LATHAM/CHURCH STREET BICYCLE BOULEVARD FEASIBILITY STUDY

Project 16-38

Final Report

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CITY OF MOUNTAIN VIEW

NELSON NYGAARD

PIN 8684

ACKNOWLEDGEMENTS

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1. INTRODUCTION

The Latham Street/Church Street study corridor has been identified as a proposed Class III Bicycle Boulevard among the top ten priority projects in the Bicycle Transportation Plan Update adopted by City Council in 2015. The purpose of this feasibility study is to determine a conceptual plan for designing and implementing a Bicycle Boulevard along the Latham-Church corridor. The Bicycle Boulevard Feasibility Study includes motor vehicle, bicycle and pedestrian data collection, community outreach, conceptual plans including proposed striping, traffic calming, signal design and intersection treatments, a proposed Bicycle Boulevard wayfinding and signage program, and cost estimates. The following sections provide descriptions of the study area, Bicycle Boulevard bikeways, previous planning efforts in the City, and the existing conditions of the study area.

This report describes the final proposed concept for the Latham/Church Street corridor.

The draft corridor concept called for a Bicycle Boulevard design, which included pavement markings, signage and infrastructure designs to prioritize bicycle travel along the corridor, plus other elements, such as traffic calming, that would also benefit pedestrians and slow traffic.

The concept was presented to the City Council at a May 15, 2018 Study Session, where the City Council voted to proceed instead with a more modest set of improvements. This final concept describes the modest set of improvements that provide traffic calming and visibility improvements but do not create a true Bicycle Boulevard by definition. Figure 18 shows a comparison of the two concepts.

1.1. STUDY AREA

The study area includes the full extent of the Latham Street and Church Street corridor, which is a Residential Collector parallel to El Camino Real. Latham Street extends from Showers Drive in the west to Shoreline Boulevard in the east, where the street name changes to Church Street. Church Street extends east from Shoreline Boulevard and terminates in a dead-end just west of State Route 237. Latham Street's western terminus at Showers Drive provides direct access to the San Antonio Transit Center. Latham Street has multi-family residential land uses, and Church Street primarily has single-family residential uses. The corridor provides access to these parks, landmarks, schools, and destinations:

- San Antonio Shopping Center / San Antonio Transit Center
- Mistral and Castro Elementary Schools
- Castro Park, between Escuela Avenue and Chiquita Avenue
- Eagle Park, between Shoreline Boulevard and Franklin Street
- Pioneer Memorial Park, between Franklin Street and Castro Street, City Hall, Mountain View Library, Chamber of Commerce
- Castro Street, Mountain View's primary downtown commercial corridor

People bicycle along the corridor to access the destinations located above. They also use Church Street/Latham Street as an alternate east-west route to El Camino Real, located one block south of Church Street/Latham Street.

1.2. BICYCLE BOULEVARDS

Bicycle Boulevards are a type of Class III bikeway that prioritize convenient and safe bicycle travel using traffic calming strategies, wayfinding signage, and other measures. They are shared roadways with low motor vehicle volumes and speeds, such that motorists passing bicyclists can use the full width of the roadway. Bicycle Boulevard improvements are coupled with traffic calming features to discourage speeding and cut-through motor vehicle traffic.

A Bicycle Boulevard is considered a low-stress facility, in that it appeals to people of all bicycling abilities and levels of confidence.[1] The National Association of City Transportation Officials (NACTO) Urban Bikeway Design Guide provides guidance on Bicycle Boulevard design. A Bicycle Boulevard has three types of treatment that prioritize bicycle travel over motor vehicle travel:

1. Signs and pavement markings
    a. Bicycle wayfinding signs and pavement markings give the route a visual identity and help guide bicyclists
    b. Center line stripes are typically removed except for short intersection approaches that have a stop line or traffic circle
2. Traffic calming and/or diversion to keep traffic volume and speeds low
    a. Bicycle Boulevards should have a maximum posted speed of 25 mph (some cities, such as Albuquerque, NM enforce 18 mph)
    b. Bicycle Boulevards should be designed for motor vehicle volumes less than 1,500 vehicles per day
    c. Motor vehicle volumes up to 3,000 may be tolerated on limited sections
3. Intersection crossing treatments
    a. Stop signs at minor intersection approaches should be limited to improve travel time for bicyclists
    b. Neighborhood traffic circles with 4-way yield signs are an alternative to stop-controlled intersections
    c. Major intersections may include intersection crossing markings, curb extensions, advance warning signs, median refuge islands, and bicycle signals depending on the intersection characteristics

[1] Stress level is based on tolerance for traffic stress. A low-stress facility is considered suitable for children. "Low-Stress Bicycling and Network Connectivity," Maaza C. Mekuria, Ph.D., P.E., PTOE, Peter G. Furth, Ph.D., Hilary Nixon, Ph.D, MTI Report 11-19 (2012)

2. POLICY CONTEXT

The following section reviews the City of Mountain View's recent policies and plans that are relevant to the context of this study. The recommendations presented with the Bicycle Boulevard Feasibility Study will be consistent with these existing plans. It is important to keep the existing policies outlined here in mind while evaluating the strengths and opportunities along the Latham/Church corridor.

2.1. 2030 GENERAL PLAN

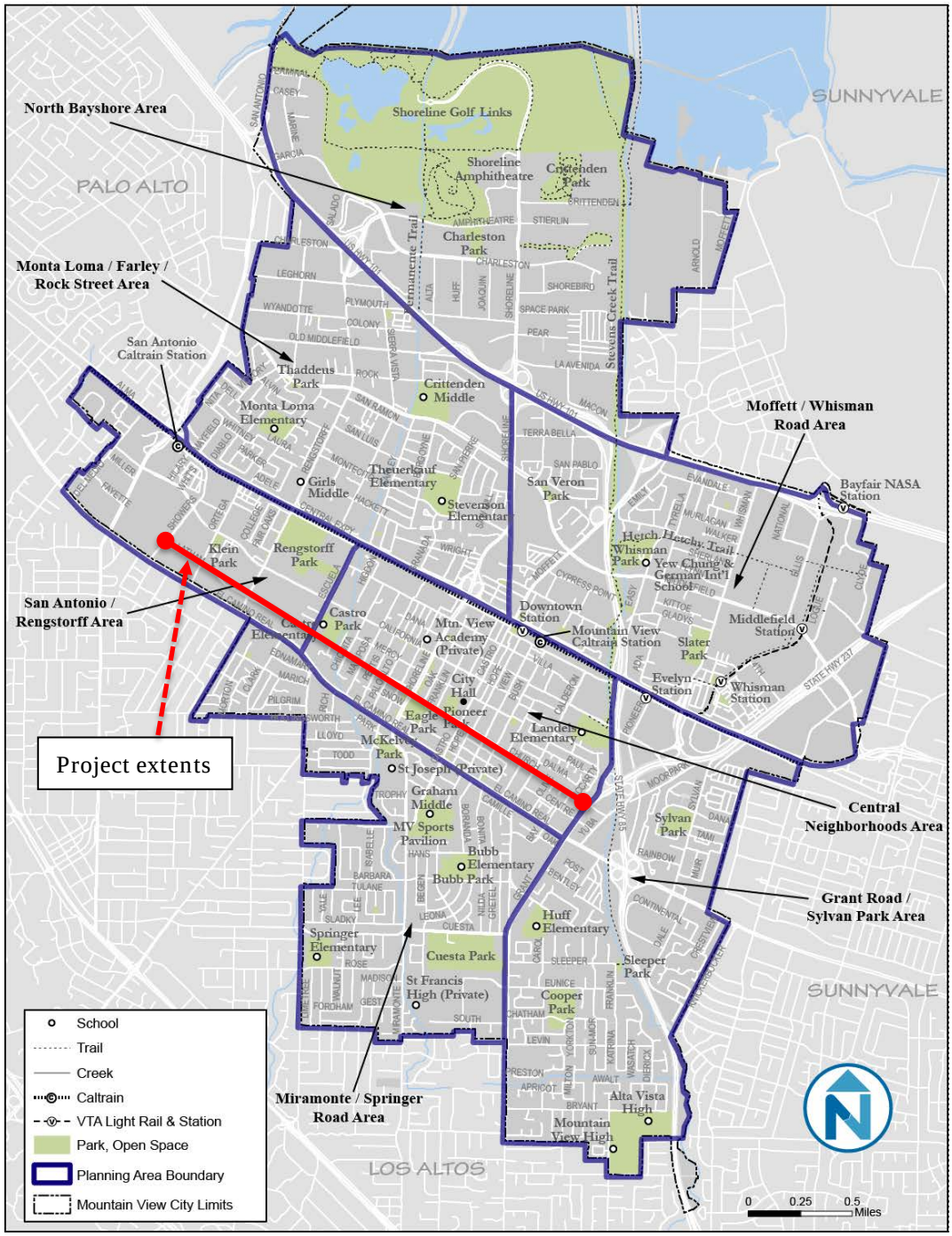
The 2030 General Plan[2], adopted in July 2012, is a comprehensive update to the City's 1992 General Plan. The Plan provides a series of goals, policies and actions that will help guide development and planning efforts over the next 2o years.

The 2030 General Plan emphasizes the importance of improving access for all modes and increasing the non-auto mode share through mobility-related goals. The General Plan emphasizes the need to maintain existing infrastructure and provide safe, efficient, and equitable uses of streets for pedestrians and cyclists through good roadway design. The multimodal goals in the plan also relate to sustainability, health and wellness, quality of life, and economic prosperity. Specifically, Mountain View seeks to reduce the risk of obesity by encouraging active transportation and improvements to pedestrian and bicycling infrastructure. The General Plan also highlights the role of active transportation in creating sustainable, commercial development.

This project area falls within two of the City's seven planning areas: San Antonio and Central Neighborhoods/Downtown, as shown in Figure 1.

[2] City of Mountain View, "Mountain View General Plan," 2012, http://www.mountainview.gov/civicax/filebank/blobdload.aspx?blobid=10702

Figure 1 Planning Areas in Mountain View



Source: City of Mountain View, "Pedestrian Master Plan," 2013

2.2. SAN ANTONIO PRECISE PLAN, 2014

In December 2014, the City of Mountain View released the San Antonio Precise Plan (SAPP).[3] The San Antonio Precise Plan covers an area of 123 acres, from San Antonio Road to Ortega Avenue, between El Camino Real and the Caltrain corridor. The study area includes recommendations for Latham Street and the Latham Street and Showers Drive intersection.

The SAPP lists Latham Street Bicycle Improvements as a short-term action and advises the City to study potential Bicycle Boulevard improvements on Latham Street and to coordinate plan area improvements with the Bicycle Transportation Plan.[4] The Bicycle Circulation Plan[5] identifies Latham Street as a primary bicycle route.

The intersection of Latham Street and Showers Drive is listed as a key intersection in the SAPP. This proposed improvement "would build on the existing high visibility crosswalk of Showers Drive, on the south side of Latham Street, to improve connectivity between the Mixed Use Center core and the adjacent neighborhood. Improvements should focus on integration of buffered bicycle lane improvements on Showers Drive with the Valley Transportation Authority (VTA) bus transfer station, including bicycle turning movements from Showers Drive onto Latham Street, and curb and median improvements to the pedestrian crossing condition."[6]

The SAPP also provides a table of potential pedestrian and bicycle improvements, as shown below in Figure 2, to be implemented on a location-specific basis.[7]

Figure 2 Examples of Typical Bike Improvements for the San Antonio Precise Plan Area

FOCUS	TARGET OF IMPROVEMENT	TYPICAL IMPROVEMENTS
Pedestrian / Bicycle	Reduce the speed at which vehicles travel through intersections	Reduce curb return radii; Eliminate or reconfigure high speed channelized right turns ("slip lanes"); Implement traffic calming measures
Pedestrian / Bicycle	Improve visibility approaching and within intersections	Appropriate sight distance triangles; Curb bulbouts; Intersection safety lighting; Proper street tree pruning; Devices that force people to look in the direction of conflicts (e.g. Z xing); Special signage with lighting such as high frequency flashers or in-road flashers
Pedestrian / Bicycle	Provide information for decision-making by all travelers.	Advanced lane configuration signs; Advanced warning signs of all types; Pedestrian countdown signal heads; Wayfinding and parking guidance systems; Real time transit arrival signs
Bicycle	Provide enhanced options for bicycle facilities	Buffered bike lanes for inexperienced or slower riders; Bike lane painting with new green bike lane treatment to improve visibility; Caltrans MUTCD approved "Shared Lane Marking" for locations where dedicated Type I or Type II facilities are not feasible; Bicycle Detector Pavement Markings at all locations of new

[3] City of Mountain View, "Draft San Antonio Precise Plan," 2014, http://www.mountainview.gov/civicax/filebank/blobdload.aspx?BlobID=13948

[4] City of Mountain View, San Antonio Precise Plan," 2014, p105

[5] City of Mountain View, Draft San Antonio Precise Plan," 2014, p17

[6] City of Mountain View, Draft San Antonio Precise Plan," 2014, p60

[7] City of Mountain View, Draft San Antonio Precise Plan," 2014, 3-24 – 3-30

FOCUS	TARGET OF IMPROVEMENT	TYPICAL IMPROVEMENTS
		dedicated bicycle facilities and bicycle priority routes; If bicycle detection is difficult to implement, install bike push buttons to assist with the activation of intersection signals, especially during low volume vehicular periods; Intersection pavement striping for bicycles traversing large intersections where conflicting movements may cause a hazard for bicycles; On bicycle priority routes implement bicycle timing options at signalized intersections, specifically bicycle green time extension (Note: Required by Caltrans.); Signage so users new to the area can follow safe routes

Source: City of Mountain View, "San Antonio Precise Plan," 2014

2.3. EL CAMINO REAL PRECISE PLAN, 2014

The City of Mountain View adopted the El Camino Real Precise Plan (ECRPP) in November 2014.[8] This plan outlines goals of improved pedestrian, bicyclist, and transit conditions along the El Camino Real corridor area, which runs parallel to the present project area. The broad goals of the plan include widening sidewalks along the corridor, increasing tree coverage, adding crosswalks for pedestrians, creating bicycle connectivity into Palo Alto and Sunnyvale, and street improvements near bus stops. The plan is also guided by a park-once policy to reduce parking impacts and encourage walking and biking in the area.

The ECRPP includes bicycle network recommendations for the corridor and adjacent roadways. Guideline 5 of the ECRPP identifies the explorations of a parallel route for people bicycling:

"Mixed-flow treatments should be evaluated for low-speed, lightly-traveled parallel streets such as Latham and Church, to improve access to El Camino Real destinations for less experienced bicyclists. These treatments may include traffic calming, bulbouts, chicanes, traffic diverters, on-street trees or medians, highly visible signage, on-street stencils or paint, and other techniques to mark the street as bicycle-priority."[9]

Assessing the priority of implementing bikeways on Church/Latham Streets is listed as a short-term implementation action in the ECRPP.[10]

2.4. BICYCLE TRANSPORTATION PLAN, 2015

The 2015 Bicycle Transportation Plan (BTP) Update builds on the City's 2008 Bicycle Transportation Plan and provides a vision, strategies, and actions for improving and encouraging bicycle travel in and through the City of Mountain View. The BTP Update supports the City Council mobility goals and expand the General Plan 2030 Mobility Goals. The City Council adopted the BTP Update in November 2015.

The BTP Update identifies and prioritizes over 180 recommended projects to improve Mountain View's bicycle-related network, infrastructure, programs and policies, including ten (10) priority

[8] City of Mountain View, "El Camino Real Precise Plan," 2014, http://www.mountainview.gov/civicax/filebank/blobdload.aspx?BlobID=13877

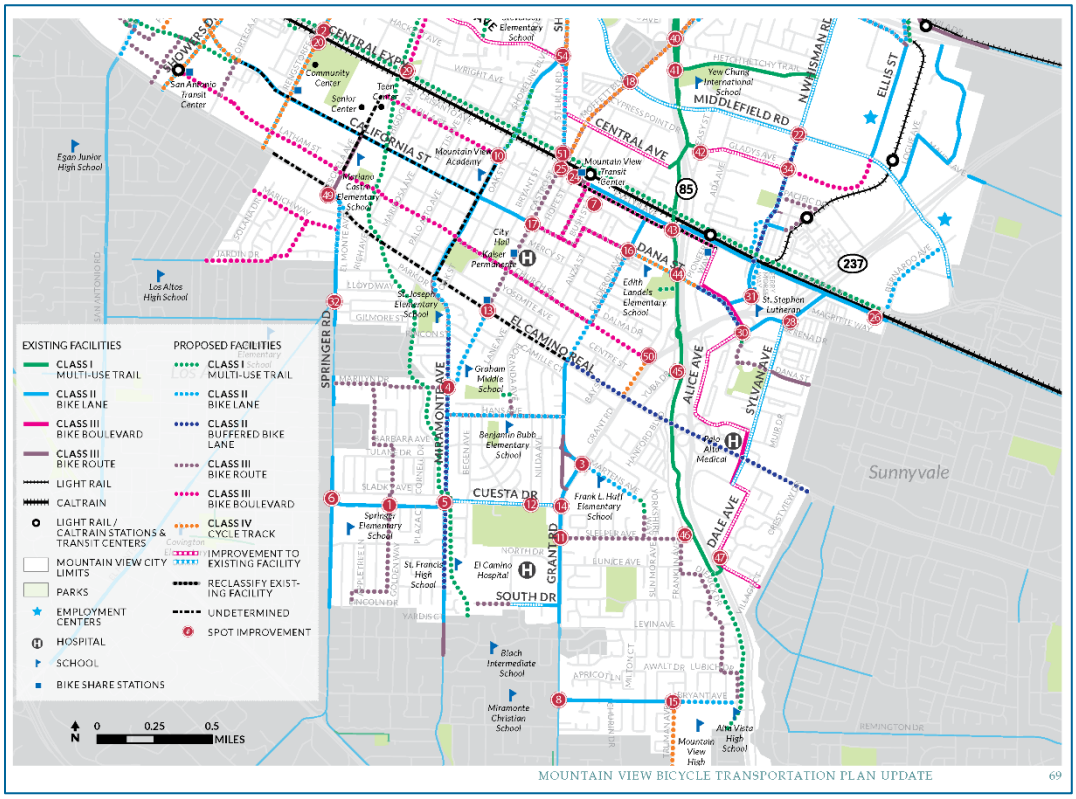
[9] City of Mountain View, "El Camino Real Precise Plan," 2014, p48

[10] City of Mountain View, "El Camino Real Precise Plan," 2014, p68

improvement projects. The ten priority projects prioritize bikeways improvements that expand the City's low-stress bicycle network, serve major destinations including downtown and major employment centers and major well-used roadways.

The Latham Street/Church Street corridor is included in Priority Project F – Bicycle Boulevard Feasibility Study. The priority project proposes conducting a feasibility study to identify improvements to three routes: two existing Bicycle Boulevards (Montecito Avenue and Evelyn Avenue-Dana Street-Alice Avenue-Dale Avenue and Church Street/Latham Street).

Figure 3 Mountain View Bicycle Transportation Plan Recommended Bikeways Map



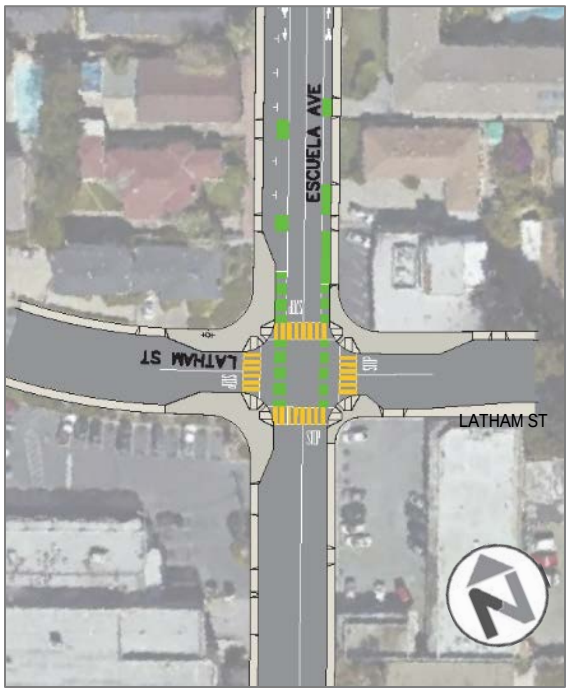
Source: Mountain View Bicycle Transportation Plan, 2015

2.5. CALIFORNIA, ESCUELA, SHORELINE COMPLETE STREETS FEASIBILITY STUDY, 2016

The California / Escuela / South Shoreline Complete Streets Feasibility Study was commissioned by the City of Mountain View in response to community interest in redesigning transportation and mobility facilities as Complete Streets. Complete streets are designed to be safe, comfortable and convenient for travel by automobile, foot, bicycle and transit. The study area includes California Street between Showers Drive and Bryant Street, Escuela Avenue between Latham Street and Crisanto Avenue, and South Shoreline Boulevard between El Camino Real and Montecito Avenue. The Study proposes bicycle and pedestrian treatments for two Latham Street intersections: Escuela Avenue/ Latham Street intersection, as shown in Figure 4, and the Shoreline Boulevard/ Latham Street intersection, as shown in Figure 5. The Escuela Avenue/Latham Street intersection is an all-way stop and proposed treatments include bulb-outs, high-visibility yellow school-zone crosswalks, and dashed green paint bike lane markings on

Escuela Avenue through the intersection. The Shoreline Boulevard/Latham Street intersection is signalized and proposed treatments include high-visibility crosswalks and dashed green paint bike lane markings on Shoreline Boulevard through the intersection.

Figure 4 Proposed Treatments for Escuela Avenue/Latham Street Intersection



Source: California, Escuela, Shoreline Complete Streets Feasibility Study, 2016

Figure 5 Proposed Treatments for Shoreline Boulevard/Latham Street Intersection

Source: California, Escuela, Shoreline Complete Streets Feasibility Study, 2016

2.6. VEHICLE EMISSIONS REDUCTION BASED AT SCHOOLS (VERBS)

The City of Mountain View is engaged with all local schools for its school-based vehicle emissions reduction program. In 2011, the City was awarded a $500,000 Vehicle Emissions Reduction Based at Schools (VERBS) grant to promote safe walking and bicycling to schools.[11] At the end of the 2011 calendar year, the City began tracking school enrollment and number of students educated in Safe Routes to School (SR2S) program goals. In the months that followed that school year, some schools conducted baseline surveys on the number of students walking and bicycling to school. By January 2014, with program education implementation occurring, all participating schools reported increases in students walking and bicycling, with the exception of Mountain View Academy, St. Francis School, and Mistral Elementary, which did not survey their student population. At Castro Elementary, a majority of students are now using alternative modes of transportation to travel to school. Figure 6 outlines the school commute data for 2011-12, 2012-13, and 2013-14 school years.

Figure 6 Commute Mode Split for Schools within the Study Area, 2011 – 2014

School Name	2011-12		2012-13		2013-14	
	% Walking	% Bicycling	% Walking	% Bicycling	% Walking	% Bicycling
Castro Elementary School	23%	2%	57%	6%	54%	5%
Mountain View Academy*	N/A	N/A	1%	3%	N/A	N/A

Note: *No students have been educated in SR2S

As can be seen above, walking and bicycling to Castro Elementary School on Escuela Avenue has increased dramatically from 25% to 59% within the past two years. This increased demand for walking and bicycle access suggests the need for special attention to non-motorized access tailored to young children in the vicinity of the elementary schools.

The 2015 BTP update recommends the City continue to provide education programming at all schools in Mountain View and pursue future funding for suggested routes to school infrastructure.

2.7. DESIGN GUIDELINES

The California Highway Design Manual (CAHDM) does not provide design requirements for Bicycle Boulevards. A few of the CAHDM Class III bike route criteria apply to a Bicycle Boulevard route, including: adjusting traffic control devices to give greater priority to bicyclists, correcting surface imperfections or irregularities, and maintaining the route at a higher standard than non-bikeway streets.[12] The VTA Bicycle Technical Guidelines provides useful guidance on Bicycle Boulevard planning, signage and design.[13] The VTA Guidelines suggest removing STOP signs along the Bicycle Boulevard right of way and installing traffic calming and diversion treatments to

[11] City of Mountain View, "Suggested Routes to School (VERBS)," 2014, http://www.mountainview.gov/depts/pw/transport/gettingaround/suggested_routes_to_schools_(verbs).asp

[12] California Highway Design Manual, Chapter 1000-22

[13] VTA Bicycle Technical Guidelines, December 13, 2007 (with 2012 Updates)

keep traffic low. The VTA Guidelines also provide design guidance for vehicle barriers and forced right-turn channelization.

Local and national design guidelines, such as the City of Berkeley Bicycle Boulevard Design Tools and Guidelines (2000), NACTO Urban Bikeway Design Guide, and Fundamentals of Bicycle Boulevard Planning & Design (2009) provide more detailed guidance for the planning, design, implementation and maintenance of Bicycle Boulevards. In addition, the nearby cities of Berkeley and Palo Alto have developed citywide Bicycle Boulevard networks, which can serve as useful case studies for this effort.

4. EXISTING CONDITIONS

Latham Street/Church Street is a two-lane, east-west Residential Collector that extends from Showers Drive in the west to its terminus at Route 237. Latham Street's western terminus at Showers Drive provides direct access to the San Antonio Transit Center. Latham Street provides on-street parking on both sides of the street. The posted speed limit is 25 mph along the study corridor and on surrounding streets. The section of Church Street between Calderon Avenue and Shoreline Boulevard is a Class III Bike Route. As a low-volume, residential street parallel to El Camino Real, Latham Street /Church Street has been identified as a potential Bicycle Boulevard within the City of Mountain View.[14]

4.1. STREET GEOMETRY

Figure 7 Narrow Road Segment on Church Street at Pioneer Memorial Park

Source: Nelson\Nygaard

The study area has a street right-of-way that ranges from approximately 45 to 55 feet. The curb-to-curb width varies within the right-of-way and is 40 feet along the widest sections (Showers Drive to Escuela Avenue and Calderon Avenue to the Terminus) and 32 feet at the narrowest points (Escuela Avenue to Shoreline Boulevard and Castro Street to Calderon Avenue). Between Shoreline Boulevard and Castro Street, the curb to curb width is 35 feet. Sidewalks are continuous on both sides of the street and maintain a five-foot width along the length of the corridor. There is sporadic buffered space between the curb and sidewalk that is used for landscaping.

The travel lane width and on-street parallel parking lane vary along the length of the street; the wider street segments have wider traffic and parallel parking lanes. Along the widest segments between Showers Drive and Escuela Avenue, travel lanes are 12 feet wide and the on-street parallel parking lanes are eight feet wide. On the narrow segments, which include the blocks between Escuela and Chiquita Avenues as well as Mariposa and Mountain View Avenues, the travel lanes are nine (9) feet wide and the parallel parking lanes are seven (7) feet wide. Centerlines are present on the corridor between Franklin Street and Calderon Avenue, and at most intersection approaches. Most intersections along the corridor are stop controlled and have crosswalks or stop lines. Shoreline Boulevard, Castro Street, and Rengstorff Avenue are signal controlled and have crosswalks at all intersection approaches. Signal modifications and bicycle detection are planned for two intersections along the corridor: Shoreline Boulevard at Church Street/Latham and Castro Street/Church Street. Intersection controls are shown in Figure 8.

[14] City of Mountain View, *Bicycle Transportation Plan Update*, November 2015.

Figure 8 Intersection Control Map

4.2. BICYCLE TRANSPORTATION CONDITIONS

Nelson\Nygaard conducted a site visit on August 17, 2016 of the approximately two and a half mile stretch of Church Street and Latham Street, between Showers Drive and the terminus of Church Street near Route 237. The study area has low traffic volumes and is lined with street trees that shade the road to create a pleasant bicycle environment. The pavement is in good condition with few potholes or obstructions for bicyclists. There are bicycle route signs along the street, spaced approximately every one to three blocks between Calderon Avenue and Shoreline Boulevard.

Corridor Segments

On Church Street, between its terminus and Bush Street, there are speed humps spaced approximately 250 feet apart. These humps and the traffic circle at the intersection of Church Street and View Street act as traffic calming features to reduce vehicle speeds in this residential area. Traffic calming features end west of View Street and vehicles may travel at higher speeds, particularly between Showers Drive and Rengstorff Avenue, where travel lanes are wider.

Figure 9 Speed humps located on Church Street near Calderon Avenue

Source: Nelson\Nygaard

Corridor Intersections

The majority of intersections are two- or four-way stop controlled. Some small dead-end streets do not have stop signs at the Church Street/Latham Street approach, where there is through, uncontrolled traffic.

Figure 10 Church Street at View Street Traffic Circle

Source: Nelson\Nygaard

Chiquita Avenue at Latham Street is a misaligned intersection, with uncontrolled traffic along Chiquita Avenue. This misalignment limits the visibility of cross traffic for bicyclists traveling along Latham Street. The Hope Street and Church Street intersection is also misaligned and the existing stop lines and crosswalks may present confusion to all road users.

The majority of the route is lined with on-street parked vehicles throughout the day. In front of Castro Park, parking is restricted during the day for student drop-off and pick-up. There are off-street parking lots along study area primarily for housing complexes and community buildings. On-street parking is permitted up to these parking lot driveways, which may limit the visibility of oncoming vehicle and bicycle traffic for exiting vehicles and create conflicts for people bicycling in the study area. The Eagle Park off-street lot on Church Street, between Shoreline Boulevard and Franklin Street,

has one driveway at Oak Street. Vehicles traveling northbound in the study area must yield to oncoming traffic to make a left turn into the lot, which increases the potential for vehicle-bicycle conflicts.

The intersection size, surrounding uses, and sidewalk geometry can greatly impact the perceived level of comfort and safety for bicyclists. The images below show the intersection crossing at the Castro Street and Shoreline Boulevard intersections on Church Street. The signalized intersection of Church Street and Castro Street is approximately 60 feet across; narrow traffic lanes, wide sidewalks, and high pedestrian activity slow vehicle traffic and contribute to a comfortable crossing for people bicycling. Conversely, the intersection of Shoreline Boulevard and Latham Street/Church Street is approximately 140 feet wide and has wide traffic lanes and low pedestrian activity. The latter intersection could therefore be expected to require more treatments in order to create low stress bicycle conditions.

At the west end of the corridor, there is a pedestrian entrance to San Antonio Shopping Center at the intersection of Latham Street and Showers Drive; however, there is no direct bicycle connection or clear crossing opportunity for bicyclists to access the shopping center or the adjacent San Antonio Transit Center.

At the start of this project, there were inhabited vehicles located on Latham Street near Showers Drive. The vehicles did not appear to affect bicycling conditions. However, the vehicles may have been impacted by any future street design changes related to a Bicycle Boulevard concept, such as speed humps, curb extensions and or parking restrictions. Towards the end of this project, signs were installed to restrict vehicles exceeding six feet in height from parking on the street.

Figure 11 Castro Street at Church Street

Source: Nelson\Nygaard

Figure 12 Shoreline Boulevard at Church Street

Source: Nelson\Nygaard

4.3. TRAFFIC CONDITIONS

The study corridor is located along residential land uses, with mixed-use areas at Rengstorff Avenue, Castro Street, Escuela Avenue, and Showers Drive. El Camino Real, one to two blocks south of the study corridor, is also a major commercial corridor.[15] Traffic volumes along the study area are low, with average daily traffic (ADT) volumes between 1,501 and 3,000 west of Shoreline Boulevard—traffic volumes that are compatible with Bicycle Boulevard facilities. There are higher traffic volumes crossing Church Street/Latham Street at Rengstorff Avenue, Showers Drive, and

[15] City of Mountain View, *Mountain View 2030 General Plan*, July 2012.

Shoreline Boulevard. These intersections will therefore need special attention to create low stress conditions.

ADT volumes and intersection counts for pedestrians, bicycles, and vehicles were gathered from existing City plans and development Traffic Impact Analysis (TIA) reports completed from 2000-2016. Figure 13 shows the intersections and segment count data sources for the study corridor. Vehicle speed data was not available.

Figure 13 Corridor and Intersection Count Sources

#	Intersections	Motor Vehicle Counts	Bicycle Counts	Pedestrian Counts
1	Latham Street / Showers Drive	The Village at San Antonio Center (Phase 2) TIA, 2013	The Village at San Antonio Center (Phase 2) TIA, 2013	The Village at San Antonio Center (Phase 2) TIA, 2013
2	Latham Street / Ortega Avenue 2	394 Ortega Avenue Residential Development Project TIA, 2016	394 Ortega Avenue Residential Development Project TIA, 2016	394 Ortega Avenue Residential Development Project TIA, 2016
3	Latham Street / South Rengstroff Avenue	1984 El Camino Real (SR 82) TIA, 2013; City of Mountain View ADT and Traffic Counts, 2000-2015	N/A	N/A
4	Latham Street / Escuela Avenue	1720/1730 El Camino Real (SR 82) TIA, 2012; City of Mountain View ADT and Traffic Counts, 2000-2015	N/A	N/A
5	Latham/Church Street / South Shoreline Boulevard	582 Hope Street Mixed-Use Development TIA, 2015; City of Mountain View ADT and Traffic Counts, 2000-2015	582 Hope Street Mixed-Use Development TIA, 2015	N/A
6	Church Street / Franklin Street	582 Hope Street Mixed-Use Development TIA, 2015	582 Hope Street Mixed-Use Development TIA, 2015	N/A
7	Church Street / Castro Street	582 Hope Street Mixed-Use Development TIA, 2015	582 Hope Street Mixed-Use Development TIA, 2015	N/A
8	Church Street / Hope Street	582 Hope Street Mixed-Use Development TIA, 2015	582 Hope Street Mixed-Use Development TIA, 2015	N/A
9	Church Street / Calderon Avenue	582 Hope Street Mixed-Use Development TIA, 2015	582 Hope Street Mixed-Use Development TIA, 2015	N/A
#	Corridor Segments	Average Daily Traffic (ADT) Counts		
1	Showers Drive to Ortega Avenue	City of Mountain View ADT and Traffic Counts, 2000-2018		
2	Ortega Avenue to Rengstorff Avenue	City of Mountain View ADT and Traffic Counts, 2000-2018		
3	Rengstorff Avenue to Escuela Avenue	City of Mountain View ADT and Traffic Counts, 2000-2018		
4	Toft Street to Chiquita Avenue	City of Mountain View ADT and Traffic Counts, 2000-2018		
5	Chiquita Avenue to Pettis Avenue	City of Mountain View ADT and Traffic Counts, 2000-2018		
6	Castro Street to View Street	City of Mountain View ADT and Traffic Counts, 2000-2015		
7	Calderon Avenue to Church Street terminus	City of Mountain View ADT and Traffic Counts, 2000-2015		

When not available, ADT for corridor segments was estimated by assuming the intersection approach in/out volume represents 10% of ADT. Pedestrian and bicycle counts are combined as crosswalk movements.

ADT volumes are higher at the west end of the study area, from Showers Drive to Pettis Avenue, and lower east of Shoreline Boulevard. ADT volumes are below 1,500 east of Castro Street. Similarly, intersection volumes are highest west of Shoreline Boulevard, with heavier traffic during the PM peak period.

With the exception of Hope Street and Franklin Street, the majority of traffic at the intersections travels on the perpendicular streets and cross Church Street/Latham Street. The intersection of Shoreline Boulevard and Church/Latham has the highest traffic volumes of any intersection on the study corridor. The majority of traffic at this intersection is Shoreline Boulevard through traffic traveling southbound towards El Camino Real in the PM peak period, and traveling northbound towards US 101 in the AM peak period. During both periods, there are more than 200 vehicles that turn onto Shoreline Boulevard from Church Street/Latham Street. East of Shoreline Boulevard, the Castro Street/Church Street intersection has the highest vehicle volumes of those studied, with the majority of AM peak period vehicles traveling north, toward US 101.

Bicycle counts were available for six intersections, pedestrian counts were available at one intersection, and crosswalk movements were available for one intersection (including both pedestrian and bicycle movements). The highest volumes are near the Castro Street and Church Street intersection. In the AM peak, the highest number of bicycles traveling through an intersection occur at Shoreline Boulevard (59), Calderon Avenue (56) and Castro Street (45); in the PM peak, the highest bicycle counts occur at Calderon Avenue (49), Castro Street (38) and Franklin Street (33). Figure 14 and Figure 15 show the ADT and intersection volumes for the AM and PM peak periods, respectively.

Figure 14 AM Peak Period Traffic and Turning Volumes

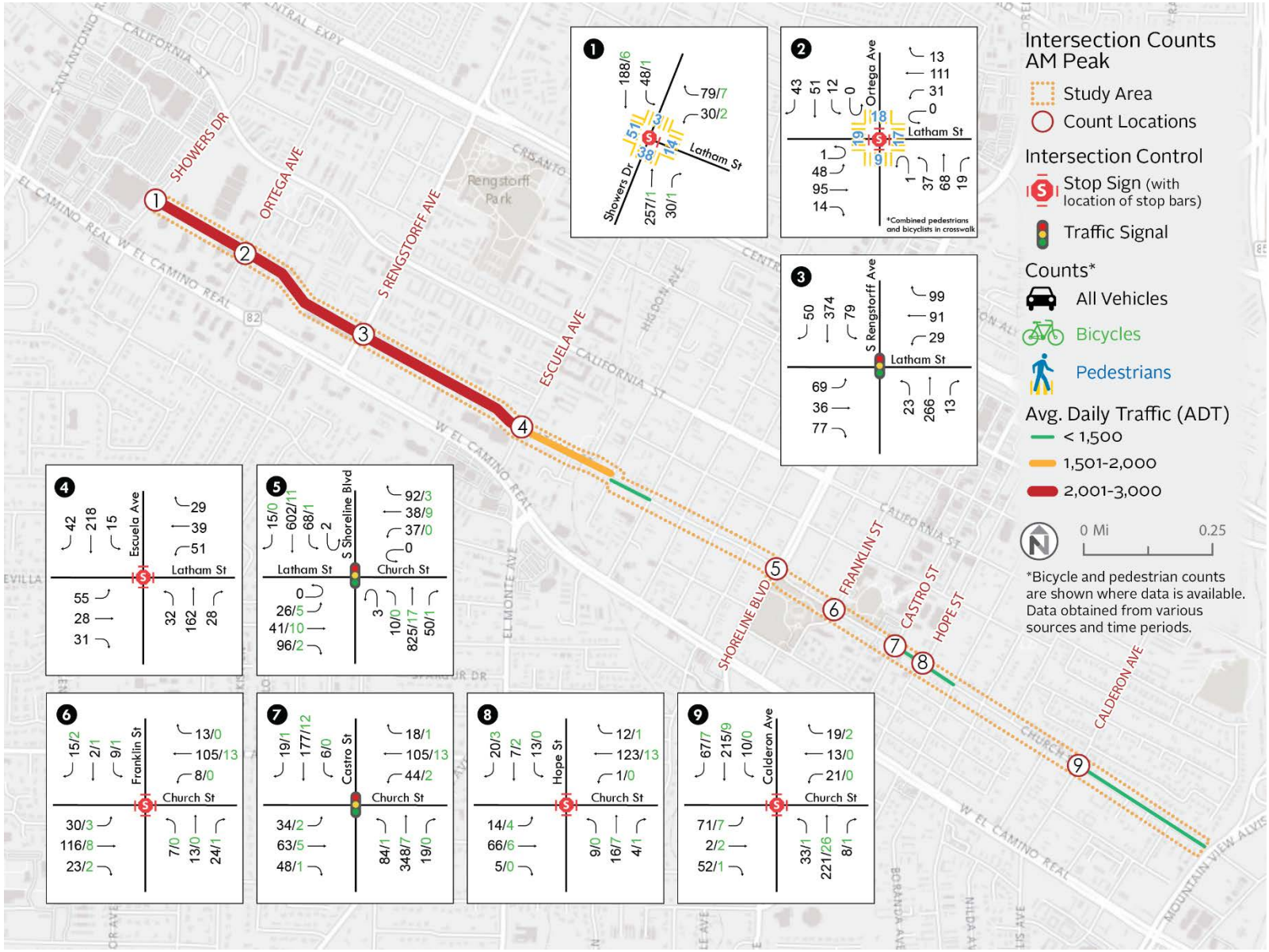
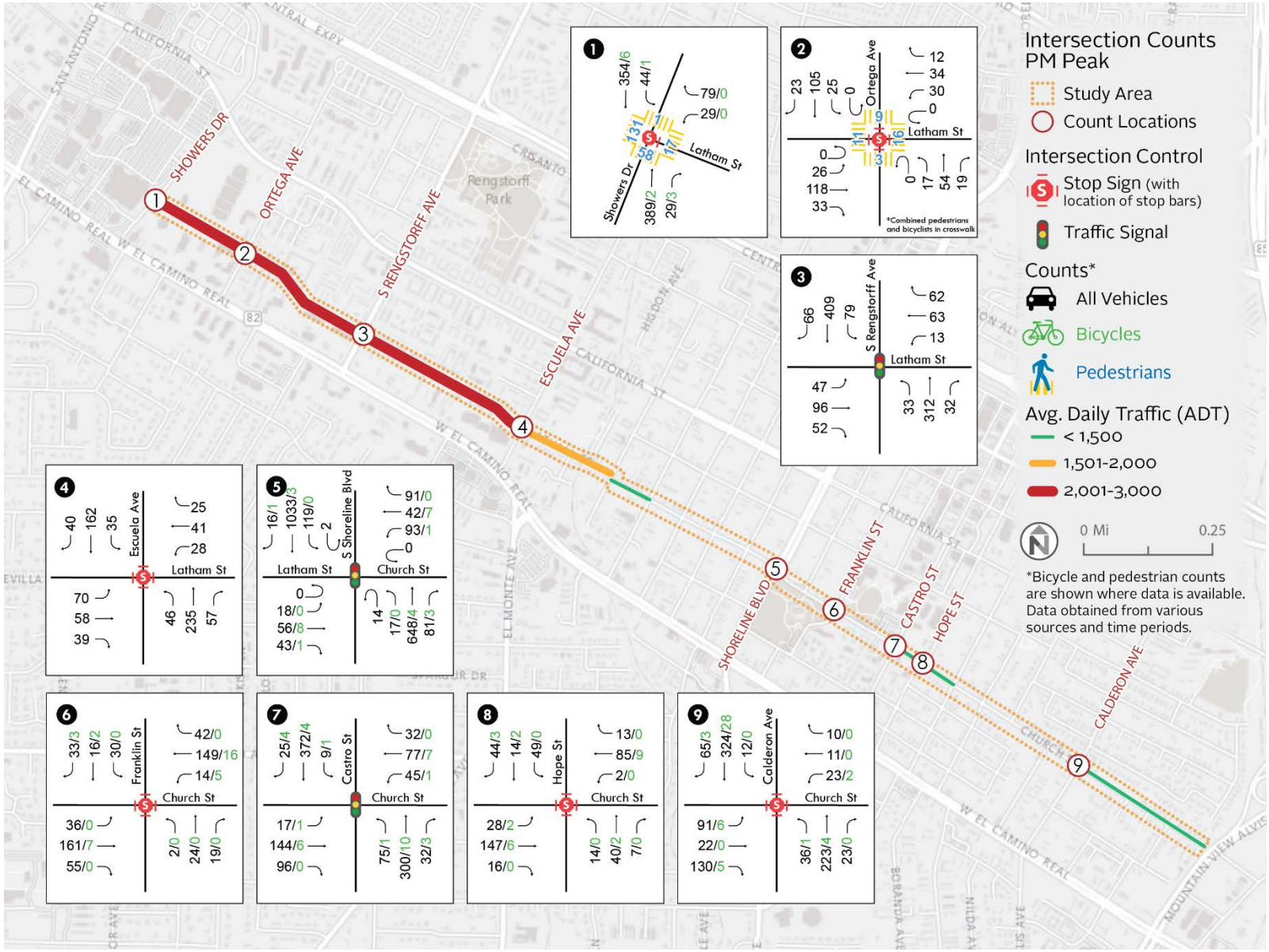


Figure 15 PM Peak Period Traffic and Turning Volumes



4.4. EXISTING CONDITIONS SUMMARY

The study corridor runs parallel to El Camino Real and provides connections to existing north-south bikeways on Calderon Avenue, Shoreline Boulevard, Escuela Avenue, Rengstorff Avenue, and Showers Drive.[16] Additionally, Church Street/Latham Street connects residential and mixed use areas and given the existing ADT volumes, is a good candidate for a Bicycle Boulevard. As stated in the Introduction, ADT volumes of 1,500 represent the ideal conditions for a Bicycle Boulevard; ADT volumes of 3,000 are the maximum threshold for vehicle traffic on limited segments of a Bicycle Boulevard. Of the segments where ADT volumes were available, the southern portion of the study area has ADT volumes below 1,500 and no segments have ADT volumes above 3,000.

East of Shoreline Boulevard, the corridor has treatments to reduce vehicle speeds and provide guidance to bicyclists. If a Bicycle Boulevard is pursued along the study corridor, roadway treatments may be considered for the entire area to reduce traffic volumes and speeds, increase bicycle presence, and prioritize bicycle travel.

[16] Santa Clara Valley Transportation Authority, *Palo Alto and Mountain View Bicycle Map,* accessed August 2016, http://vtaorgcontent.s3-us-west-1.amazonaws.com/Site_Content/BikewaysMapA.pdf.

5. COMMUNITY OUTREACH AND INPUT

The study process offered multiple opportunities for members of the community to provide feedback on the concept. The outreach effort was designed to engage residents who live on or near the study area. The project team sent two postcards to residents and businesses in the study area to inform them about the study and encourage their attendance at each of the community and public meetings. The postcards were bilingual with text in English and Spanish. Below is an image from the mailer sent to community members for the March 2017 public community meeting.

Figure 16 Mailer for 3/27/17 Public Community Meeting

Source: Nelson\Nygaard

5.1. PUBLIC COMMUNITY MEETING (03/27/2017)

At a March 27, 2017 community meeting, the project team presented the Bicycle Boulevard concept and solicited feedback from local residents and visitors. In general, the public supported the concept and offered the following feedback.

- Strong support for lower vehicle speeds, traffic diverters, and some interest in additional diverters
- Traffic calming seen as good for residents, drivers, people with pets, and pedestrians too—not just good for people who ride bikes.

Figure 17 Public Community Meeting on March 27, 2017

Source: Nelson\Nygaard

- Concerns about education and learning curve for drivers and bicyclists; wayfinding and consistent pavement markings/symbols will be especially important.
- Additional design considerations should be included regarding concerns about narrow sections of the corridor near Castro/Mistral School and Pioneer Park.
- Questions about improving morning drop-off at Castro and Mistral Schools; potential management strategies, separate from Bicycle Boulevard designs.

5.2. BICYCLE / PEDESTRIAN ADVISORY COMMITTEE (10/25/2017)

The project team presented the same concept to the Mountain View Bicycle/Pedestrian Advisory Committee (B/PAC) on October 25, 2017. The B/PAC was supportive of the proposed Bicycle Boulevard concept. Members of the public voiced concerns about the following items:

- **Castro/Mistral School drop-off**. Residents voiced concern about the narrow roadway and slow traffic during school drop-off and pickup times.
- **Community Shuttle Route**. The MV Community shuttle turns left from Latham onto Ortega. That won't be possible with the proposed right-turn only diverter.
- **Retailer/Trucks Use of Latham.** Retail representatives are concerned about restricted turns and speed humps on Latham.
- **Traffic Counts**. This project did not include new traffic counts and residents raised concerns that the data is out of date.
- **Stop Sign Removal.** The project team needs clarity on the process for removing stop-signs and what steps would be required.

Based on this feedback, the project team conducted new traffic counts along the corridor. No other changes were made to the concept.

5.3. COUNCIL TRANSPORTATION COMMITTEE (2/15/18)

The project team presented the Bicycle Boulevard concept to the City Council Transportation Committee (CTC) on February 15, 2018. The CTC was supportive of the traffic calming elements of the project, but voiced concerns about the proposed concept's traffic diverters and how that would impact residents who drive automobiles.

5.4. CITY COUNCIL MEETING (5/15/18)

Based on the feedback from the 2/15/18 CTC meeting, the project team presented the same concept to the City Council on May 14, 2018, but included options for next steps, including moving forward with a more modest set of improvements. Similar to the CTC, the City Council was supportive of the traffic calming elements of the project, but voiced concerns about the proposed concept's traffic diverters and how that would impact residents who drive automobiles. There was also a perceived concern that removing stop signs along the corridor would create conflicts for people crossing the street. As such, the City Council recommended staff proceed with a more modest set of improvements to the corridor that would help calm traffic but would not provide the necessary designs to create an official Bicycle Boulevard.

6. FINAL CONCEPT

This section describes the final concept for the corridor based on City Council direction and input, and compares the initial draft Bicycle Boulevard concept to the final concept. The concept is shown in Appendix A on Page 32.

6.1. CONCEPT COMPARISON

The draft corridor concept called for a Bicycle Boulevard, which included design elements such as pavement markings, signage and infrastructure to prioritize bicycle travel along the corridor, plus other elements, such as traffic calming, that would also benefit pedestrians and slow traffic. The City Council supported the traffic calming elements of the project, but voiced concerns about the proposed concept's traffic diverters and how that would impact residents who drive automobiles. There was also a perceived concern that removing stop signs along the corridor would create conflicts for people crossing the street. The City Council voted to proceed instead with a more modest set of improvements. Figure 18 shows a comparison of the two concepts.

Figure 18 Concept Comparison Table

Street Design Element	Bicycle Boulevard Concept	Final Concept (Modest Improvements)
Bicycle Boulevard Signs and Pavement Markings		
Bicycle Boulevard Pavement Markings	✓	
Bicycle Boulevard Wayfinding Signs	✓	
Center Line Removal	✓	
Speed Management		
Speed Humps	✓	✓
Minor Street Crossings		
Splitter Islands	✓	✓
Raised Intersections	✓	✓
Removed Cross-Culverts	✓	✓
Intersection Visibility Improvements	✓	✓
New Stop Signs on Chiquita Ave	✓	✓
New Stop Sign on Toft St	✓	✓
New High-visibility Crosswalks	✓	✓
New Crosswalk Advanced Stop Bars	✓	✓
Stop Sign Removal	✓	

Street Design Element	Bicycle Boulevard Concept	Final Concept (Modest Improvements)
Major Street Crossings		
Channelized Right-Turn Diverter at Ortega Avenue	✓	
Partial Closure Diverter at Shoreline Boulevard	✓	
Curb Extensions at Intersection at Rengstorff Avenue	✓	✓
Intersection Bicycle Crossing Markings	✓	
Bicycle Signal Heads	✓	
High-Visibility Crosswalks	✓	✓
Off-Set Street Crossings		
Directional Sharrows	✓	

The final concept described below includes the modest set of improvements that provide traffic calming and visibility improvements but do not create a true Bicycle Boulevard by definition.

6.2. SPEED MANAGEMENT

Speed Humps or Speed Cushions

Managing motor vehicle speeds to stay at or below the speed limit will help create a more pleasant and safer street for all roadway users.

Speed humps are 3 to 4 inches high and 12 to 14 feet long, such that speeds are reduced to 15 to 20 mph. They are often referred to as "bumps" on signage and by the general public.[17] Speed cushions are speed humps with wheel cutouts to allow emergency vehicles to pass unaffected, though these are not as effective for speed control because all vehicles can pass through at least one of the cushion's cutouts.

Figure 19 An Existing Speed Hump on Church St.

Source: Nelson\Nygaard

Fifteen speed humps are proposed between Showers Drive and Escuela Avenue, spaced approximately 250' apart. The spacing encourages drivers to maintain a speed of 25 mph or less throughout the block.

Impacts

- Decreases motor vehicle speeds to help reach 85th percentile speeds at 25 mph or less

[17] http://nacto.org/publication/urban-bikeway-design-guide/bicycle-boulevards/speed-management/

6.3. INTERSECTIONS

Splitter Islands

Splitter islands are small medians in the roadway that separate traffic at the centerline. Often referred to as "pedestrian refuge islands," these splitters calm traffic by narrowing the roadway at the intersection, horizontally deflecting traffic, and providing a buffer at the center of the roadway for pedestrians crossing the street. Splitters are an effective traffic calming tool on neighborhood streets where there is no stop control, or where stop signs are removed in order preserve the neighborhood character of the street.

Figure 20 Example of Splitter Island, San Francisco, CA

Source: Google Maps

Appropriate signage and striping is installed with splitters to notify drivers to maneuver around the median island. Splitters can be landscaped if adequate width is available for planting. There are low cost options for islands that are pinned into the roadway which do not require a full reconstruction effort.

To allow adequate space for vehicles to drive around the splitter islands, red curb equal to fewer than three parking spaces will be required at each corner to maintain a clear path of travel. Some of this red curb space required for the splitter islands is already unavailable for parking due to existing red curbs, driveways, or fire hydrants. Therefore, the effective parking loss at each corner with a splitter island would be zero to three spaces.

Impacts

- Decreases motor vehicle speeds to help reach 85th percentile speeds at 25 mph or less
- Increases pedestrian visibility at intersections and reduces uninterrupted crossing distance
- New red curb removes between zero and three on-street parking spaces at each corner

Raised Intersections

Raised intersections are traffic calming and pedestrian safety features typically installed at minor intersections to encourage drivers to drive slowly through the intersection and yield to pedestrians. The raised portion meets the level of the curb and creates a flush crossing for pedestrians. A raised intersection is an effective traffic calming tool to preserve slow moving traffic, particularly in conditions when stop signs are removed. This concept, however, retains all existing stop signs. A raised intersection is accompanied with detectable warning panels at the corners of the

Figure 21 A Raised Intersection in Cambridge, MA

Source: Nelson\Nygaard

sidewalk, and the center of the intersection can be treated with special paving like bricks or other patterns.

Impacts

- Similar to speed humps in that they slow vehicle traffic to the posted 25 mph or below through vertical deflection

Eliminate Cross Culverts

There are a handful of cross culverts along the study corridor. A culvert is a structure that allows water to flow beneath a road. However, the current cross culvert design is outdated and poses a risk for people on bikes who may fall into the culvert ditch between the roadway and the curb. The concept proposes to replace the cross culverts with traditional inlets.

Impacts

- Eliminates risk of people biking or driving into the cross culvert

Curb Extensions at Intersections

Curb extensions or bulb-outs extend the sidewalk or curb face into the parking lane or shoulder at an intersection. Curb extensions reduce the crossing distance for pedestrians, can increase the amount of space available for street furniture and trees and decrease turning motor vehicle speeds.[18]

Impacts

- Decreases motor vehicle speeds
- Increases pedestrian visibility
- Reduces pedestrian crossing distance

High-Visibility Crosswalks

Crosswalks should be designed to offer as much comfort and protection to pedestrians as possible. High-visibility ladder, zebra, and continental crosswalk markings are preferable to standard parallel or dashed pavement markings. These are more visible to approaching vehicles and have been shown to improve yielding behavior.[19]

- Improves yielding behavior to pedestrians

Figure 22 A High Visibility Crosswalk in Asheville, NC.

Source: Nelson\Nygaard

[18] http://nacto.org/publication/urban-bikeway-design-guide/bicycle-boulevards/speed-management/

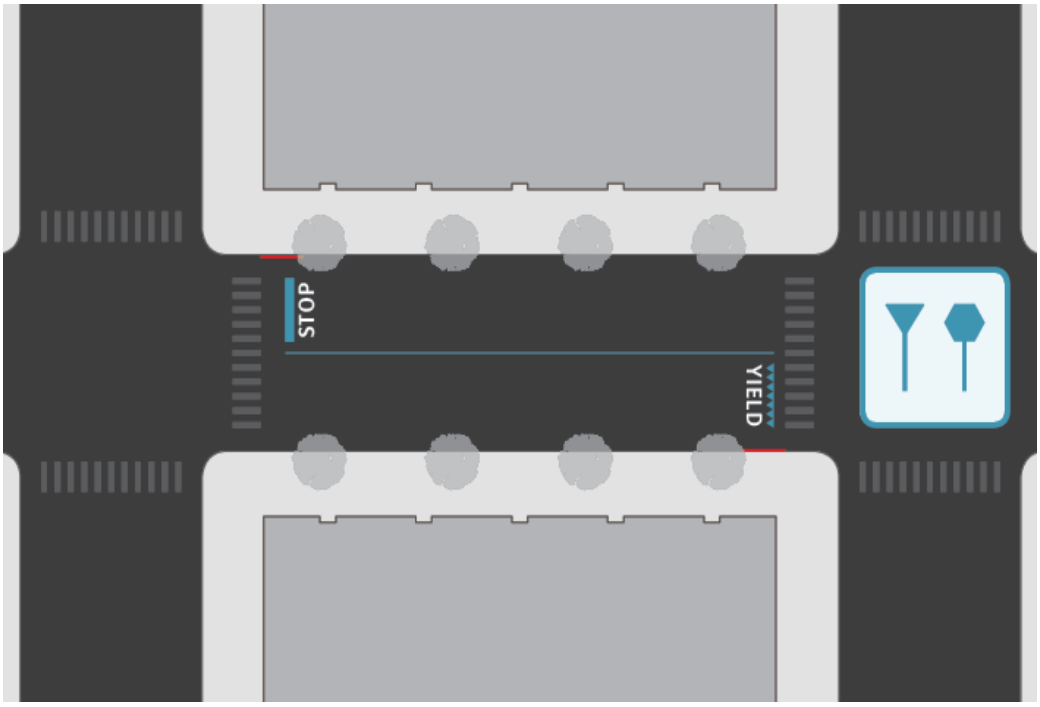
19 http://nacto.org/publication/urban-street-design-guide/intersection-design-elements/crosswalks-and-crossings/conventional-crosswalks/

Advanced Stop Bars

An advanced stop bar, a painted white line located in advanced of a crosswalk, indicates where vehicles must stop in compliance with a stop sign or a traffic signal. It reinforces the requirement for vehicles to yield to people in the crosswalk. Stop bars should be perpendicular to the travel lane (not the crosswalk).

- Improves yielding behavior to pedestrians
- Reduces encroachment on crosswalk

Figure 23 Advanced Stop Bar and Yield Line (Shark's Teeth)



Source: San Francisco Planning Department

Yield Lines (Shark's Teeth)

Similar to advanced stop bars, yield lines, also known as "shark's teeth," indicate where a vehicle must yield at crosswalks without a stop sign or signal. A yield line, a row of painted white triangles located in advance of a crosswalk, reinforces the requirement for vehicles to yield to people in the crosswalk. A "Yield to Pedestrian" sign should accompany the yield line.

- Improves yielding behavior to pedestrians
- Reduces encroachment on crosswalk

7. COST ESTIMATE

The estimated cost for the Final Concept (modest improvements) is in the range of $850,000 to $1.34 million. The breakdown of costs by segment is provided in Figure 24. These estimates are conservative and are based on unit prices and characteristics from the Metropolitan Transportation Commission (MTC)'s Bicycle/Pedestrian Toolkit and recent unit bid prices and Caltrans unit costs. Costs are escalated to 2022. The cost estimates include the following elements:

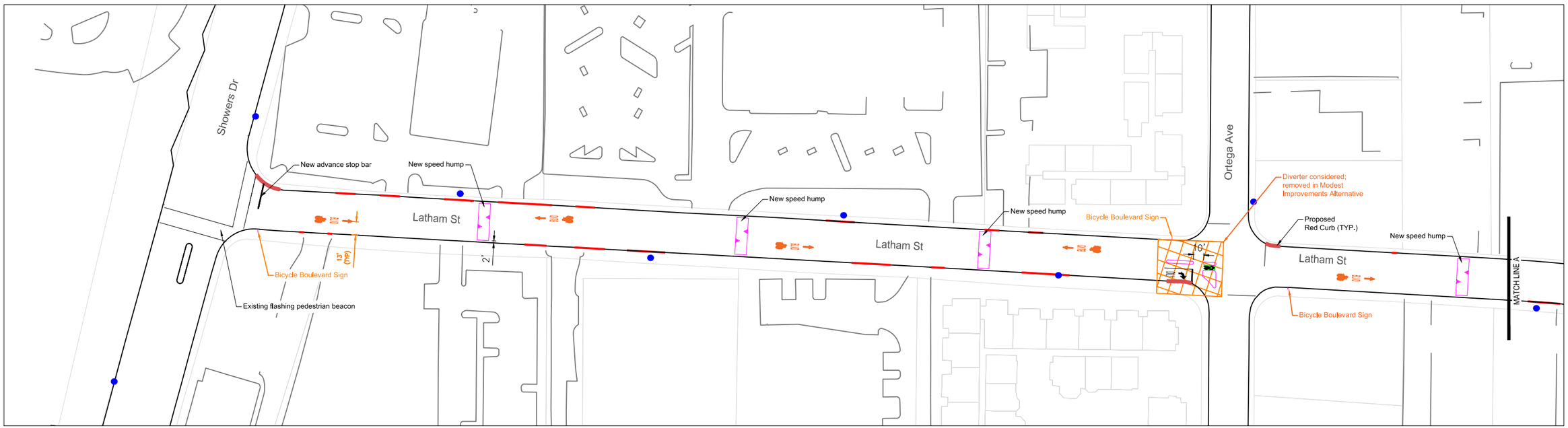
- utilities, traffic handling, and mobilization
- project contingency costs
- environmental and design costs
- city administration costs (including design, testing and inspection)
- construction management
- escalation to 2022 at 3% per year

Figure 24 Estimated Costs by Segment (2022 Escalated Cost)

Project Segment	Estimated Cost	
	Low Range	High Range
Segment 1: Showers Dr to Escuela Ave	$170,000	$340,000
Segment 2: Escuela Ave to Castro St	$880,000	$1,320,000
Segment 3: Castro St to CA-237	$10,000	$20,000
Total Cost	$1,060,000	$1,680,000

Appendix A Final Concept – Modest Improvements Alternative

Latham Street - Showers Drive to Rengstorff Avenue



Latham Bike Blvd DESIGN V10.1.1.dwg

Latham Street Bicycle Boulevard
Mountain View, CA
Sheet 1 of 5

Considered & Removed in Modest Improvements Alternative

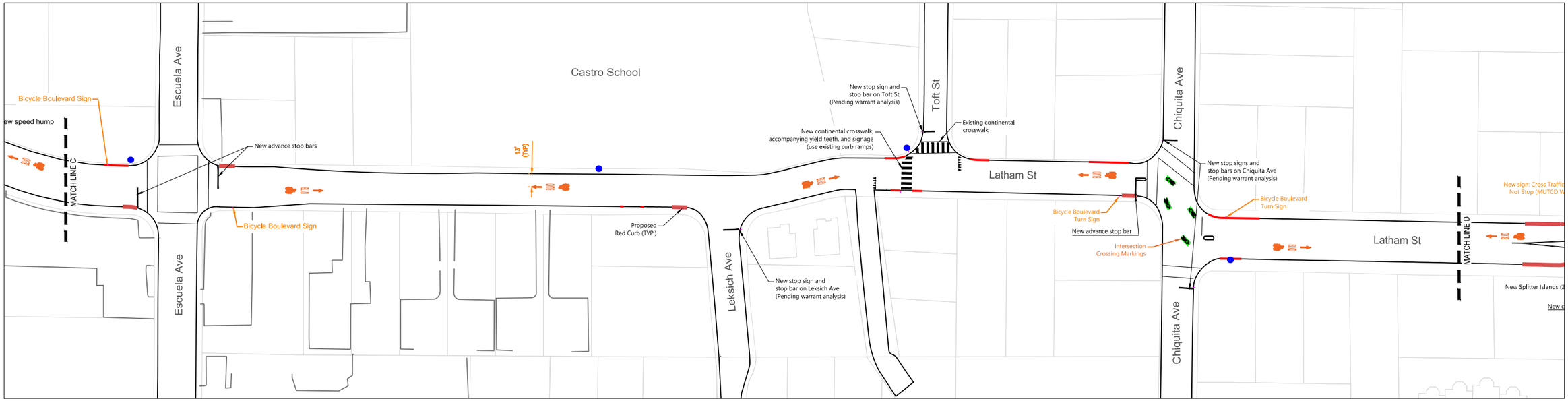
CONCEPTUAL
NOT FOR CONSTRUCTION

0' 50' 100' 200'

NELSON NYGAARD

27 August 2018

Latham Street - Rengstorff Avenue to Chiquita Avenue



Latham Street Bicycle Boulevard
Mountain View, CA
Sheet 2 of 5

Considered & Removed in Modest Improvements Alternative

CONCEPTUAL
NOT FOR CONSTRUCTION

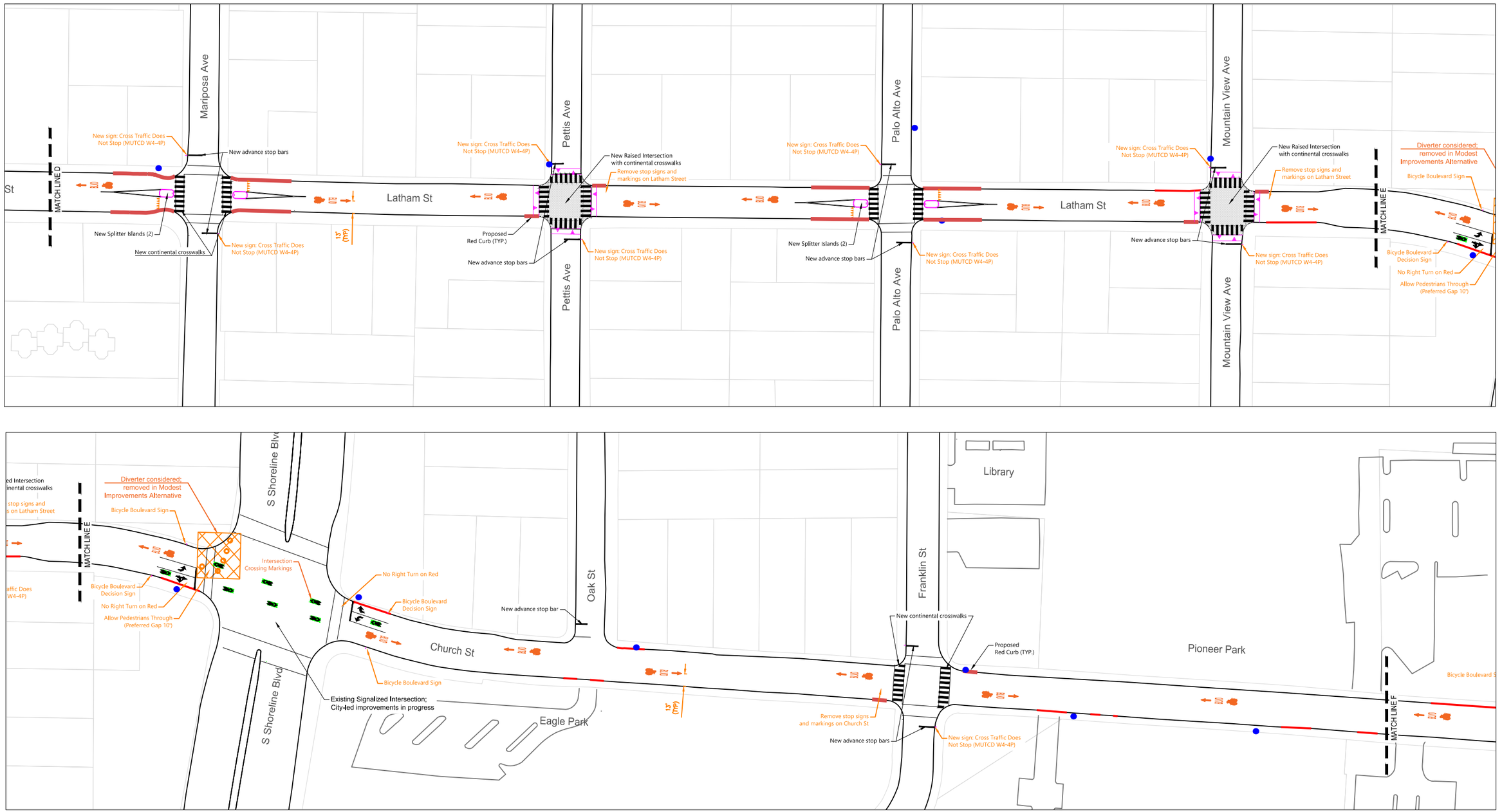
0' 50' 100' 200'

NELSON NYGAARD

27 August 2018

Latham Bike Blvd DESIGN V10.1.1.dwg

Latham Street - Chiquita Avenue to Franklin Street



Latham Bike Blvd DESIGN V10.1.1.dwg

Latham Street Bicycle Boulevard

Mountain View, CA

Sheet 3 of 5

Considered & Removed in Modest Improvements Alternative

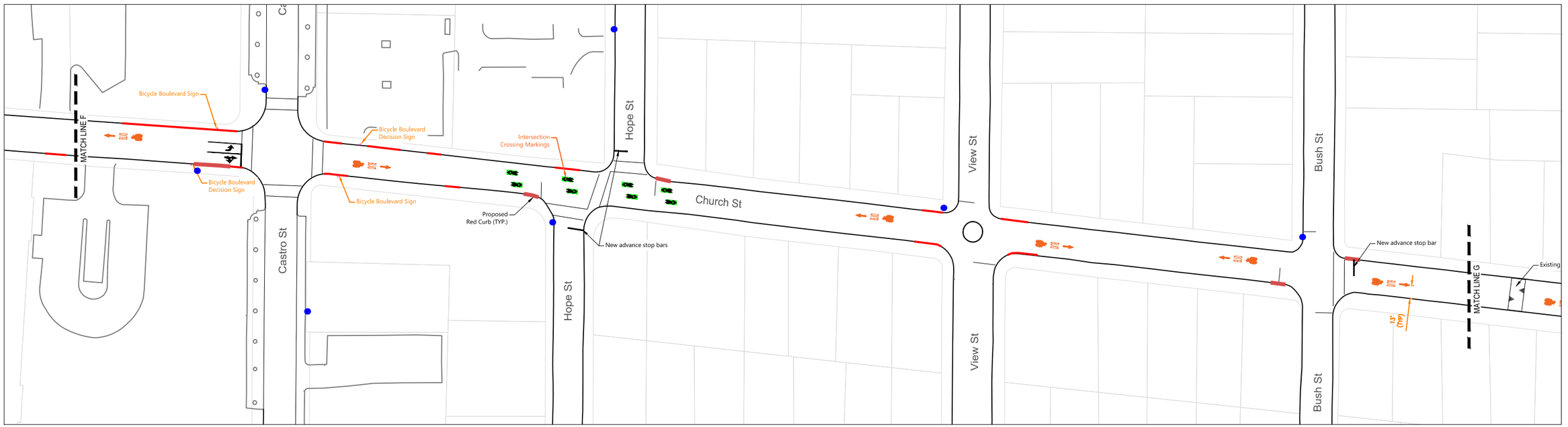
CONCEPTUAL
NOT FOR CONSTRUCTION

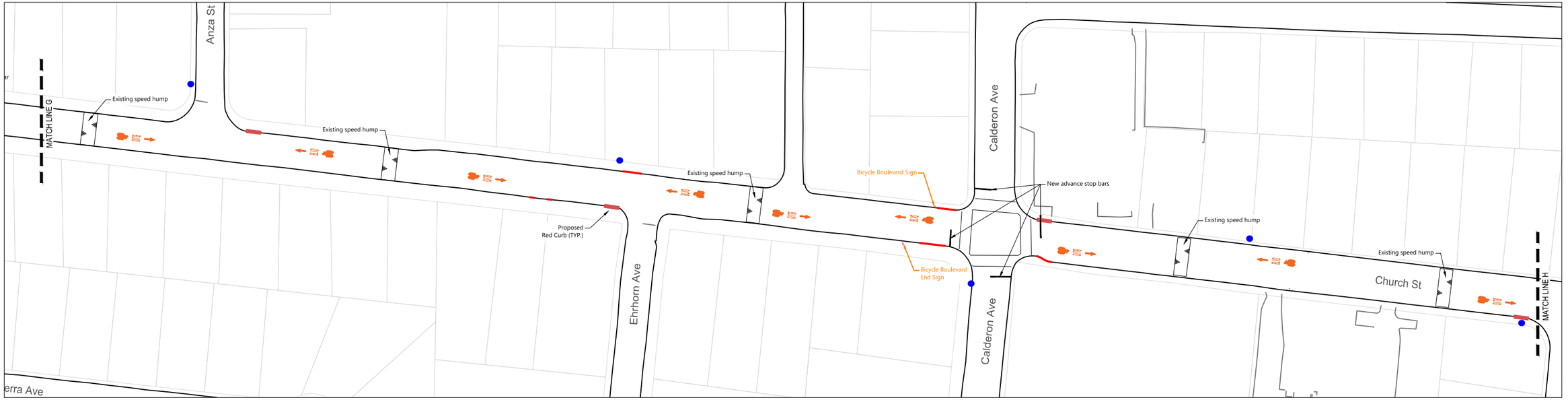
0' 50' 100' 200'

NELSON NYGAARD

27 August 2018

Latham Street - Castro Street to Calderon Avenue





Latham Bike Blvd DESIGN V10.1.1.dwg

Latham Street Bicycle Boulevard

Mountain View, CA

Sheet 4 of 5

Considered & Removed in Modest Improvements Alternative

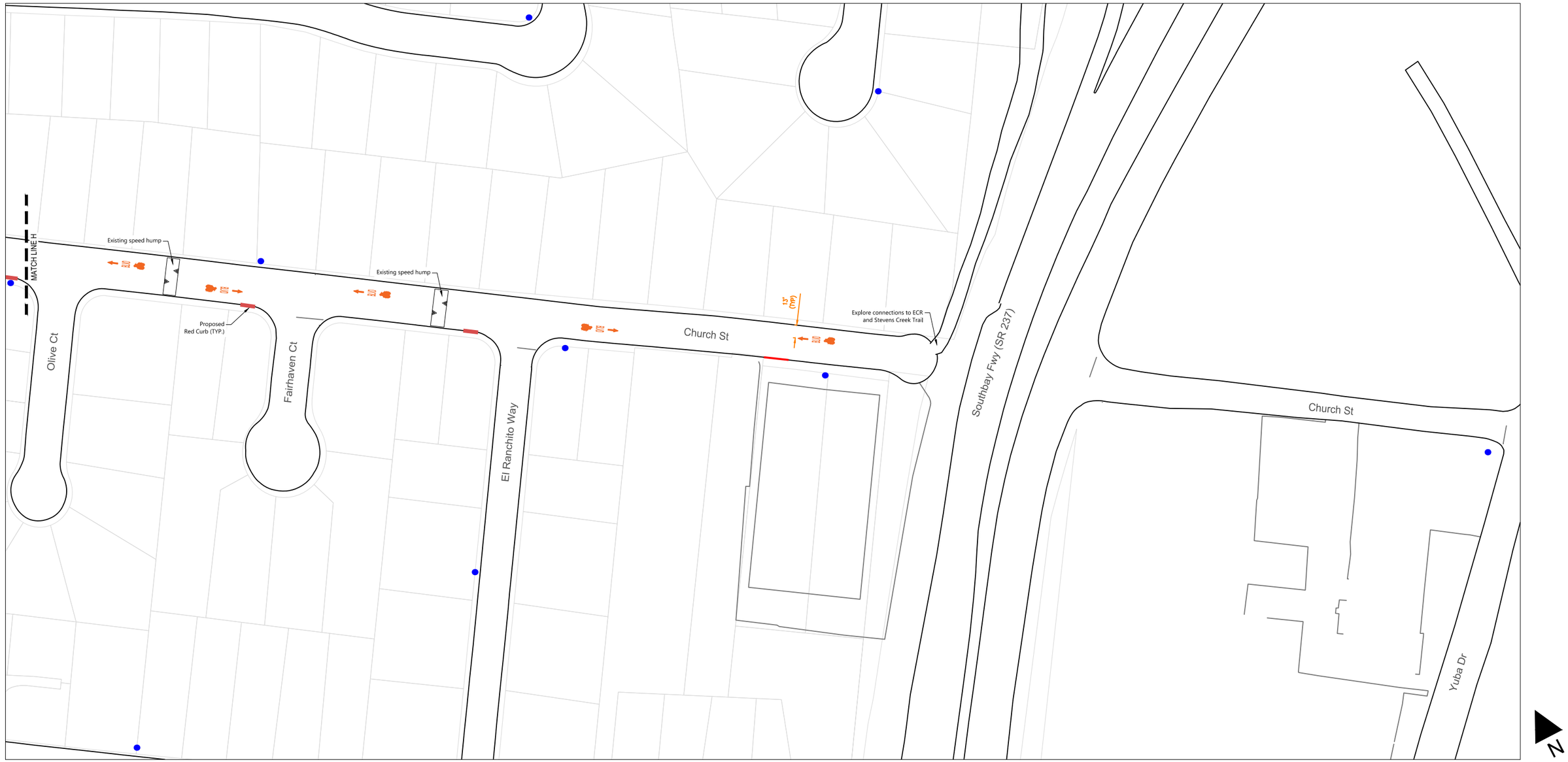
CONCEPTUAL
NOT FOR CONSTRUCTION

0' 50' 100' 200'

NELSON NYGAARD

27 August 2018

Church Street - Calderon Avenue to End of Church Street



Latham Bike Blvd DESIGN V10.1.1.dwg

Latham Street Bicycle Boulevard

Mountain View, CA

Sheet 5 of 5

Considered & Removed in Modest Improvements Alternative

CONCEPTUAL
NOT FOR CONSTRUCTION

0' 50' 100' 200'

NELSON NYGAARD

27 August 2018