way left-turn lane on Alameda de las Pulgas between the Y intersection and Avy Avenue
- Addition of northbound and southbound left turn lanes at the intersection of Alameda de las Pulgas/Sharon Road

The Alternative A level of service (LOS) and delay results for the signalized intersections are provided in Table 6-1, Table 6-2, and Table 6-3 for the Existing (2019), Medium-term (2030), and Long-term (2040) scenarios, respectively. For the LOS results and queues of all study intersections, see Appendix C. Queues were not estimated for 2030 scenarios.

As shown in the tables below, Alternative A results in similar levels of service and slightly worse delays throughout the corridor relative to the No-Build. At the signalized intersection of Santa Cruz Avenue/Sand Hill Road, the delay slightly worsens due to the no right turn on red restriction. While the delay at intersections along Alameda de las Pulgas increase in Alternative A compared to the No-Build due to the reduction in travel lanes, the magnitude of increase is relatively small and is generally within a level of service grade. It should be noted that the intersection of Alameda de las Pulgas/Avy Avenue remains similar to the No-Build scenario because that intersection is already one through lane in each direction along Alameda de las Pulgas.

Table 6-4 shows Alternative A travel time results in comparison to No-Build for the Existing (2019), Medium-term (2030), and Long-term (2040) scenarios. The travel times for Alameda de las Pulgas are between the intersection of Santa Cruz Avenue/Sand Hill Road and the intersection of Alameda de las Pulgas/Avy Avenue.

Table 6-1: Alternative A Existing (2019) Intersection Delay and Level of Service Results

#	Study Intersection	No Improvements				Alternative A					
		Control (a)	AM Peak Hour		PM Peak Hour		Control (a)	AM Peak Hour		PM Peak Hour	
			Delay (s)	LOS	Delay (s)	LOS		Delay (s)	LOS	Delay (s)	LOS
1	Sand Hill Rd / Santa Cruz Ave	Signal	48.7	D	57.3	E	Signal	49.7	D	58.0	E
5	Santa Cruz Ave / Alameda de las Pulgas / Campo Bello Ln	Signal	13.1	B	13.2	B	Signal	19.4	B	19.9	B
10	Alameda de las Pulgas / Sharon Rd	Signal	11.6	B	9.3	A	Signal	15.1	B	11.8	B
14	Alameda de las Pulgas / Avy Ave	Signal	24.1	C	19.0	B	Signal	23.3	C	18.0	B

Notes:  
(a) Signal = Signalized



Table 6-2: Alternative A Medium-Term (2030) Intersection Delay and Level of Service Results

#	Study Intersection	No Improvements				Alternative A					
		Control (a)	AM Peak Hour		PM Peak Hour		Control (a)	AM Peak Hour		PM Peak Hour	
			Delay (s)	LOS	Delay (s)	LOS		Delay (s)	LOS	Delay (s)	LOS
1	Sand Hill Rd / Santa Cruz Ave	Signal	68.9	E	63.5	E	Signal	76.5	E	65.4	E
5	Santa Cruz Ave / Alameda de las Pulgas / Campo Bello Ln	Signal	21.0	C	13.5	B	Signal	25.2	C	19.0	B
10	Alameda de las Pulgas / Sharon Rd	Signal	11.9	B	11.1	B	Signal	17.0	B	13.1	B
14	Alameda de las Pulgas / Avy Ave	Signal	29.8	C	35.7	D	Signal	30.2	C	36.5	D

Notes:  
(a) Signal = Signalized

Table 6-3: Alternative A Long-term (2040) Intersection Delay and Level of Service Results

#	Study Intersection	No Improvements				Alternative A					
		Control (a)	AM Peak Hour		PM Peak Hour		Control (a)	AM Peak Hour		PM Peak Hour	
			Delay (s)	LOS	Delay (s)	LOS		Delay (s)	LOS	Delay (s)	LOS
1	Sand Hill Rd / Santa Cruz Ave	Signal	109.3	F	100.5	F	Signal	130.7	F	101.1	F
5	Santa Cruz Ave / Alameda de las Pulgas / Campo Bello Ln	Signal	25.6	C	14.5	B	Signal	30.2	C	16.3	B
10	Alameda de las Pulgas / Sharon Rd	Signal	12.4	B	15.8	B	Signal	19.9	B	16.1	B
14	Alameda de las Pulgas / Avy Ave	Signal	40.4	D	86.4	F	Signal	42.8	D	88.4	F

Notes:  
(a) Signal = Signalized



Table 6-4: Alternative A Corridor Travel Times

Direction	Roadway	From	To	No Improvements		Alternative A	
				AM Peak Hour	PM Peak Hour	AM Peak Hour	PM Peak Hour
Existing (2019)							
Northbound	Santa Cruz Avenue	Sand Hill Road	Sharon Road	1.53	1.50	1.58	1.53
				-	-	3%	2%
Southbound	Santa Cruz Avenue	Sharon Road	Sand Hill Road	2.85	2.75	2.87	2.47
				-	-	1%	-10%
Northbound	Alameda de las Pulgas <sup>(1)</sup>	Sand Hill Road	Avy Avenue	2.22	2.28	2.45	2.68
				-	-	11%	18%
Southbound	Alameda de las Pulgas <sup>(1)</sup>	Avy Avenue	Sand Hill Road	2.90	2.68	3.28	2.97
				-	-	13%	11%
Medium-Term (2030)							
Northbound	Santa Cruz Avenue	Sand Hill Road	Sharon Road	1.53	1.50	1.80	1.52
				-	-	17%	1%
Southbound	Santa Cruz Avenue	Sharon Road	Sand Hill Road	3.57	2.68	3.78	2.53
				-	-	6%	-6%
Northbound	Alameda de las Pulgas <sup>(1)</sup>	Sand Hill Road	Avy Avenue	2.25	2.52	2.48	2.77
				-	-	10%	10%
Southbound	Alameda de las Pulgas <sup>(1)</sup>	Avy Avenue	Sand Hill Road	4.00	2.68	3.58	2.98
				-	-	-10%	11%
Long-Term (2040)							
Northbound	Santa Cruz Avenue	Sand Hill Road	Sharon Road	1.53	1.50	1.85	1.50
				-	-	21%	0%
Southbound	Santa Cruz Avenue	Sharon Road	Sand Hill Road	4.00	2.80	3.78	2.55
				-	-	-5%	-9%
Northbound	Alameda de las Pulgas <sup>(1)</sup>	Sand Hill Road	Avy Avenue	2.32	2.98	2.53	2.92
				-	-	9%	-2%
Southbound	Alameda de las Pulgas <sup>(1)</sup>	Avy Avenue	Sand Hill Road	4.00	2.88	4.42	3.02
				-	-	10%	5%

Notes:

Travel times represent the average travel time per vehicle driving on each roadway between the listed boundaries in the indicated peak hour. All alternatives include signal coordination and modifications to signal timing parameters.

- (1) Alameda de las Pulgas in this context is between the intersection of Santa Cruz Avenue/Sand Hill Road and Alameda de las Pulgas/Avy Avenue.

Alternative A generally results in a small increase in travel times compared to the baseline condition. For northbound Santa Cruz Avenue, the travel times increase due to the addition of the pedestrian crosswalk on the east leg at the Y intersection. The addition of the crosswalk resulted in a modification of the signal timing at the Y intersection that reduced the amount of green time for the northbound right turn movement to allow for a protected pedestrian phase. For northbound Alameda de las Pulgas, the travel times increase due to the road diet on Alameda de las Pulgas between the Y intersection and Avy Avenue. For southbound Santa Cruz Avenue, the travel times typically decrease due to optimized intersection timings at the Y intersection. For southbound Alameda de las Pulgas, the travel times generally increase due to the road diet on Alameda de las Pulgas between the Y intersection and Avy Avenue.



### Alternative B

Improvements included in Alternative B that affect circulation metrics (discussed in greater detail in the preceding chapters) are:

- Modification to signal timing to restrict right turns on red for the southbound right turn movement at the intersection of Santa Cruz Avenue/Sand Hill Road
- Modification to signal timing to add a pedestrian phase for the east leg of the Y intersection. This resulted in a modification to the signal timing for the northbound right turn movement at the Y intersection
- Removal of one northbound through lane and one southbound through lane on Santa Cruz Avenue between Sand Hill Road and the Y intersection
- Removal of one westbound left turn lane at the Y intersection
- Reduction of one travel lane in each direction and addition of a center two-way left-turn lane on Alameda de las Pulgas between the Y intersection and Avy Avenue
- Addition of northbound and southbound left turn lanes at the intersection of Alameda de las Pulgas/Sharon Road

The Alternative B LOS and delay results are provided in Table 6-5, Table 6-6, and Table 6-7 for the Existing (2019), Medium-term (2030), and Long-term (2040) scenarios, respectively. For the LOS results and queues of all study intersections, see Appendix C. Queues were not estimated for 2030 scenarios.



**Table 6-5: Alternative B Existing (2019) Intersection Delay and Level of Service Results**

#	Study Intersection	No Improvements				Alternative B					
		Control (a)	AM Peak Hour		PM Peak Hour		Control (a)	AM Peak Hour		PM Peak Hour	
			Delay (s)	LOS	Delay (s)	LOS		Delay (s)	LOS	Delay (s)	LOS
1	Sand Hill Rd / Santa Cruz Ave	Signal	48.7	D	57.3	E	Signal	64.1	E	70.1	E
5	Santa Cruz Ave / Alameda de las Pulgas / Campo Bello Ln	Signal	13.1	B	13.2	B	Signal	24.5	C	20.9	C
10	Alameda de las Pulgas / Sharon Rd	Signal	11.6	B	9.3	A	Signal	20.7	C	11.5	B
14	Alameda de las Pulgas / Avy Ave	Signal	24.1	C	19.0	B	Signal	29.4	C	18.2	B

Notes:  
(a) Signal = Signalized

**Table 6-6: Alternative B Medium-term (2030) Intersection Delay and Level of Service Results**

#	Study Intersection	No Improvements				Alternative B					
		Control (a)	AM Peak Hour		PM Peak Hour		Control (a)	AM Peak Hour		PM Peak Hour	
			Delay (s)	LOS	Delay (s)	LOS		Delay (s)	LOS	Delay (s)	LOS
1	Sand Hill Rd / Santa Cruz Ave	Signal	68.9	E	63.5	E	Signal	89.6	F	79.4	E
5	Santa Cruz Ave / Alameda de las Pulgas / Campo Bello Ln	Signal	21.0	C	13.5	B	Signal	35.5	D	29.0	C
10	Alameda de las Pulgas / Sharon Rd	Signal	11.9	B	11.1	B	Signal	31.0	C	12.1	B
14	Alameda de las Pulgas / Avy Ave	Signal	29.8	C	35.7	D	Signal	55.7	E	36.2	D

Notes:  
(a) Signal = Signalized

**Table 6-7: Alternative B Long-term (2040) Intersection Delay and Level of Service Results**

#	Study Intersection	No Improvements				Alternative B					
		Control (a)	AM Peak Hour		PM Peak Hour		Control (a)	AM Peak Hour		PM Peak Hour	
			Delay (s)	LOS	Delay (s)	LOS		Delay (s)	LOS	Delay (s)	LOS
1	Sand Hill Rd / Santa Cruz Ave	Signal	109.3	F	100.5	F	Signal	143.6	F	118.0	F
5	Santa Cruz Ave / Alameda de las Pulgas / Campo Bello Ln	Signal	25.6	C	14.5	B	Signal	47.6	D	37.8	D
10	Alameda de las Pulgas / Sharon Rd	Signal	12.4	B	15.8	B	Signal	46.8	D	13.2	B
14	Alameda de las Pulgas / Avy Ave	Signal	40.4	D	86.4	F	Signal	64.1	E	95.0	F

Notes:  
(a) Signal = Signalized



Alternative B results in only a marginal increase in level of service and delay with existing volumes, but the level of impact increases in future scenarios. The increase at most intersections in LOS is 1 to 2 letter grades with the Long-term scenario. As overall traffic volumes increase, the road diet on Santa Cruz Avenue between the Y and Sand Hill becomes more constraining. At the signalized intersection of Santa Cruz Avenue/Sand Hill Road, the delay worsens due to the no right turn on red restriction and the reduction in northbound lanes from two lanes to one lane just north of this intersection. At the Y, there are fewer lanes entering this intersection from the westbound approach. The majority of the unsignalized intersections along Santa Cruz Avenue and Alameda de las Pulgas experience higher delay in Alternative B compared to the No-Build due to the reduction in travel lanes from two lanes to one lane in each direction and spillback from the Sand Hill Road intersection.

Table 6-8 shows Alternative B travel time results in comparison to No Build for the Existing, Medium-term, and Long-term scenarios. The travel times for Alameda de las Pulgas are between the intersection of Santa Cruz Avenue/Sand Hill Road and the intersection of Alameda de las Pulgas/Avy Avenue.

Alternative B generally results in an increase in travel times compared to the No-Build condition travel times. For northbound Santa Cruz Avenue, the travel times increase due to the addition of the pedestrian crosswalk on the east leg at the Y intersection. The addition of the crosswalk resulted in a modification of the signal timing at the Y intersection that modified the amount of green time for the northbound right turn movement to allow for a protected pedestrian phase. For northbound Alameda de las Pulgas, the travel times generally increase due to the road diet on Alameda de las Pulgas between the Y intersection and Avy Avenue. However, for the PM peak hour in the Medium-term (2030) and Long-term (2040) conditions, the travel times decrease because the northbound vehicles are already constrained at the intersection of Santa Cruz Avenue/Sand Hill Road, and therefore the delay is not experienced on the study corridor itself. For southbound Santa Cruz Avenue, the travel times increase due to one lane section on Santa Cruz Avenue approaching the intersection with Sand Hill Road. For southbound Alameda de las Pulgas, the travel times increase due to the road diet on Alameda de las Pulgas between the Y intersection and Avy Avenue and the road diet on Santa Cruz Avenue between the Y intersection and Sand Hill Road. The PM peak hour has the highest southbound travel time increase in the Medium-term (2030) and Long-term (2040) scenarios, with an increase in travel time approaching 100 percent.



Table 6-8: Alternative B Corridor Travel Times

Direction	Roadway	From	To	No Improvements		Alternative B	
				AM Peak Hour	PM Peak Hour	AM Peak Hour	PM Peak Hour
Existing (2019)							
Northbound	Santa Cruz Avenue	Sand Hill Road	Sharon Road	1.53	1.50	1.63	1.53
				-	-	7%	2%
Southbound	Santa Cruz Avenue	Sharon Road	Sand Hill Road	2.85	2.75	3.35	3.38
				-	-	18%	23%
Northbound	Alameda de las Pulgas <sup>(1)</sup>	Sand Hill Road	Avy Avenue	2.22	2.28	2.50	2.43
				-	-	13%	7%
Southbound	Alameda de las Pulgas <sup>(1)</sup>	Avy Avenue	Sand Hill Road	2.90	2.68	4.10	3.53
				-	-	41%	32%
Medium-Term (2030)							
Northbound	Santa Cruz Avenue	Sand Hill Road	Sharon Road	1.53	1.50	1.70	1.55
				-	-	11%	3%
Southbound	Santa Cruz Avenue	Sharon Road	Sand Hill Road	3.57	2.68	3.77	5.25
				-	-	6%	96%
Northbound	Alameda de las Pulgas <sup>(1)</sup>	Sand Hill Road	Avy Avenue	2.25	2.52	2.57	2.43
				-	-	14%	-3%
Southbound	Alameda de las Pulgas <sup>(1)</sup>	Avy Avenue	Sand Hill Road	4.00	2.68	4.30	4.53
				-	-	8%	69%
Long-Term (2040)							
Northbound	Santa Cruz Avenue	Sand Hill Road	Sharon Road	1.53	1.50	1.70	1.55
				-	-	11%	3%
Southbound	Santa Cruz Avenue	Sharon Road	Sand Hill Road	4.00	2.80	4.40	5.40
				-	-	10%	93%
Northbound	Alameda de las Pulgas <sup>(1)</sup>	Sand Hill Road	Avy Avenue	2.32	2.98	2.68	2.43
				-	-	16%	-18%
Southbound	Alameda de las Pulgas <sup>(1)</sup>	Avy Avenue	Sand Hill Road	4.00	2.88	7.43	4.88
				-	-	86%	69%

Notes:

Travel times represent the average travel time per vehicle driving on each roadway between the listed boundaries in the indicated peak hour. All alternatives include signal coordination and modifications to signal timing parameters.

(1) Alameda de las Pulgas is between the intersection of Santa Cruz Avenue/Sand Hill Road and Alameda de las Pulgas/Avy Avenue.

**Alternatives Comparison**

Among the two Build alternatives, vehicle operations generally operate the best in Alternative A. This is due to the segment of Santa Cruz Avenue between Sand Hill Road and the Y intersection preserving existing capacity (i.e. two lanes in each direction). This is particularly notable in the AM peak hour, when the peak traffic flow is in the southbound direction, and thus the spillback from the Sand Hill Road intersection affects many of the study intersections.

In comparison of arterial travel times along the project corridor, generally, the travel times were longer for Alternative B in each direction and peak hour, as is expected due to the reduction in travel lanes for Alternative B compared to Alternative A. The exception is that Alternative A has a longer travel time for northbound Alameda de las Pulgas in the PM peak hour for both the Existing and 2040 scenarios. A



potential reason for this is because the bottleneck for the northbound direction is at the intersection of Santa Cruz Avenue/Sand Hill Road in Alternative B, while the bottleneck for Alternative A is at the Y intersection. The delay for Alternative A is captured in the travel time results, however the delay for Alternative B is partially upstream of the corridor and therefore not fully captured by the travel time results.

For bicyclists, Alternative B should provide the most safety features compared to the other alternatives. Alternative B provides a buffered bicycle lane in each direction on Santa Cruz Avenue between Sand Hill Road and the Y intersection, as well as on Alameda de las Pulgas from the Y intersection to Avy Avenue. Although Alternative C does provide a bicycle lane in each direction, which should improve bicyclist safety, it is not buffered for the entirety of the study segment on Santa Cruz Avenue between Sand Hill Road and the Y intersection.

For pedestrians, all the alternatives propose widening the existing sidewalks to a maximum of 5 feet and 6 inches. The major differences between the alternatives as it relates to pedestrians is the configuration of the Y intersection. Alternative A removes the pedestrian crosswalk on the south leg of the intersection but does extend the sidewalk on the northeast corner of the intersection towards the center of the intersection to reduce the walking distance on the north leg. Alternative B adds back in the crosswalk on the south leg of the intersection, but the sidewalk on the northeast corner is not as pronounced and therefore the walking distance on the north leg of the intersection is longer. Alternative C should provide the best pedestrian accommodations since it has crosswalks on all legs of the intersection and proposes a porkchop raised median on the northeast corner of the intersection to reduce the walking distance on the north leg of the intersection.

### 6.2. No Right Turn on Red Intersection Analysis – Y Intersection

In response to the community request to restrict right turns on red for the northbound right turn movement at the Y intersection, Kimley-Horn conducted a traffic analysis to determine the effect it had on arterial travel times. Table 6-9 and Table 6-10 show the traffic results from the VISSIM model comparing the without and with no right turn on red restriction for Alternative A and Alternative B, respectively. As shown, the no right turn on red restriction for Alternatives A and B increases the travel time slightly for northbound Santa Cruz Avenue between Sand Hill Road and Sharon Road. However, this increase in travel time is a maximum of 0.47 minutes, or less than 30 seconds, which occurs in the AM peak hour in the 2040 scenario with Alternative B.



**Table 6-9: No Right Turn on Red Corridor Travel Times – Alternative A**

Direction	Roadway	From	To	Alternative A Right Turns on Red Allowed		Alternative A Right Turns on Red Restricted	
				AM Peak Hour	PM Peak Hour	AM Peak Hour	PM Peak Hour
Existing (2019)							
Northbound	Santa Cruz Avenue	Sand Hill Road	Sharon Road	1.58	1.53	1.87	1.85
				-	-	18%	21%
Medium-term (2030)							
Northbound	Santa Cruz Avenue	Sand Hill Road	Sharon Road	1.80	1.52	1.87	1.75
				-	-	4%	15%
Long-Term (2040)							
Northbound	Santa Cruz Avenue	Sand Hill Road	Sharon Road	1.85	1.50	1.87	1.60
				-	-	1%	7%

Notes:

Travel times represent the average travel time per vehicle driving on each roadway between the listed boundaries in the indicated peak hour. All alternatives include signal coordination and modifications to signal timing parameters.

**Table 6-10: No Right Turn on Red Corridor Travel Times – Alternative B**

Direction	Roadway	From	To	Alternative B Right Turns on Red Allowed		Alternative B Right Turns on Red Restricted	
				AM Peak Hour	PM Peak Hour	AM Peak Hour	PM Peak Hour
Existing (2019)							
Northbound	Santa Cruz Avenue	Sand Hill Road	Sharon Road	1.63	1.53	1.95	1.67
				-	-	19%	9%
Medium-term (2030)							
Northbound	Santa Cruz Avenue	Sand Hill Road	Sharon Road	1.70	1.55	2.15	1.73
				-	-	26%	12%
Long-Term (2040)							
Northbound	Santa Cruz Avenue	Sand Hill Road	Sharon Road	1.70	1.55	2.17	1.77
				-	-	27%	14%

Notes:

Travel times represent the average travel time per vehicle driving on each roadway between the listed boundaries in the indicated peak hour. All alternatives include signal coordination and modifications to signal timing parameters.



## 7. Community Input on Alternatives and Recommendations

The Task Force was convened to provide input on the development of alternatives, review the findings of the technical analysis, and provide further direction on the refinement of the improvements. The Task Force additionally guided the format and content of the community meeting that presented the project alternatives and supporting analysis to the broader community. Several Task Force meetings were held throughout the project duration. The Community was able to review and provide input through the Task Force and through an additional survey during and after the Community meeting in January 2020.



### 7.1. Task Force Meetings

A total of 19 Task Force Meetings were held throughout the project at approximately one meeting per month, except during data collection and concept development phases, which required longer periods of technical effort between meetings. Kimley-Horn attended one meeting in August 2019 to present the project alternatives to the group.

At and between Task Force meetings, members of the Task Force communicated their needs and concerns about the existing conditions. Subgroups of the Task Force, representing different stakeholders, made presentations about what cyclists needed, what pedestrians needed, and what seniors living nearby needed for safe access to this corridor. The Task Force explored various options, reviewed data provided by Kimley-Horn traffic simulation models and discussed the potential impacts that certain modifications may make to this corridor. The Task Force also reached out to the community to keep them briefed of the discussions and to get the community's input on certain aspects of the conceptual plans and needs during this period.

Although opinions varied throughout the meetings, the Task Force was able to narrow down the improvements to a few alternatives. As a result, the County directed Kimley-Horn to produce three alternatives for the Santa Cruz Avenue segment between Sand Hill Road and the Y, and three alternatives for the Y intersection. These alternatives were then presented to the larger community for their consideration.

In addition, based on suggestions from the community, the County installed a pilot project, the northbound lane closure at the Y, to improve the accessibility for residents along the northeast segment of Santa Cruz Avenue from Alameda de las Pulgas to Sharon Road. The County had Kimley-Horn and



Associates evaluate this intersection for impacts prior to the implementation. Results are listed in Section 6.2. While the results showed that there would be some impacts to the homes on either side of the change, the Task Force voted to move forward with the 90-day trial period. During this period, the team evaluated traffic impacts during the pilot closure in order to evaluate the potential impacts of a lane reduction at this intersection and potential impacts to surrounding intersections. There was some opposition from motorists and cyclists during the first few days after the pilot project was implemented, but this opposition subsided as motorists became familiar with the lane closure. The pilot was extended beyond the 90-day trial period and was supported by a majority of the public in the 2020 survey.

### 7.2. Community Meeting

The community meeting was held on January 30, 2020, from 7:00 to 9:00 PM at Las Lomas Elementary School in Atherton, CA. The purpose of the meeting was to inform the public about the project alternatives and elicit feedback from the meeting participants to help determine which improvements they would like to see for the project corridor. Approximately 100 community members attended this meeting.

#### Summary of Community Meeting

The meeting began with a presentation by County staff, a Task Force representative, and the project team. The presentation reviewed the findings of the initial community survey, identified the project need, reviewed the project alternatives, and then presented the supporting technical analysis. Attendees raised questions during the presentation and were encouraged to provide questions and feedback on comment cards, which were then addressed by the project team at the end of the meeting. Following the presentation, the meeting attendees were free to review the conceptual designs posted around the room and discuss any questions with the project team. During this time, VISSIM traffic simulations of the improvement alternatives were shown on the main screen. Attendees were encouraged to take the online survey and vote for which alternatives they preferred.

### 7.3. Feedback and Survey Results

The online survey was open from January 31, 2020 to February 23, 2020 and was publicized on social media, on the County's website, and on electronic message boards.

The County provided a summary of the survey results (see Appendix F). A total of 537 responses were collected. In addition, the County of San Mateo Bicycle and Pedestrian Advisory Committee (BPAC) provided its recommendations for the preferred alternatives in a letter to the County dated February 20, 2020 (see Appendix F). The results of the survey were divided by user group:

- Residents
  - Motorists
  - Bicyclists
- Non-resident
  - Motorists
  - Bicyclists
- Pedestrians



There was consensus by all respondents of the survey for changes along the study corridor. Approximately 80 percent of the survey respondents felt the study corridor should be changed. Table 7-1 summarizes the preferred alternatives for each group.

Table 7-1: Survey Responses

User Group	Santa Cruz Ave	Alameda de las Pulgas	Y Intersection	Signal Timing for NB Right Turn at Y
Residents (All)	Alt A = 20% Alt B = 34% <b>Alt C = 36%</b> No Change = 10%	<b>Road Diet = 70%</b> No Change = 30%	Alt A = 26% Alt B = 23% <b>Alt C = 39%</b> No Change = 12%	<b>No RTOR = 60%</b> Extended Green = 25% RTOR allowed = 15%
Residents (Motorists)	Alt A = 24% Alt B = 26% <b>Alt C = 38%</b> No Change = 12%	<b>Road Diet = 65%</b> No Change = 35%	Alt A = 27% Alt B = 22% <b>Alt C = 33%</b> No Change = 18%	<b>No RTOR = 51%</b> Extended Green = 33% RTOR allowed = 16%
Residents (Bicyclists)	Alt A = 5% <b>Alt B = 58%</b> Alt C = 36% No Change = 1%	<b>Road Diet = 95%</b> No Change = 5%	Alt A = 12% Alt B = 20% <b>Alt C = 67%</b> No Change = 1%	<b>No RTOR = 66%</b> Extended Green = 18% RTOR allowed = 16%
Non-residents (Motorists)	Alt A = 21% Alt B = 22% <b>Alt C = 43%</b> No Change = 14%	Road Diet = 35% <b>No Change = 65%</b>	Alt A = 22% Alt B = 19% <b>Alt C = 34%</b> No Change = 25%	<b>No RTOR = 46%</b> Extended Green = 38% RTOR allowed = 16%
Non-residents (Bicyclists)	Alt A = 6% <b>Alt B = 57%</b> Alt C = 36% No Change = 1%	<b>Road Diet = 96%</b> No Change = 4%	Alt A = 11% Alt B = 22% <b>Alt C = 67%</b> No Change = 0%	<b>No RTOR = 68%</b> Extended Green = 16% RTOR allowed = 16%
Pedestrians (All)	Alt A = 0% Alt B = 40% <b>Alt C = 60%</b> No Change = 0%	<b>Road Diet = 100%</b> No Change = 0%	Alt A = 7% <b>Alt B = 46%</b> Alt C = 40% No Change = 7%	<b>No RTOR = 71%</b> Extended Green = 29% RTOR allowed = 0%

Note: Options in **green bold** represent the highest response.

After receiving the survey responses, the project team met with the Task Force on March 11, 2020 to review the responses and select the recommended solutions for the corridor. During the meeting, the Task Force reviewed the responses, and it was clear to them that there was a consensus across different types of users. The Task Force voted on and approved the following conceptual improvements:

- Alternative C for Santa Cruz Avenue between Sand Hill Road and the Y intersection
- Road diet for Alameda de las Pulgas between the Y intersection and Avy Avenue
- Alternative C for the “Y” intersection
- “No right turn on red” signal configuration at the “Y” intersection



## Santa Cruz Avenue and Alameda de las Pulgas

### IMPROVEMENTS STUDY

FINAL REPORT - AUGUST 2020

The Task Force also requested a review copy of this Final Report and an opportunity to provide comments to the Final Report before it is submitted to the County Board of Supervisors for their consideration. Consistent with this request, the report and its contents were made available to Task Force members prior to the finalization of the report.



## 8. Recommended Solutions

### 8.1. Task Force Vote

On March 11, 2020, County of San Mateo staff met with the Task Force and concluded that there was a consensus from the public regarding which alternatives to move forward with for each segment. The Task Force voted on the recommended solutions and the following details the results:

- Alameda de las Pulgas from Avy Avenue to the Y Intersection
  - Unanimous decision for the Road Diet
- Santa Cruz Avenue from Sand Hill Road to the Y Intersection
  - Unanimous decision for Alternative C
- Y Intersection
  - 4 ayes and 1 abstain for Alternative C
- Signal Operation of Y Intersection for Northbound Right Turn along Santa Cruz Avenue
  - Unanimous decision for No Right Turn on Red

It should be noted that there was further discussion on the Y Intersection by the group. Of the 503 survey responses, 18 respondents requested consideration of SAFE Concept 10.5 and the Task Force recommended including a discussion in the Final Report specific to SAFE Concept 10.5 and aspects of that concept that were either feasible or infeasible. As noted in Chapter 5, that alternative was considered and implemented to the extent feasible. Other aspects of that concept not included in the plan were deemed geometrically infeasible given the constraints of this project.

### 8.2. Recommended Corridor Configuration

#### Design Assumptions

Improvement design has been completed at a conceptual level based on aerial photographs only. Existing right-of-way and roadway geometrics have not been confirmed by a field survey. Thus, recommended improvements will likely undergo refinement through preliminary engineering and final design once precise geometrics are obtained.

The Caltrans Highway Design Manual was used as a basis of design. The proposed concepts assume a minimum vehicle lane width of 10 feet for the travel lanes and 11 feet for the center two-way left turn lane to reduce the overall geometric cross section. The concepts assume a minimum bicycle lane width of five feet, not including a striped buffer. Horizontal curve radii were based on design speed and did not account for superelevation, as no vertical information was known about the existing roadway. The current widths of the sidewalks along the study corridor are estimates and will need to be confirmed and/or revised during the final design based on field survey.

The goal of the conceptual development work included as part of this project was to evaluate feasibility, gain an understanding of opportunities within the estimated right-of-way, estimate improvement costs, and develop a set of recommendations that can be advanced for further engineering. A set of engineering concepts was developed for each of the alternatives discussed in this report and for the final preferred alternative. The improvement alternative concepts are provided in Appendix D and the preferred alternative concept is provided in Appendix G.



### Preferred Alternative Benefits

Based on the community input, the following improvements shown in Tables 8-1 through 8-3 summarize the preferred alternative for the study corridor.

Table 8-1: Santa Cruz Avenue between Sand Hill Road and the Y Intersection Improvements

Location	Improvement	Benefit
Entire segment	Install 5-foot or 6-foot bicycle lane Provide dashed green striping in bike lanes within conflict areas	Improved bicycle safety
Entire segment	Reconstruct/widen sidewalk where feasible to a maximum of 5 feet and 6 inches	Improved pedestrian safety
Entire segment	Remove one travel lane in the southbound direction	Allow for other improvements
Entire segment	Restripe travel lanes to be 10 feet wide and the center two-way left-turn lane to be 11 feet	Reduced vehicle speeds
Intersection of Santa Cruz Avenue/Sand Hill Road	Install two-stage turn box for bicyclists making a southbound left turn <sup>a</sup>	Improved bicycle safety
Intersection of Santa Cruz Avenue/Sand Hill Road	Shift crosswalk locations on the north and west legs to be closer to center of intersection <sup>a</sup>	Improved pedestrian safety
Intersection of Santa Cruz Avenue/Sand Hill Road	No right turn on red restriction for southbound right turn movement <sup>a</sup>	Improved pedestrian safety
Intersection of Santa Cruz Avenue/Sand Hill Road	Install 2-foot raised median separating southbound traffic and northbound traffic on north leg of intersection	Improved vehicle safety
Intersection of Santa Cruz Avenue/Palo Alto Way	Install new curb ramp and bulb out on northeast corner of intersection Install a rectangular rapid flashing beacon Install yield pavement markings Install a 3-foot raised median island on the north leg of the intersection	Improved pedestrian safety

(a) Improvement to be coordinated with City of Menlo Park



Table 8-2: Alameda de las Pulgas between the Y Intersection and Avy Avenue Improvements

Location	Improvement	Benefit
Entire segment	Install 5-foot or 6-foot bicycle lane with 3-foot buffer Provide dashed green striping in bike lanes within conflict areas	Improved bicycle safety
Entire segment	Reconstruct/widen sidewalk where feasible to a maximum of 5 feet and 6 inches	Improved pedestrian safety
Entire segment	Remove one vehicle travel lane in each direction	Allow for other improvements
Entire segment	Install a center two-way left-turn lane	Improved vehicle safety
Entire segment	Restripe travel lanes to be 10 feet wide and the center two-way left-turn lane to be 11 feet	Reduced vehicle speeds and provide width for bicycle facility
Intersection of Alameda de las Pulgas/Clayton Drive	Install new curb ramps Install new crosswalk on Clayton Drive	Improved pedestrian safety
Intersection of Alameda de las Pulgas/Sharon Road	Install new bus stop on southwest corner	Improved safety
Intersection of Alameda de las Pulgas/Sharon Road	Install new curb ramps Install bulb outs Modify signal timing to include a leading pedestrian interval	Improved pedestrian safety
Intersection of Alameda de las Pulgas/Prospect Street	Install new curb ramps Install new crosswalk on Prospect Street	Improved pedestrian safety
Intersection of Alameda de las Pulgas/Liberty Park Avenue	Install new curb ramps Install a rectangular rapid flashing beacon Install yield pavement markings Install a raised median island on the north leg and south leg of the intersection	Improved pedestrian safety and reduced vehicle speeds
Intersection of Alameda de las Pulgas/Harkins Avenue	Install new curb ramps Install new crosswalk on Harkins Avenue	Improved pedestrian safety
Intersection of Alameda de las Pulgas/Avy Avenue	Install bicycle loops on both Avy Avenue approaches	Improved bicycle safety



Table 8-3: Y Intersection Improvements

Location	Improvement	Benefit
Entire intersection	Reconstruct/widen sidewalk where feasible to a maximum of 5 feet and 6 inches	Improved pedestrian safety
South leg of intersection	Install a 5-foot bicycle lane and a 2-foot raised median between the northbound through lane and the right turn lane	Improved bicycle safety
South leg of intersection	Install a 5-foot bicycle lane to the right of the northbound right turn lane	Improved bicycle safety
South leg of intersection	Install a buffered 5-foot bicycle lane to the left of the southbound receiving lane	Improved bicycle safety
South leg of intersection	Preserve pilot signal timing to restrict Right Turn on Red movements	Improved safety for all users
East leg of intersection	Install new curb ramps and crosswalk	Improved pedestrian safety
East leg of intersection	Install raised median separating eastbound and westbound vehicle traffic lanes	Improved vehicle safety
East leg of intersection	Construct new sidewalk and raised porkchop island on northeast corner of intersection	Improved pedestrian safety
North leg of intersection	Install raised median separating northbound and southbound vehicle traffic lanes	Improved vehicle safety
North leg of intersection	Install new curb ramps and crosswalk	Improved pedestrian safety

### Opinions of Probable Cost

Opinions of probable cost were prepared for the recommended corridor configuration. The total construction cost of improvements for the entire study corridor is estimated to be \$3.7 Million (2020 dollars). Inclusive of engineering, design and permitting costs, the total cost is estimated to be \$5.4 Million (2020 dollars). The calculation worksheet for the opinion of probable cost is provided in Appendix H.

### 8.3. Preferred Alternative Traffic Analysis

Similar to the traffic analysis for Alternatives A and B, the recommended improvements for each segment and intersection were combined into one preferred alternative corridor and VISSIM model. The circulation metrics (discussed in greater detail in the preceding chapters) affecting the traffic analysis are:

- Modification to signal timing to restrict right turns on red for the southbound right turn movement at the intersection of Santa Cruz Avenue/Sand Hill Road
- Modification to signal timing to restrict right turns on red for the northbound right turn movement at the Y intersection
- Removal of one northbound through lane at the Y intersection
- Removal of one westbound left turn lane at the Y intersection
- Reduction of one travel lane in each direction and addition of a center two-way left-turn lane on Alameda de las Pulgas between the Y intersection and Avy Avenue



- Addition of northbound and southbound left turn lanes at the intersection of Alameda de las Pulgas/Sharon Road

The Preferred Alternative LOS and delay results are provided in Table 8-4, Table 8-5, and Table 8-6 for the Existing (2019), Medium-term (2030), and Long-term (2040) scenarios, respectively. For the LOS results and queues of all study intersections, see Appendix C. Queues were not estimated for 2030 scenarios.

As shown in the tables below, the Preferred Alternative generally performs within one level of service letter grade as the No-Build for all signalized intersections. Effects on unsignalized intersections are relatively minor with existing conditions but become larger in future volume scenarios. This is due to the roadway approaching capacity in segments proposed for a lane reduction, and thus the potential for fewer available gaps for turning movements from the side-streets onto Alameda de las Pulgas or Santa Cruz Avenue. These delays are associated with movements from the side-streets only and not on the main arterial. In general, the Preferred Alternative performs better than Alternative B as it does not include the additional capacity reduction for northbound movements on Santa Cruz Avenue approaching the Y.

Table 8-7 shows Preferred Alternative travel time results in comparison to the No-Build for the Existing (2019), Medium-term (2030), and Long-term (2040) scenarios. The travel times for the Alameda de las Pulgas/Santa Cruz Avenue corridor are for the segment between the intersection of Santa Cruz Avenue/Sand Hill Road and the intersection of Alameda de las Pulgas/Avy Avenue.

The Preferred Alternative generally results in a modest increase in travel times compared to the No Build condition travel times. For northbound Santa Cruz Avenue, the travel times increase due to the addition of the no right turn on red restriction at the Y intersection. For northbound Alameda de las Pulgas, the travel times generally increase due to the road diet on Alameda de las Pulgas between the Y intersection and Avy Avenue. For the PM peak hour in the Existing and Medium-term (2030) and for the AM peak hour in the Long-term (2040) conditions, the travel times decrease in the northbound direction because of capacity constraints metering traffic flow through the Santa Cruz Avenue/Sand Hill Road. For southbound Santa Cruz Avenue, the travel times increase due to the one lane section on Santa Cruz Avenue approaching the intersection with Sand Hill Road. For southbound Alameda de las Pulgas, the travel times increase due to the road diet on Alameda de las Pulgas between the Y intersection and Avy Avenue and the road diet on Santa Cruz Avenue between the Y intersection and Sand Hill Road. While travel times are generally longer for the Preferred Alternative than with Alternative A, particularly in the southbound direction, travel times are generally less than with Alternative B.



**Table 8-4: Preferred Alternative Existing (2019) Intersection Delay and Level of Service Results**

#	Study Intersection	No Improvements				Preferred Alternative					
		Control (a)	AM Peak Hour		PM Peak Hour		Control (a)	AM Peak Hour		PM Peak Hour	
			Delay (s)	LOS	Delay (s)	LOS		Delay (s)	LOS	Delay (s)	LOS
1	Sand Hill Rd / Santa Cruz Ave	Signal	48.7	D	57.3	E	Signal	49.9	D	55.2	D
5	Santa Cruz Ave / Alameda de las Pulgas / Campo Bello Ln	Signal	13.1	B	13.2	B	Signal	32.0	C	22.8	C
10	Alameda de las Pulgas / Sharon Rd	Signal	11.6	B	9.3	A	Signal	28.3	C	11.9	B
14	Alameda de las Pulgas / Avy Ave	Signal	24.1	C	19.0	B	Signal	33.0	C	24.7	C

Notes:  
(a) Signal = Signalized

**Table 8-5: Preferred Alternative Medium-term (2030) Intersection Delay and Level of Service Results**

#	Study Intersection	No Improvements				Preferred Alternative					
		Control (a)	AM Peak Hour		PM Peak Hour		Control (a)	AM Peak Hour		PM Peak Hour	
			Delay (s)	LOS	Delay (s)	LOS		Delay (s)	LOS	Delay (s)	LOS
1	Sand Hill Rd / Santa Cruz Ave	Signal	68.9	E	63.5	E	Signal	81.4	F	64.9	E
5	Santa Cruz Ave / Alameda de las Pulgas / Campo Bello Ln	Signal	21.0	C	13.5	B	Signal	32.8	C	32.7	C
10	Alameda de las Pulgas / Sharon Rd	Signal	11.9	B	11.1	B	Signal	28.5	C	12.1	B
14	Alameda de las Pulgas / Avy Ave	Signal	29.8	C	35.7	D	Signal	41.9	D	40.5	D

Notes:  
(a) Signal = Signalized



Table 8-6: Preferred Alternative Long-term (2040) Intersection Delay and Level of Service Results

#	Study Intersection	No Improvements				Preferred Alternative					
		Control (a)	AM Peak Hour		PM Peak Hour		Control (a)	AM Peak Hour		PM Peak Hour	
			Delay (s)	LOS	Delay (s)	LOS		Delay (s)	LOS	Delay (s)	LOS
1	Sand Hill Rd / Santa Cruz Ave	Signal	109.3	F	100.5	F	Signal	145.5	F	111.8	F
5	Santa Cruz Ave / Alameda de las Pulgas / Campo Bello Ln	Signal	25.6	C	14.5	B	Signal	49.8	D	47.8	D
10	Alameda de las Pulgas / Sharon Rd	Signal	12.4	B	15.8	B	Signal	36.5	D	20.7	C
14	Alameda de las Pulgas / Avy Ave	Signal	40.4	D	86.4	F	Signal	54.8	D	88.4	F

Notes:

(a) Signal = Signalized



Table 8-7: Preferred Alternative Corridor Travel Times

Direction	Roadway	From	To	No Improvements		Preferred Alternative	
				AM Peak Hour	PM Peak Hour	AM Peak Hour	PM Peak Hour
Existing (2019)							
Northbound	Santa Cruz Avenue	Sand Hill Road	Sharon Road	1.53	1.50	1.85	1.63
				-	-	21%	9%
Southbound	Santa Cruz Avenue	Sharon Road	Sand Hill Road	2.85	2.75	3.48	3.07
				-	-	22%	12%
Northbound	Alameda de las Pulgas <sup>(1)</sup>	Sand Hill Road	Avy Avenue	2.22	2.28	2.42	2.03
				-	-	9%	-11%
Southbound	Alameda de las Pulgas <sup>(1)</sup>	Avy Avenue	Sand Hill Road	2.90	2.68	3.90	3.45
				-	-	34%	29%
Medium-term (2030)							
Northbound	Santa Cruz Avenue	Sand Hill Road	Sharon Road	1.53	1.50	1.83	1.70
				-	-	20%	13%
Southbound	Santa Cruz Avenue	Sharon Road	Sand Hill Road	3.57	2.68	4.30	3.65
				-	-	21%	36%
Northbound	Alameda de las Pulgas <sup>(1)</sup>	Sand Hill Road	Avy Avenue	2.25	2.52	2.33	2.27
				-	-	4%	-10%
Southbound	Alameda de las Pulgas <sup>(1)</sup>	Avy Avenue	Sand Hill Road	4.00	2.68	4.50	3.43
				-	-	13%	28%
Long-Term (2040)							
Northbound	Santa Cruz Avenue	Sand Hill Road	Sharon Road	1.53	1.50	1.82	1.83
				-	-	18%	22%
Southbound	Santa Cruz Avenue	Sharon Road	Sand Hill Road	4.00	2.80	4.48	3.90
				-	-	12%	39%
Northbound	Alameda de las Pulgas <sup>(1)</sup>	Sand Hill Road	Avy Avenue	2.32	2.98	2.17	3.08
				-	-	-6%	3%
Southbound	Alameda de las Pulgas <sup>(1)</sup>	Avy Avenue	Sand Hill Road	4.00	2.88	5.72	4.15
				-	-	43%	44%

Notes:

Travel times represent the average travel time per vehicle driving on each roadway between the listed boundaries in the indicated peak hour. All alternatives include signal coordination and modifications to signal timing parameters.

(1) Alameda de las Pulgas is between the intersection of Santa Cruz Avenue/Sand Hill Road and Alameda de las Pulgas/Avy Avenue.

### 8.4. Summary and Next Steps

Implementation of the Preferred Alternative, as selected based on community input, addresses many of the key issues identified by the community. It would address pedestrian, bicyclist, and vehicle safety concerns throughout the entire study corridor. If implemented as proposed, pedestrians would have improved sidewalks on either side of the road within the study corridor that includes widening up to 5 feet and 6 inches. Raised pedestrian visibility through RRFB and pedestrian safety islands at unsignalized crosswalks across Santa Cruz Avenue and across Alameda de las Pulgas would improve pedestrian comfort as well. In addition, crosswalks at signalized intersections would be modified to have a shorter crossing distance and reduced blind spots through bulbouts and crosswalk reconfiguration. Bicyclists would experience a more comfortable ride with the proposed bicycle lanes (and some segments with



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buffered bike lanes) in each direction along the corridor, as well as new bicycle detection at signalized side-streets and two-stage bike turn boxes at the Sand Hill Road intersection. Lastly, vehicle speeds along the corridor would be expected to drop with the reduction in travel lanes and travel lane widths, the implementation of new raised medians and safety islands, and signal operation modifications at the Y. Further engineering will be required to refine the improvement concepts included in the preferred alternative based on additional survey and utility data collection.

Grant funding will need to be identified for the implementation of improvements. The improvements may be competitive for a variety of grants focusing on improving bicycle and pedestrian connectivity and safety, roadway safety, and complete streets.



## Appendices

Appendix A: Traffic Counts

Appendix B: 2018 Public Meeting Survey Results

Appendix C: Traffic Analysis LOS and Queue Tables

Appendix D: Improvement Concept Alternatives Preliminary Designs

Appendix E: VISSIM Simulation Screenshots

Appendix F: 2020 Public Meeting Survey Results

Appendix G: Preferred Concept Alternative Preliminary Design

Appendix H: Preferred Concept Alternative Opinions of Probable Cost