Appendix G. RHSP Countermeasure Toolbox

WHAT YOU'LL SEE IN THIS TOOLBOX

Countermeasure category

Countermeasure icon

INTERSECTIONS & ROADWAYS

Countermeasure title

Splitter Island

Countermeasure description

A raised area that separates the two directions of travel on the minor street approach at an unsignalized intersection or roundabout. Helps channelize traffic in opposing directions of travel. Also helps improve the visibility of an intersection when approaching it. Provides a refuge for pedestrians.

Countermeasure cost (excluding ROW costs) and the availability of low cost/ quick build alternatives

$ = less than $15k

$$ = from $15k to $150k

$$$ = greater than $150k

Cost

$$

Low Cost / Quick Build alternative available

Safe System Hierarchy tier(s)

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	Tier 4
Remove Severe Conflicts	Reduce Vehicle Speeds	Manage Conflicts in Time	Increase Attentiveness and Awareness

BIKEWAYS

Bicycle Crossing (Solid Green Paint)

Solid green paint across an intersection signifies the path of the bicycle crossing. Increases visibility of bicyclists' anticipated path of travel through an intersection.

Cost **$**

Low Cost / Quick Build alternative available

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	**Tier 4**
			Increase Attentiveness and Awareness

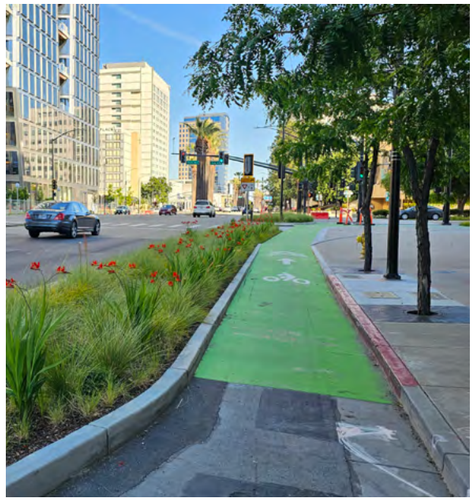
RURAL HIGHWAYS SAFETY PLAN

BIKEWAYS

Bicycle Ramp

A ramp that connects bicyclists from the road to the sidewalk or a shared use path.

Cost **$**



Safe System Hierarchy

Tier 1	Tier 2	Tier 3	Tier 4
Remove Severe Conflicts			

BIKEWAYS

Bicycle Signal/ Exclusive Bike Phase

A traffic signal directing bicycle traffic across an intersection. Separates in time bicycle movements from conflicting motor vehicle, streetcar, light rail, or pedestrian movements. May be applicable for Class IV facilities when the bikeway is brought up to the intersection.

Cost **$$$**

Safe System Hierarchy

Tier 1	Tier 2	**Tier 3**	Tier 4
Remove Severe Conflicts		Manage Conflicts in Time	

BIKEWAYS

Bicycle Guide & Wayfinding Signage

Designated bike route signs, destination signs, and distance signs. Bike route signs should be placed every 1–2 miles as reassurance in rural areas, but guidance should be provided to bicyclists at major junctions to help navigate the correct routes. Destination and distance signs should be provided for bicyclists in locations where the bike path of travel is separate or different from an adjacent vehicle path of travel.

Cost **$**

Low Cost / Quick Build alternative available

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	**Tier 4**
			Increase Attentiveness and Awareness

BIKEWAYS

Bicycle Warning & Regulatory Signage

Bicycle warning signs and regulatory signs, including "bicycles allowed use of full lane" signs. The "bicycles allowed use of full lane" sign may be placed on roads without bike lanes or bikeable shoulders where the travel lane is too narrow to allow safe side-by-side in-lane passing of a bicyclist by a motorist. Placement of these signs is typically focused on locations with constrained roadway widths and near the ends of bike lanes or bikeable shoulders to communicate to drivers that bicycle may use the full travel lane. Signs are intended to encourage motorists to provide ample space between side of the vehicle and an adjacent bicyclist when passing and may be placed every 1-2 miles or after key intersections.

Bike warning signs may be provided in advance of area where bicyclists are more likely to be in the vehicle travel lanes due to volume of bicyclists or geometric conditions. Bike warning signs may also be used to enhance awareness of the potential for bicyclists in the travel lane in low visibility areas such as tunnels or narrow, shaded, or curved roads. Bike warning signs with bicycle detection and flashing beacons may be used in areas with greater potential for undesirable interactions to indicate the presence of a bicyclist.

Cost **$**

Low Cost / Quick Build alternative available

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	**Tier 4**
			Increase Attentiveness and Awareness

BIKEWAYS

Bike Box

A designated area between the crosswalk and vehicle stop bar at a signalized intersection that is often painted green where bicyclists can wait during a red signal phase. The use of the bike box places bicyclists in a location where they are more visible to motorists.

Cost **$**

Low Cost / Quick Build alternative available

LRSM ID **S20PB**

Safe System Hierarchy

Tier 1	Tier 2	**Tier 3**	**Tier 4**
Remove Severe Conflicts		Manage Conflicts in Time	Increase Attentiveness and Awareness

RURAL HIGHWAYS SAFETY PLAN

BIKEWAYS

Bike Detection

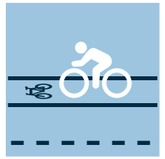
Technology used at signalized intersections, either through use of push-buttons, in-pavement loops, or by video or infrared cameras, to call a green light for bicyclists and reduce delay for bicycle travel. Discourages red light running by bicyclists and increases convenience of bicycling.

Cost **$$**

Safe System Hierarchy

Tier 1	Tier 2	**Tier 3**	Tier 4
		Manage Conflicts in Time	

BIKEWAYS



Bike Lane

Bike lanes designate an exclusive space for bicyclists using pavement markings and signage. The bike lane is located adjacent to motor vehicle travel lanes and flows in the same direction as motor vehicle traffic. Bike lanes are typically on the right side of the street, between the adjacent travel lane and curb, road edge, or travel lane.

Cost **$$**

Low Cost / Quick Build alternative available

LRSM ID **R32PB**

Safe System Hierarchy

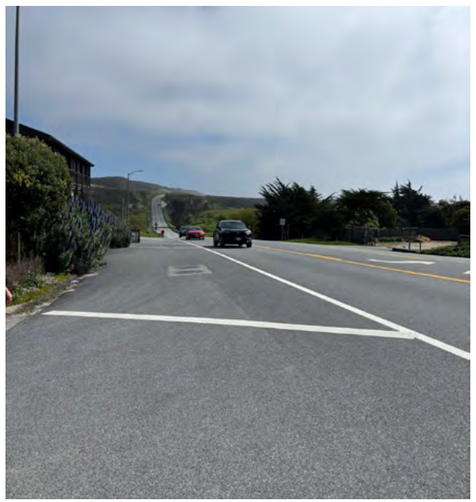
Tier 1	Tier 2	Tier 3	Tier 4
Remove Severe Conflicts			

BIKEWAYS

Bikeable Shoulders

Shoulders that are wide enough that bicyclists have space to bike alongside vehicle lanes. Avoid placing drain grating or rumble striping in the right-of-way that may pose a hazard to bicyclists by increasing their risk of falling.

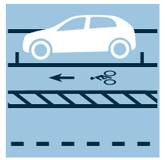
Cost **$$**



Safe System Hierarchy

Tier 1	Tier 2	Tier 3	Tier 4
Remove Severe Conflicts			

BIKEWAYS



Buffered Bike Lane

Buffered Bike Lanes are standard bike lanes paired with a designated horizontal buffer space, separating the bicycle lane from the adjacent motor vehicle travel lane and/or parking lane. This type of bikeway provides greater distance between vehicles and bicycles; provides space for bicyclists to pass each other; provides greater space for bicycling without making the bike lane appear so wide that it might be mistaken for a travel lane; and encourages bicycling by contributing to the perception of safety.

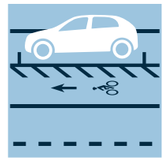
Cost **$$**
Low Cost / Quick Build alternative available

LRSM ID **R32PB**

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	Tier 4
Remove Severe Conflicts			

BIKEWAYS



Door Zone Markings

Pavement markings denoting door zone of parked vehicles to raise awareness of bicyclists and motorists of that conflict area where an open car door could obstruct the path of a passing bicyclist.

Cost **$**
Low Cost / Quick Build alternative available

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	Tier 4
			Increase Attentiveness and Awareness

BIKEWAYS

Extend Bike Lane to Intersection

In locations where a bike lane is dropped due to the addition of a right turn pocket, the intersection approach may be restriped to allow for bicyclists to move to the left side of right turning vehicles ahead of reaching the intersection.

Cost **$**
Low Cost / Quick Build alternative available

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	Tier 4
Remove Severe Conflicts			Increase Attentiveness and Awareness

BIKEWAYS

Extend Green Time For Bikes

Prolongs the green phase when bicyclists are present to provide additional time for bicyclists to clear the intersection. Can occur automatically in the signal phasing or when prompted with bicycle detection. Topography should be considered in clearance time.

Cost **$**

LRSM ID **S03**

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	Tier 4
		Manage Conflicts in Time	

BIKEWAYS

Floating Transit Island or Bus Boarding Island

Transit boarding island that is designed to allow bicycles to pass between the sidewalk and island thereby avoiding a bus-bike conflict when the bus stops at the boarding island. Can be used in combination with a bike lane, buffered bike lane, or separated bike lane. The treatment can also reduce vehicle speeds as the island itself visually narrows the roadway and can have a traffic calming effect.

Cost **$$**

Low Cost / Quick Build alternative available

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	Tier 4
Remove Severe Conflicts	Reduce Vehicle Speeds		

RURAL HIGHWAYS SAFETY PLAN

BIKEWAYS

Green Conflict Striping

Green conflict striping is green pavement markings in a dashed pattern that extend across bike lanes approaching an intersection and/or going through an intersection. Green conflict striping improves and increases the visibility of bicyclists and potential conflict points so motorists and bicyclists can use caution when traveling toward and through an intersection.

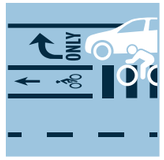
Cost **$**

Low Cost / Quick Build alternative available

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	Tier 4
			Increase Attentiveness and Awareness

BIKEWAYS



Mixing Zone

A mixing zone is where a suggested bike lane is within the inside portion of a dedicated motor vehicle turn lane. Lane markings delineate space for bicyclists and motorists within the same lane and indicate the intended path for bicyclists to reduce conflict with turning motor vehicles.

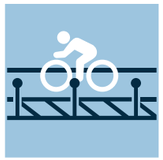
Cost **$**

Low Cost / Quick Build alternative available

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	Tier 4
			Increase Attentiveness and Awareness

BIKEWAYS



Separated Bikeway

A separated bikeway, also called a cycle track, provides dedicated street space, typically adjacent to outer vehicle travel lanes, with physical separation from vehicle traffic, designated lane markings, pavement legends, and signage. Physical separation may consist of plastic posts, parked vehicles, raised median, or a curb (if the separated bike lane is raised to sidewalk level). Separated bikeways reduce conflicts between people biking and motorists. They also provide more physical protection that further reduces the risk of severe conflicts between bicycles and vehicles on the road. Separated bike lanes can also help manage or reduce vehicle speeds as some of the design features can have a traffic calming effect.

Cost **$$$**
Low Cost / Quick Build alternative available

LRSM ID **R33PB**

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	Tier 4
Remove Severe Conflicts			

RURAL HIGHWAYS SAFETY PLAN

BIKEWAYS

Shared-Use Path

Shared-use paths or trails are off-street facilities that provide exclusive use for nonmotorized travel, including bicyclists and pedestrians. They could be located alongside a roadway, or exist in a separate right-of-way. Bike paths have minimal cross flow with motorists and can be utilized for both recreational and commute trips. Ensure there is adequate right-of-way to construct shared-use paths that align with Caltrans standards.

Cost **$$$**
Low Cost / Quick Build alternative available

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	Tier 4
Remove Severe Conflicts			

RURAL HIGHWAYS SAFETY PLAN

BIKEWAYS

Two-Stage Turn Queue Bike Box

This roadway treatment provides bicyclists with a means of making a left turn at a multi-lane signalized intersection from a bike lane or cycle track on the far right side of the roadway. In this way, bicyclists are removed from the flow of traffic while waiting to turn. Use of this treatment could be mirrored for right-turns from a one-way street with a left-side bikeway.

Cost **$**
Low Cost / Quick Build alternative available

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	Tier 4
Remove Severe Conflicts		Manage Conflicts in Time	Increase Attentiveness and Awareness

RURAL HIGHWAYS SAFETY PLAN

INTERSECTIONS & ROADWAYS

All-Way Stop Control

An all-way stop-controlled intersection requires all vehicles to stop before crossing the intersection. An all-way stop-controlled intersection reduces the risk of severe conflicts as long as all road users see and obey the stop signs. The MUTCD (Manual on Uniform Traffic Control Devices) includes information on when and how to implement "All Way" Or "Multi-Way" stop control intersections.

Cost **$**

LRSM ID **NS02**

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	Tier 4
Remove Severe Conflicts	Reduce Vehicle Speeds	Manage Conflicts in Time	Increase Attentiveness and Awareness

INTERSECTIONS & ROADWAYS

Centerline Hardening

Centerline hardening involves placing durable plastic bollards, flex posts, and/or rubber curbs along the centerline. When used at intersections, they can be effective at requiring motorists to make left-turn movements at a 90-degree angle, thereby slowing vehicle speeds and improving motorists' visibility of the crosswalks across which they travel when turning. When used along a roadway segment, they can be effective at generally slowing vehicle speeds and preventing undesirable left-turning and/or U-turns between intersections.

Cost **$**
Low Cost / Quick Build alternative available

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	Tier 4
	Reduce Vehicle Speeds		Increase Attentiveness and Awareness

INTERSECTIONS & ROADWAYS

Close Slip Lane

Modifies the corner of an intersection to remove the sweeping right turn lane for vehicles. Results in shorter crossings for pedestrians, reduced speed for turning vehicles, better sight lines, and space for landscaping and other amenities.

Cost **$$$**

Other Reference Information
FHWA Pedestrian Safety Guide and Countermeasure Selection System. http://www.pedbikesafe.org/PEDSAFE/countermeasures_detail.cfm?CM_NUM=24

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	Tier 4
Remove Severe Conflicts	Reduce Vehicle Speeds		

INTERSECTIONS & ROADWAYS

Directional Median Openings to Restrict Left Turns

A directional median opening restricts specific turning movements, such as allowing a left-turn from a major street but not from a minor street. A directional median opening to restrict left turn improves safety by reducing the number of conflict points.

Cost **$$**
Low Cost / Quick Build alternative available

LRSM ID **S14**

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	Tier 4
Remove Severe Conflicts			

INTERSECTIONS & ROADWAYS

Guardrail

Guardrail redirects a vehicle away from embankment slopes or fixed objects and dissipates the energy of an errant vehicle. Guardrail is installed to reduce the severity of lane departure crashes. However, guardrail can reduce crash severity only for those conditions where striking the guardrail is less severe than going down an embankment or striking a fixed object.

Cost **$$**

LRSM ID **R04**

Other Reference Information
FHWA Manual for Selecting Safety Improvements on High Risk Rural Roads

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	Tier 4
Remove Severe Conflicts			

INTERSECTIONS & ROADWAYS

Improved Pavement Friction

High friction surface treatments improve a vehicles' ability to stay on the roadway as well as come to a stop over a shorter distance. The treatment can be used to help address roadway departure crashes and/or intersection crashes on approach to unsignalized intersections.

Cost **$$**

LRSM ID **R21**

Other Reference Information
FHWA Manual for Selecting Safety Improvements on High Risk Rural Roads

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	Tier 4
Remove Severe Conflicts	Reduce Vehicle Speeds		

INTERSECTIONS & ROADWAYS

Intersection Reconstruction and Tightening

Intersections that intersect at a skewed angle or angle notably different than 90-degrees have a greater likelihood of collisions. Squaring up the intersection helps reduce the likelihood of collisions. "Squaring up" an intersection as close to 90 degrees as possible involves intersection reconstruction and approach realignment to provide better visibility for all road users, also reducing high speed turns, reducing length exposure for vehicles and/or bikes passing through the intersection, and reducing pedestrian crossing length.

Cost **$$$**
Low Cost / Quick Build alternative available

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	Tier 4
Remove Severe Conflicts	Reduce Vehicle Speeds		Increase Attentiveness and Awareness

RURAL HIGHWAYS SAFETY PLAN

INTERSECTIONS & ROADWAYS

Left Turn Enhanced Daylighting/Slow Turn Wedge

Uses paint and bollards to extend the curb and slow left turns at intersections of one-way to one-way or two-way streets. Widening the turning radii of left-turning vehicles expands the field of vision for drivers and increases the visibility of pedestrians.

Cost **$**
Low Cost / Quick Build alternative available

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	Tier 4
	Reduce Vehicle Speeds		Increase Attentiveness and Awareness

INTERSECTIONS & ROADWAYS

Median Barrier

Barrier in the center of the roadway that physically separates opposing vehicular traffic. Median barriers can also help control access to and from side streets and driveways, reducing the number of conflict points. On rural roads, medians help to narrow vehicle lanes, encouraging slower motor vehicle speeds. Where heavy vehicle volumes are high, medians should be designed with aprons to accommodate large vehicles and support emergency access and response.

Cost **$$$**
Low Cost / Quick Build alternative available

LRSM ID **R03**

Other Reference Information
FHWA Manual for Selecting Safety Improvements on High Risk Rural Roads

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	Tier 4
Remove Severe Conflicts			

INTERSECTIONS & ROADWAYS

Partial Closure/Diverter

A roadway treatment that restricts through vehicle movements using physical diversion while allowing bicyclists and pedestrians to proceed through an intersection in all directions.

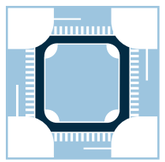
Cost **$**

Low Cost / Quick Build alternative available

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	Tier 4
Remove Severe Conflicts			

INTERSECTIONS & ROADWAYS

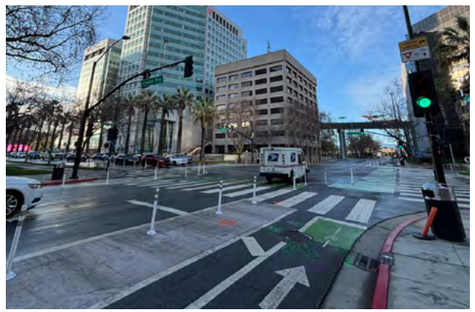


Protected Intersection

Protected intersections use corner islands, curb extensions, and colored paint to delineate bicycle and pedestrian movements across an intersection. Slower driving speeds and shorter crossing distance increase safety for pedestrians. Separates bicycles from pedestrians as well as moving vehicles.

Cost **$$$**

Low Cost / Quick Build alternative available



Other Reference Information
Evolution of the Protected Intersection, Alta Planning and Design, December 2015. https://altaplanning.com/wp-content/uploads/Evolution-of-the-Protected-Intersection_ALTA-2015.pdf

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	Tier 4
Remove Severe Conflicts	Reduce Vehicle Speeds		

INTERSECTIONS & ROADWAYS

Raised Crosswalk

A Raised Crosswalk is a pedestrian crosswalk that is typically elevated 3-6 inches above the road or at sidewalk level. A Raised Crosswalk improves increases crosswalk and pedestrian visibility and slows down motorists.

Cost **$$**

LRSM ID **R36PB**

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	Tier 4
	Reduce Vehicle Speeds		Increase Attentiveness and Awareness

INTERSECTIONS & ROADWAYS

Raised Intersection

Elevates the intersection to bring vehicles to the sidewalk level. Serves as a traffic calming measure by extending the sidewalk context across the road.

Cost **$$$**

Other Reference Information
Note: some studies in CMF Clearinghouse show an increase in crashes. See additional source below showing decrease. (1) Perkins+Will Consultant Team. “Pedestrians at Multi-Modal Intersections.” Better Market Street Existing Conditions & Best Practices, Part Two: Best Practices 36-58, City & County of San Francisco, San Francisco. http://www.bettermarketstreetsf.org/about-reports-existing-conditions.html (2) Bhatt, Shailen, Natalie Barnhart, Mark Luszcz, Tom Meyer, & Michael Sommers. “Delaware Traffic Calming Design Manual.” Delaware Department of Transportation, State of Delaware, Dover, DE. https://nacto.org/wp-content/uploads/2015/04/DE-Trafc-Calming-Manual_2012.pdf (3) King, Michael R, Jon A Carnegie, and Reid Ewing. “Pedestrian Safety through a Raised Median and Redesigned Intersections.” Journal of the Transportation Research Board 1828 (1), 56-66, Transportation Research Board, Washington, DC. https://trid.trb.org/view/663867 (4) Fitzpatrick, Kay, Mark D Wooldridge, and Joseph D Blaschke. “Urban Intersection Design Guide: Volume 1–Guidelines.” Texas Transportation Institute, Texas A&M University System, Texas Department of Transportation, Austin, TX. https://static.tti.tamu.edu/tti.tamu.edu/documents/0-4365-P2.pdf

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	Tier 4
	Reduce Vehicle Speeds		Increase Attentiveness and Awareness

INTERSECTIONS & ROADWAYS

Raised Median

Curbed sections in the center of the roadway that are physically separated from vehicular traffic. Raised medians can also help control access to and from side streets and driveways, reducing conflict points.

Cost **$$**
Low Cost / Quick Build alternative available

LRSM ID **S12/NS14/R08**

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	Tier 4
Remove Severe Conflicts	Reduce Vehicle Speeds		

INTERSECTIONS & ROADWAYS

Reduced Left-Turn Conflict Intersection

Geometric designs that alter how left-turn movements occur can simplify decisions and minimize the potential for left-turn related crashes. Two designs that rely on U-turns to complete certain left-turn movements are known as the restricted crossing U-turn (RCUT) and the median U-turn (MUT). Both designs require some out of direction travel for vehicles.

Cost **$$$**

LRSM ID **NS16**

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	Tier 4
Remove Severe Conflicts			

RURAL HIGHWAYS SAFETY PLAN

INTERSECTIONS & ROADWAYS

Refuge Island

A Raised Median, or Refuge Island, is a raised barrier in the center of the roadway that can restrict certain turning movements and provide a place for pedestrians to wait if they are unable to finish crossing the intersection. A Raised Median reduces the number of potential conflict points with designated zones for vehicles to turn, and a pedestrian refuge island reduces the exposure for pedestrians crossing the intersection. Pedestrian refuge areas constructed from paint and plastic may be implemented as part of a low-cost/quick build project.

Cost **$$**
Low Cost / Quick Build alternative available

LRSM ID **NS19PB**

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	Tier 4
Remove Severe Conflicts	Reduce Vehicle Speeds		

INTERSECTIONS & ROADWAYS

Road Diet

A Road Diet reduces roadway space dedicated to vehicle travel lanes to create room for bicycle facilities, wider sidewalks, or center turn lanes. A Road Diet reduces vehicle speeds and creates designated space for all road users.

Cost **$$**
Low Cost / Quick Build alternative available

LRSM ID **R14**

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	Tier 4
Remove Severe Conflicts	Reduce Vehicle Speeds		

INTERSECTIONS & ROADWAYS

Roundabout

A roundabout is a type of circular intersection in which road traffic is permitted to flow in one direction around a central island, and priority is typically given to traffic already in the junction. The types of conflicts that occur at roundabouts are different from those occurring at conventional intersections; namely, severe conflicts from crossing and left-turn movements are not present in a roundabout. The geometry of a roundabout forces drivers to reduce speeds as they proceed through the intersection; the range of vehicle speeds is also narrowed, reducing the severity of crashes when they do occur. Pedestrians also only have to cross one direction of traffic at a time at roundabouts, thus reducing exposure to vehicle traffic.

Cost **$$$**

Low Cost / Quick Build alternative available

LRSM ID **S16/NS04**

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	Tier 4
Remove Severe Conflicts	Reduce Vehicle Speeds		

INTERSECTIONS & ROADWAYS

Rumble Strips

Rumble strips create noise and vibration inside the vehicle that alert a driver as they cross the centerline or edge line. Treatment can help with lane keeping instances where a driver is distracted or drowsy. Rumble strips also alert drivers to the lane limits when conditions such as rain, fog, snow, or dust reduce driver visibility.

Cost **$**

LRSM ID **R30/R31**

Other Reference Information
FHWA Manual for Selecting Safety Improvements on High Risk Rural Roads

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	Tier 4
			Increase Attentiveness and Awareness

RURAL HIGHWAYS SAFETY PLAN

INTERSECTIONS & ROADWAYS

Safety Edge

When a vehicle leaves the traveled way and encounters a pavement-shoulder drop-off, it can be difficult for the driver to return safely to the roadway. A safety edge is a treatment intended to minimize the severity of roadway or lane departure crashes. With this treatment, the shoulder pavement edge is sloped at an angle (30-35 degrees) to make it easier for a driver to safely reenter the roadway after inadvertently driving onto the shoulder. This treatment could be incorporated as a standard practice in overlay or roadway resurfacing projects.

Cost **$**

Other Reference Information
FHWA Manual for Selecting Safety Improvements on High Risk Rural Roads

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	Tier 4
Remove Severe Conflicts			

INTERSECTIONS & ROADWAYS

Signal

Traffic signals at intersections control the flow of traffic by assigning right-of-way to different movements at different times. Some traffic signal phasing is more effective at reducing the likelihood of severe injury collisions. For example, protected left-turn signal phasing reduces the likelihood of severe left-turn collisions more effectively than permitted left-turn signal phasing.

Cost **$$$**

LRSM ID **NS03**

Other Reference Information
Currently the CMF Clearinghouse has only one reference for ped/vehicle collisions which indicates an increase in crash likelihood. However, a majority of references for all crash types show a decrease in collisions. See additional reference: FHWA Manual for Selecting Safety Improvements on High Risk Rural Roads

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	Tier 4
		Manage Conflicts in Time	

INTERSECTIONS & ROADWAYS

Speed Hump or Speed Table

These traffic calming devices use vertical deflection to raise the entire wheelbase of a vehicle and encourage motorists to travel at slower speeds.

Cost **$**

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	Tier 4
	Reduce Vehicle Speeds		Increase Attentiveness and Awareness

INTERSECTIONS & ROADWAYS

Splitter Island

A raised area that separates the two directions of travel on the minor street approach at an unsignalized intersection or roundabout. Helps channelize traffic in opposing directions of travel. Also helps improve the visibility of an intersection when approaching it. Provides a refuge for pedestrians.

Cost **$$**
Low Cost / Quick Build alternative available

LRSM ID **NS13**

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	Tier 4
Remove Severe Conflicts	Reduce Vehicle Speeds		Increase Attentiveness and Awareness

RURAL HIGHWAYS SAFETY PLAN

INTERSECTIONS & ROADWAYS

Straighten Crosswalk

Straightening crosswalks improves sight lines, making pedestrians more visible to oncoming drivers, and may shorten the crossing distance, reducing the length of time required for pedestrians to cross an intersection.

Cost **$**
Low Cost / Quick Build alternative available

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	Tier 4
Remove Severe Conflicts			Increase Attentiveness and Awareness

INTERSECTIONS & ROADWAYS

Superelevation at Horizontal Curve Locations

Superelevation is the rotation of the pavement on the approach to and through a horizontal curve and is intended to assist the driver in negotiating the curve by counteracting the lateral acceleration produced by tracking. In other words, the road is designed so that the pavement rises as it curves, offsetting the horizontal sideways momentum of the approaching vehicle. Superelevation can help vehicles stay on the roadway. Superelevation can also inadvertently make it easier for drivers to drive at higher than desirable speeds. Consider the target or desired speed for a roadway and relevant design guidance when selecting appropriate superelevation.

Cost **$$**

Other Reference Information
FHWA Manual for Selecting Safety Improvements on High Risk Rural Roads

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	Tier 4
Remove Severe Conflicts			

INTERSECTIONS & ROADWAYS

Widen/Pave Shoulder

Widened and paved shoulders, which may also include flattening the slopes along the sides of the roadway, create a separated space for bicyclists, create space for a driver to safely recover if they inadvertently depart the travel lane, and also provide space for inoperable vehicles to pull out of the travel lane. The addition of a paved shoulder to an existing road can help to reduce run-off-road crashes. Benefits can be realized for high-risk rural roads without paved shoulders, regardless of existing lane pavement width. Adding paved shoulders within horizontal curve sections may help agencies maximize the benefits of the treatment while minimizing costs as opposed to adding paved shoulders to an entire corridor.

Cost **$$**

LRSM ID **R15**

Other Reference Information
FHWA Manual for Selecting Safety Improvements on High Risk Rural Roads

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	Tier 4
Remove Severe Conflicts			

PEDESTRIAN FACILITIES

Add Sidewalk

Adding sidewalks provides a separated and continuous facility for people to walk or roll along the roadway. Sidewalks provide designated spaces for pedestrians that are grade separated which helps to reduce conflicts and in turn reduce severe crash outcomes. Continuous sidewalks help to encourage people to walk by providing comfortable and accessible facilities for walking and rolling.

Cost **$$$**

LRSM ID **R34PB**

Other Reference Information
Data in the CMF Clearinghouse is currently limited to bicycle/vehicle collisions. See additional reference: FHWA Pedestrian Safety Guide and Countermeasure Selection System. http://www.pedbikesafe.org/PEDSAFE/countermeasures_detail.cfm?CM_NUM=1

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	Tier 4
Remove Severe Conflicts			

RURAL HIGHWAYS SAFETY PLAN

PEDESTRIAN FACILITIES

Audible Push Button Upgrade

Push buttons must comply with the Americans with Disability Act (ADA) standards for accessibility. Pushbuttons should be visible and conveniently located for pedestrians waiting at a crosswalk. Accessible pedestrian signals, including audible push buttons, improve access for pedestrians who are blind or have low vision. Public Rights of Way Accessibility Guidelines (PROWAG) includes accessibility design guidance.

Cost **$**

Other Reference Information
Audible Push Button Upgrade and Extended Time Pushbutton: FHWA Pedestrian Safety Guide and Countermeasure Selection System. http://www.pedbikesafe.org/PEDSAFE/countermeasures_detail.cfm?CM_NUM=52

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	Tier 4
		Manage Conflicts in Time	Increase Attentiveness and Awareness

PEDESTRIAN FACILITIES

Co-Locate Bus Stops and Pedestrian Crossings

Place bus stops and pedestrian crossings in close proximity to allow transit riders to cross the street at well-designed crossing locations. Where feasible, bus stops should be located on the far side of intersections to reduce sight distance concerns for pedestrians, riders exiting the bus, and side-street motorists.

Cost **$**
Low Cost / Quick Build alternative available

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	Tier 4
			Increase Attentiveness and Awareness

PEDESTRIAN FACILITIES

Curb Extensions

A curb extension is a traffic calming measure that widens the sidewalk for a short distance to enhance the pedestrian crossing. This reduces the crossing distance and allows pedestrians and drivers to see each other when parked vehicles would otherwise block visibility. Paint and plastic curb extensions are a low-cost/ quick-build option.

Cost **$$**
Low Cost / Quick Build alternative available

LRSM ID **NS21PB**

Other Reference Information
(1) Application of Pedestrian Crossing Treatments for Streets and Highways, NCHRP, 2016. https://www.nap.edu/catalog/24634/application-of-pedestrian-crossing-treatments-for-streets-and-highways (2) Development of Crash Modification Factors for Uncontrolled Pedestrian Crossing Treatments, NCHRP, 2017. https://www.nap.edu/catalog/24627/development-of-crash-modifcation-factors-for-uncontrolled-pedestrian-crossing-treatments (3) Evaluation of Pedestrian-Related Roadway Measures, Pedestrian and Bicycle Information Center, 2014. http://www.pedbikeinfo.org/cms/downloads/PedestrianLitReview_April2014.pdf

Safe System Hierarchy

Tier 1	**Tier 2**	Tier 3	**Tier 4**
	Reduce Vehicle Speeds		Increase Attentiveness and Awareness

PEDESTRIAN FACILITIES

Extend Time Push Button

A push button that can be pressed to request extra time for using the crosswalk, beyond the standard crossing time. Ideal near senior-serving land uses.

Cost **$**

Other Reference Information
Audible Push Button Upgrade and Extended Time Pushbutton: FHWA Pedestrian Safety Guide and Countermeasure Selection System. http://www.pedbikesafe.org/PEDSAFE/countermeasures_detail.cfm?CM_NUM=52

Safe System Hierarchy

Tier 1	Tier 2	**Tier 3**	Tier 4
		Manage Conflicts in Time	

RURAL HIGHWAYS SAFETY PLAN

PEDESTRIAN FACILITIES

High-Visibility Crosswalk

A high-visibility crosswalk has a striped pattern with ladder markings made of high-visibility material, such as thermoplastic tape, instead of paint. A high-visibility crosswalk improves the visibility of marked crosswalks and provides motorists a cue to slow down and yield to pedestrians.

Cost **$**
Low Cost / Quick Build alternative available

LRSM ID **S18/NS20**

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	**Tier 4**
			Increase Attentiveness and Awareness

PEDESTRIAN FACILITIES

Install/Upgrade Pedestrian Crossing at Uncontrolled Locations (Signs and Markings Only)

A pedestrian crossing at an intersection or on a segment provides a formalized location for people to cross the street, reducing the risk of people crossing outside crosswalks where drivers are not expecting them. Crosswalk striping, signs, and other enhanced features alert drivers that there may be a pedestrian crossing.

Cost **$**
Low Cost / Quick Build alternative available

LRSM ID **R35PB**

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	**Tier 4**
			Increase Attentiveness and Awareness

PEDESTRIAN FACILITIES

Landscape Buffer

Separating drivers from bicyclists and pedestrians using landscaping provides more space between the modes and can produce a traffic calming effect by encouraging drivers to drive at slower speeds, lowering the risk of crashing.

Cost **$$**

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	Tier 4
Remove Severe Conflicts	Reduce Vehicle Speeds		

PEDESTRIAN FACILITIES

Leading Pedestrian Interval and Pedestrian Recall

At intersection locations that have a high volume of turning vehicles and have high pedestrian vs. vehicle crashes, a leading pedestrian interval gives pedestrians the opportunity to enter an intersection 3 – 7 seconds before vehicles are given a green indication. With this head start, pedestrians can better establish their presence in the crosswalk before vehicles have priority to turn left or right. Pedestrian recall is a traffic signal timing function that causes a pedestrian walk phase to activate automatically every cycle.

Cost **$**

LRSM ID **S21PB**

Other Reference Information
Pedestrian Phase Recall: Evaluation of Pedestrian-Related Roadway Measures, Pedestrian and Bicycle Information Center, 2014. http://www.pedbikeinfo.org/cms/downloads/PedestrianLitReview_April2014.pdf

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	Tier 4
		Manage Conflicts in Time	

PEDESTRIAN FACILITIES

Pedestrian Countdown Timer

Displays “countdown” of seconds remaining on the pedestrian signal. Countdown indications improve safety for all road users, and are required for all newly installed traffic signals where pedestrian signals are installed.

Cost **$$**

LRSM ID **S17PB**

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	Tier 4
			Increase Attentiveness and Awareness

PEDESTRIAN FACILITIES

Pedestrian Detection

An intersection treatment that relies on sensors to detect when a pedestrian is waiting at a crosswalk and automatically triggers the pedestrian “WALK” phase. Reduces crossings at inappropriate times while providing sufficient time for pedestrians to cross the roadway.

Cost **$$**

Other Reference Information
FHWA Pedestrian Safety Guide and Countermeasure Selection System. http://www.pedbikesafe.org/PEDSAFE/countermeasures_detail.cfm?CM_NUM=11

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	Tier 4
		Manage Conflicts in Time	

PEDESTRIAN FACILITIES

Pedestrian Hybrid Beacon

A pedestrian-hybrid beacon (PHB) is used at unsignalized intersections or mid-block crosswalks to notify oncoming motorists to stop with a series of red and yellow lights. Unlike a traffic signal, the PHB rests in dark until a pedestrian activates it via pushbutton or other form of detection.

Cost $$$

LRSM ID NS23PB

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	Tier 4
		Manage Conflicts in Time	Increase Attentiveness and Awareness

PEDESTRIAN FACILITIES

Rectangular Rapid Flashing Beacon

A rectangular rapid flashing beacon (RRFB) is a pedestrian-activated flashing light with additional signage to alert motorists of a pedestrian crossing. An RRFB increases the visibility of marked crosswalks and provides motorists a cue to slow down and yield to pedestrians.

Cost $$

LRSM ID NS22PB

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	Tier 4
			Increase Attentiveness and Awareness

PEDESTRIAN FACILITIES

Remove Crossing Prohibition

Removes existing crossing prohibitions and provides marked crosswalk and other crossing enhancements for pedestrians to cross the street.

Cost $

Low Cost / Quick Build alternative available

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	Tier 4
			Increase Attentiveness and Awareness

PEDESTRIAN FACILITIES

Restripe Crosswalk

Periodic restriping of crosswalks is necessary to maintain visibility of the traffic markings. Crosswalk may be restriped with high visibility markings.

Cost $

Low Cost / Quick Build alternative available

Other Reference Information

FHWA Pedestrian Safety Guide and Countermeasure Selection System. http://www.pedbikesafe.org/PEDSAFE/countermeasures_detail.cfm?CM_NUM=4

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	Tier 4
			Increase Attentiveness and Awareness

PEDESTRIAN FACILITIES

Upgrade Curb Ramp

Tactile warning devices must be detectable to visually impaired pedestrians. Curb ramps must follow PROWAG and local design guidelines.

Cost **$$**

Other Reference Information
FHWA Pedestrian Safety Guide and Countermeasure Selection System. http://www.pedbikesafe.org/PEDSAFE/countermeasures_detail.cfm?CM_NUM=3

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	Tier 4
Remove Severe Conflicts			Increase Attentiveness and Awareness

PEDESTRIAN FACILITIES

Widen Sidewalk

Widening sidewalks provides a more comfortable space for pedestrians, particularly in locations with high volumes of pedestrians, and provides space to accommodate people in wheelchairs. Widening sidewalks reduces the likelihood of collisions with pedestrians walking in the road.

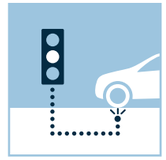
Cost **$$**

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	Tier 4
Remove Severe Conflicts			

RURAL HIGHWAYS SAFETY PLAN

SIGNALS



Advanced Dilemma Zone Detection

The Advanced Dilemma-Zone Detection system adjusts the start time of the yellow-signal phase (i.e. earlier or later) based on observed vehicle locations and speeds. The Advanced Dilemma-Zone Detection system minimizes the number of drivers that are faced with the dilemma of determining if they should stop at the intersection or drive through the intersection based on their speed and distance from the intersection.

Cost **$$**

LRSM ID **S04**

Other Reference Information
FHWA Manual for Selecting Safety Improvements on High Risk Rural Roads

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	Tier 4
		Manage Conflicts in Time	

SIGNALS

Extend Pedestrian Crossing Time

Increases time for pedestrian walk phases, especially to accommodate vulnerable populations, such as children and the elderly.

Cost **$**
Low Cost / Quick Build alternative available

LRSM ID **S03**

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	Tier 4
		Manage Conflicts in Time	

SIGNALS

Extend Yellow and All Red Time

Extending yellow and all red time increases the time allotted for the yellow and red lights during a signal phase. Extending yellow and all red time allows drivers and bicyclists a few additional seconds of time at the end of a signal phase to cross through a signalized intersection before conflicting traffic movements are permitted to enter the intersection.

Cost **$**
Low Cost / Quick Build alternative available

LRSM ID **S03**

Safe System Hierarchy

Tier 1 | Tier 2 | **Tier 3** | Tier 4

Manage Conflicts in Time

SIGNALS

Flashing Yellow Turn Phase

Flashing yellow turn arrow alerts drivers to proceed with caution and decide if there is a sufficient gap in oncoming traffic to safely make a turn. To be used only when a pedestrian walk phase is not called. Protected-only phases should be used when pedestrians are present.

Cost **$$**

LRSM ID **S03**

Safe System Hierarchy

Tier 1 | Tier 2 | Tier 3 | **Tier 4**

Increase Attentiveness and Awareness

RURAL HIGHWAYS SAFETY PLAN

SIGNALS

Pedestrian Scramble

A form of pedestrian “WALK” phase at a signalized intersection in which all vehicular traffic is required to stop, allowing pedestrians to cross through the intersection in any direction, including diagonally.

Cost **$$**

LRSM ID **S03**

Safe System Hierarchy

Tier 1 | Tier 2 | **Tier 3** | Tier 4

Remove Severe Conflicts

Manage Conflicts in Time

SIGNALS

Prohibit Left Turn

Prohibitions of left turns at locations where a turning vehicle may conflict with pedestrians in the crosswalk or where opposing traffic volume is high. Reduces pedestrian interaction with vehicles when crossing.

Cost **$**
Low Cost / Quick Build alternative available

LRSM ID **S15/NS16**

Safe System Hierarchy

Tier 1 | Tier 2 | **Tier 3** | Tier 4

Remove Severe Conflicts

Manage Conflicts in Time

SIGNALS

Prohibit Right-Turn-on-Red

Prohibiting right-turn-on-red movements should be considered at skewed intersections, or where exclusive pedestrian "WALK" phases, Leading Pedestrian Intervals (LPIs), sight distance issues, or high pedestrian volumes are present. Can help prevent crashes between vehicles turning right on red from one street and through vehicles on the cross street, and crashes involving pedestrians.

Cost **$**
Low Cost / Quick Build alternative available

Other Reference Information
Currently the CMF Clearinghouse does not include specific studies; however, permitting right-turns-on-red shows an increase in ped/vehicle crashes. Additional information is available at the FHWA Pedestrian Safety Guide and Countermeasure Selection System. http://www.pedbikesafe.org/PEDSAFE/countermeasures_detail.cfm?CM_NUM=49

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	Tier 4
Remove Severe Conflicts		Manage Conflicts in Time	

SIGNALS

Prohibit Turns During Pedestrian Phase

Restricts left or right turns during the pedestrian crossing phase at locations where a turning vehicle may conflict with pedestrians in the crosswalk. This restriction may be displayed with a blank-out sign.

Cost **$**

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	Tier 4
		Manage Conflicts in Time	

RURAL HIGHWAYS SAFETY PLAN

SIGNALS

Protected Left Turns

A protected left turn can be implemented at signalized intersections (with existing left turns pockets) that currently have a permissive left-turn or no left-turn protection. Providing protected left-turn phases for signalized intersections removes the need for the drivers to navigate through gaps in oncoming/opposing through vehicles.

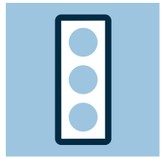
Cost **$$**

LRSM ID **S06/S07**

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	Tier 4
Remove Severe Conflicts		Manage Conflicts in Time	

SIGNALS



Retroreflective Tape on Signals

Retroreflective borders enhance the visibility of traffic signals for aging and color-vision-impaired drivers, enabling them to understand which signal indication is illuminated. Retroreflective borders may also alert drivers to signalized intersections during periods of power outages when the signals would otherwise be dark and non-reflective signal heads and backplates would not be visible.

Cost **$**
Low Cost / Quick Build alternative available

LRSM ID **S02**

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	Tier 4
			Increase Attentiveness and Awareness

SIGNALS

Separate Right-Turn Phasing

Provides a green arrow phase for right-turning vehicles. Avoids conflicts between right-turning traffic and bicyclists or pedestrians crossing the intersection on their right.

Cost **$$$**

Other Reference Information
(1) Evaluation of Pedestrian-Related Roadway Measures, Pedestrian and Bicycle Information Center, 2014. http://www.pedbikeinfo.org/cms/downloads/PedestrianLitReview_April2014.pdf (2) FHWA Manual for Selecting Safety Improvements on High Risk Rural Roads

Safe System Hierarchy

Tier 1	Tier 2	**Tier 3**	Tier 4
		Manage Conflicts in Time	

SIGNALS

Shorten Cycle Length

Traffic signal cycle lengths have a significant impact on the quality of the urban realm and consequently, the opportunities for bicyclists, pedestrians, and transit vehicles to operate effectively along a corridor. Long signal cycles, compounded over multiple intersections, can make crossing a street or walking even a short distance prohibitive and frustrating. Short cycle lengths of 60–90 seconds are ideal for urban areas.

Cost **$**
Low Cost / Quick Build alternative available

Other Reference Information
FHWA Pedestrian Safety Guide and Countermeasure Selection System. http://www.pedbikesafe.org/PEDSAFE/countermeasures_detail.cfm?CM_NUM=45

Safe System Hierarchy

Tier 1	Tier 2	**Tier 3**	Tier 4
		Manage Conflicts in Time	

SIGNALS

Signal Interconnectivity and Coordination / Green Wave

The emphasis on improving signal coordination for this countermeasure is to provide an opportunity for slow-speed signal coordination. Coordinating signals to allow for bicyclist progression, also known as a 'green wave,' gives bicyclists and pedestrians more time to cross through the 'green wave' intersections. It also slows vehicle speeds, helping to reduce the likelihood of severe collisions.

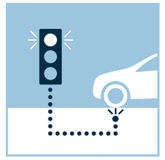
Cost **$$**

LRSM ID **S03**

Safe System Hierarchy

Tier 1	**Tier 2**	Tier 3	Tier 4
	Reduce Vehicle Speeds		

SIGNALS



Speed Sensitive Rest in Red Signal

At certain hours (e.g. late night) a signal remains red for all approaches or certain approaches until a vehicle arrives at the intersection. If the vehicle is going faster than the desired speed, the signal will not turn green until after vehicle stops. If the vehicle is going the desired speed the signal will change to green before the vehicle arrives. This signal timing provides operational benefit to drivers traveling at the desired speed limit. Can be paired with variable speed warning signs.

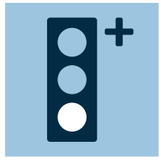
Cost **$$**

LRSM ID **R26**

Safe System Hierarchy

Tier 1	**Tier 2**	**Tier 3**	Tier 4
	Reduce Vehicle Speeds	Manage Conflicts in Time	

SIGNALS



Supplemental Signal Heads

Additional signal heads allow drivers to anticipate signal changes farther away from intersections. Supplemental traffic signals may be placed on the near side of an intersection, far-left, far-right, or very high.

Cost **$$**

LRSM ID **S02**

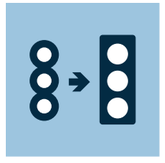
Safe System Hierarchy

Tier 1 | Tier 2 | Tier 3 | **Tier 4**

Increase Attentiveness and Awareness

RURAL HIGHWAYS SAFETY PLAN

SIGNALS



Upgrade Signal Head

Upgrading Signal Heads replaces existing 8-inch signal heads with 12-inch signal heads to comply with the California MUTCD's 2014 guidelines. Upgrading signal heads provides better visibility of intersection signals and by aiding drivers' advanced perception of upcoming intersections.

Cost **$**

LRSM ID **S02**

Safe System Hierarchy

Tier 1 | Tier 2 | Tier 3 | **Tier 4**

Increase Attentiveness and Awareness

RURAL HIGHWAYS SAFETY PLAN

SIGNING & STRIPING

Advance Stop Bar

An advanced stop bar is a horizontal stripe painted ahead of the crosswalk at stop signs and signals to indicate where drivers should stop. An advanced stop bar reduces instances of vehicles encroaching on the crosswalk. Creating a wider stop bar or setting the stop bar further back may be appropriate for locations with known crosswalk encroachment issues.

Cost **$**

Low Cost / Quick Build alternative available

LRSM ID **S20PB**

Safe System Hierarchy

Tier 1 | Tier 2 | Tier 3 | **Tier 4**

Increase Attentiveness and Awareness

RURAL HIGHWAYS SAFETY PLAN

SIGNING & STRIPING

Advance Yield Markings

Yield lines are placed 20 to 50 feet in advance of multi-lane pedestrian crossings to increase visibility of pedestrians. They can reduce the likelihood of a multiple-threat crash.

Cost **$**

Low Cost / Quick Build alternative available

Safe System Hierarchy

Tier 1 | Tier 2 | Tier 3 | **Tier 4**

Increase Attentiveness and Awareness

SIGNING & STRIPING

Chevron Signs on Horizontal Curves

Post-mounted chevrons are intended to warn drivers of an approaching curve and provide tracking information and guidance to the drivers.

Cost **$**
Low Cost / Quick Build alternative available

LRSM ID **R23**

Other Reference Information
FHWA Manual for Selecting Safety Improvements on High Risk Rural Roads

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	**Tier 4**
			Increase Attentiveness and Awareness

SIGNING & STRIPING

Curve Advance Warning Sign

A curve advance warning sign notifies drivers of an approaching curve and may include an advisory speed limit as drivers navigate around the curve. This warning sign is ideally combined with other infrastructure that alerts drivers of the curve, such as chevron signs, delineators, and flashing beacons. A curve advance warning sign provides drivers additional time to slow down for the curve.

Cost **$**
Low Cost / Quick Build alternative available

LRSM ID **R24**

Other Reference Information
FHWA Manual for Selecting Safety Improvements on High Risk Rural Roads

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	**Tier 4**
			Increase Attentiveness and Awareness

RURAL HIGHWAYS SAFETY PLAN

SIGNING & STRIPING

Flashing Beacon as Advance Warning

A flashing beacon as an Advanced Warning is a blinking light with signage to notify motorists of an upcoming intersection or crosswalk. A flashing beacon provides motorists more time to be aware of and slow down for an intersection or yield to pedestrians crossing a crosswalk.

Cost **$$**

LRSM ID **S10**

Other Reference Information
FHWA Manual for Selecting Safety Improvements on High Risk Rural Roads

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	**Tier 4**
			Increase Attentiveness and Awareness

SIGNING & STRIPING

LED-Enhanced Sign

An LED-Enhanced Sign has LED lights embedded in the sign to outline the sign itself or the words and symbols on the sign. The LEDs may be set to flash or operate in a steady mode. An LED-enhanced sign improves the visibility of signs at locations with visibility limitations or with a documented history of drivers failing to see or obey the sign (e.g. at STOP signs).

Cost **$**
Low Cost / Quick Build alternative available

LRSM ID **NS08**

Other Reference Information
FHWA Manual for Selecting Safety Improvements on High Risk Rural Roads

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	**Tier 4**
			Increase Attentiveness and Awareness

SIGNING & STRIPING

Painted Centerline and Raised Pavement Markers at Curves on Residential Streets

A raised pavement marker is a small device attached to the road and used as a positioning guide for drivers.

Cost **$**

Low Cost / Quick Build alternative available

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	**Tier 4**
			Increase Attentiveness and Awareness

SIGNING & STRIPING

Speed Feedback Sign

A speed feedback sign notifies drivers of their current speed, usually followed by a reminder of the posted speed limit. A speed feedback sign provides a cue for drivers to check their speed and slow down, if necessary.

Cost **$**

Low Cost / Quick Build alternative available

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	**Tier 4**
			Increase Attentiveness and Awareness

SIGNING & STRIPING

Speed Legends on Pavement at Neighborhood Entries

Speed legends are numerals painted on the roadway indicating the current speed limit in miles per hour. They are usually placed near speed limit signposts.

Cost **$**

Low Cost / Quick Build alternative available

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	**Tier 4**
			Increase Attentiveness and Awareness

SIGNING & STRIPING

Striping Through Intersection

Adding clear pavement markings can guide motorists through complex intersections. Intersections where the lane designations are not clearly visible to approaching motorists and/or intersections noted as being complex and experiencing crashes that could be attributed to a driver's unsuccessful attempt to navigate the intersection can benefit from this treatment.

Cost **$**

Low Cost / Quick Build alternative available

LRSM ID **S09**

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	**Tier 4**
			Increase Attentiveness and Awareness

SIGNING & STRIPING

Time-Based Turn Restriction

Restricts left-turns or right-turns during certain time periods when there may be increased potential for conflict (e.g., peak periods, school hours).

Cost **$**
Low Cost / Quick Build alternative available

Safe System Hierarchy

Tier 1	Tier 2	**Tier 3**	Tier 4
		Manage Conflicts in Time	

SIGNING & STRIPING

Upgrade Intersection Pavement Markings

Upgrading intersection pavement marking can include "Stop Ahead" markings and the addition of centerlines and stop bars. Upgrading intersection pavement markings can increase the visibility of intersections for drivers approaching and at the intersection.

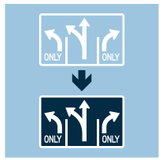
Cost **$**
Low Cost / Quick Build alternative available

LRSM ID **NS07**

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	**Tier 4**
			Increase Attentiveness and Awareness

SIGNING & STRIPING



Upgrade Signs with Fluorescent Sheeting

Upgrading signs with fluorescent sheeting replaces existing signs with new signs that can clearly display warnings by reflecting headlamp light back to vehicles. Upgrading signs with fluorescent sheeting improves visibility of signs to drivers at night.

Cost **$**
Low Cost / Quick Build alternative available

LRSM ID **R22**

Other Reference Information
FHWA Manual for Selecting Safety Improvements on High Risk Rural Roads

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	**Tier 4**
			Increase Attentiveness and Awareness

SIGNING & STRIPING

Upgrade Striping

Restripe lanes with reflective striping to improve striping visibility and clarify lane assignment, especially where the number of lanes changes.

Cost **$**
Low Cost / Quick Build alternative available

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	**Tier 4**
			Increase Attentiveness and Awareness

SIGNING & STRIPING

Upgrade to Larger Warning Signs

Upgrading to larger warning signs replaces existing signs with physically larger signs with larger warning information. Upgrading to larger warning signs increases the visibility of the information provided, particularly for older drivers.

Cost **$**

Low Cost / Quick Build alternative available

LRSM ID **NS06**

Safe System Hierarchy

Tier 1 | Tier 2 | Tier 3 | **Tier 4**

Increase Attentiveness and Awareness

SIGNING & STRIPING

Wayfinding

A network of signs that highlight nearby pedestrian and bicycle facilities. Can help to reduce crossings at locations with poor sight distance or limited crossing enhancements.

Cost **$**

Safe System Hierarchy

Tier 1 | Tier 2 | Tier 3 | **Tier 4**

Increase Attentiveness and Awareness

SIGNING & STRIPING

Yield To Pedestrians Sign

"Yield Here to Pedestrians" signs alert drivers about the presence of pedestrians. These signs are required with advance yield lines. Other sign types can be placed on the centerline in the roadway.

Cost **$**

Low Cost / Quick Build alternative available

LRSM ID **NS06**

Safe System Hierarchy

Tier 1 | Tier 2 | Tier 3 | **Tier 4**

Increase Attentiveness and Awareness

OTHER

Access Management/ Close Driveway

Vehicles entering and exiting driveways may conflict with pedestrians and with vehicles on the main road, especially at driveways within 250 feet of intersections. Driveway consolidation reduces conflict points along a segment and/or near intersections.

Cost **$$**

LRSM ID **NS06**

Other Reference Information

The CMF Clearinghouse has limited research related to vehicle/pedestrian crashes. See additional reference: FHWA Pedestrian Safety Guide and Countermeasure Selection System. http://www.pedbikesafe.org/PEDSAFE/countermeasures_detail.cfm?CM_NUM=20

Safe System Hierarchy

Tier 1 | Tier 2 | Tier 3 | Tier 4

Remove Severe Conflicts

OTHER

Back-In Angled Parking

Back-In Angled Parking requires motorists to back into an angled on-street parking spot and to drive forward when exiting a parking spot. Back-in angled parking increases the visibility of passing vehicles and bicycles while exiting a spot, particularly if large adjacent vehicles obstruct sight, and allows trunk unloading to happen on the curb instead of in the street.

Cost **$**
Low Cost / Quick Build alternative available

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	**Tier 4**
			Increase Attentiveness and Awareness

OTHER

Create or Increase Clear Zone

A clear zone is an unobstructed, traversable roadside area that allows a driver to stop safely or regain control of a vehicle that has left the roadway. The width of the clear zone is informed by roadway context, desired vehicle speeds, and agency design standards.

Cost **$$**

Other Reference Information
FHWA Manual for Selecting Safety Improvements on High Risk Rural Roads

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	**Tier 4**
			Increase Attentiveness and Awareness

OTHER

Curbside Management

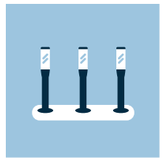
Curbside management helps prioritize different uses that would otherwise be in conflict with one another such as location of bus stops, bicycle infrastructure, freight deliveries, passenger pick-ups/drop-offs, green stormwater infrastructure, public spaces, and parking management.

Cost **$**

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	Tier 4
Remove Severe Conflicts			

OTHER



Delineators, Reflectors, and/or Object Markers

Delineators, reflectors and/or object markers are intended to warn drivers of an approaching curve or fixed object that cannot easily be removed. They are generally less costly than Chevron Signs as they don't require posts to place along the roadside.

Cost **$**
Low Cost / Quick Build alternative available

LRSM ID **R27**

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	**Tier 4**
			Increase Attentiveness and Awareness

OTHER

Far-Side Bus Stop

Far-side bus stops are located immediately after an intersection, allowing the bus to pass through the intersection before stopping for passenger loading and unloading. Far-side stops encourage pedestrians to cross behind the bus for greater visibility and can improve transit service reliability.

Cost $

Other Reference Information
FHWA Manual for Selecting Safety Improvements on High Risk Rural Roads

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	Tier 4
			Increase Attentiveness and Awareness

OTHER

Impact Attenuators

Impact attenuators bring an errant vehicle to a more-controlled stop or redirect the vehicle away from a rigid object. Impact attenuators are typically used to shield rigid roadside objects such as concrete barrier ends, steel guardrail ends and bridge pillars from oncoming automobiles. Attenuators tend to be installed where it is impractical for the objects to be removed.

Cost $$

LRSM ID R05

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	Tier 4
Remove Severe Conflicts			Increase Attentiveness and Awareness

OTHER

Intersection Lighting

Adding intersection and/or pedestrian-scale lighting at intersections increases the visibility of all road users. This countermeasure is most effective at reducing or preventing collisions at intersections at night or in low-light conditions. When lighting pedestrian crosswalks, it is helpful to use lighting analysis to avoid designs that inadvertently introduce glare or backlight pedestrians, making it hard for motorists to see them. In designated Dark Sky areas, lighting should be downward directed and Dark Sky friendly.

Cost $$

LRSM ID NS01

Other Reference Information
Pedestrian-Level Lighting: FHWA Pedestrian Safety Guide and Countermeasure Selection System. http://www.pedbikesafe.org/PEDSAFE/countermeasures_detail.cfm?CM_NUM=8

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	Tier 4
			Increase Attentiveness and Awareness

OTHER

Median Guardrail

The installation of median guardrail is most suitable for use in traversable medians having no or little change in grade and cross slope. While these systems may not reduce the frequency of crashes due to roadway departure, they can help prevent a lane-departure crash from becoming a head-on collision.

Cost $$

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	Tier 4
Remove Severe Conflicts			

OTHER

Red Light Camera

A red light camera enforces traffic signal compliance by capturing the image of a vehicle that has entered an intersection in spite of the traffic signal indicating red. The automatic photographic evidence is used by authorities to enforce traffic laws and issue traffic violation tickets.

Cost **$$**

Other Reference Information
FHWA Manual for Selecting Safety Improvements on High Risk Rural Roads

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	**Tier 4**
			Increase Attentiveness and Awareness

OTHER

Relocate Select Hazardous Utility Poles

Relocating or removing utility poles from within the clear zone alleviates the potential for fixed-object crashes. If utility poles cannot be completely eliminated from within the clear zone, efforts can be made to either relocate the poles to a greater offset from the road or given high-visibility treatments.

Cost **$$**

Other Reference Information
FHWA Manual for Selecting Safety Improvements on High Risk Rural Roads

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	Tier 4
Remove Severe Conflicts			

RURAL HIGHWAYS SAFETY PLAN

OTHER

Remove Obstructions For Sightlines

Remove objects that may prevent drivers and pedestrians from having a clear sightline. May include installing red curb at intersection approaches to remove parked vehicles (also called “daylighting”), trimming or removing landscaping, or removing or relocating large signs.

Cost **$**
Low Cost / Quick Build alternative available

LRSM ID **NS11**

Other Reference Information
FHWA Manual for Selecting Safety Improvements on High Risk Rural Roads

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	**Tier 4**
			Increase Attentiveness and Awareness

OTHER

Segment Lighting

Providing roadway lighting increases driver awareness and can improve visibility of other road users and/or objects in the roadway. In designated Dark Sky areas, lighting should be downward directed and Dark Sky friendly.

Cost **$$**

LRSM ID **R01**

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	**Tier 4**
			Increase Attentiveness and Awareness

OTHER

Speed Limit Reduction

As an industry, there is a consistent movement away from setting speed limits solely based on 85th percentile vehicle speeds. Roadway characteristics, adjacent land use context, as well as the risk higher speeds create for all road users are now considered. Where separate space is not available for vulnerable road users and/or severe conflicts (e.g., crossing or turning conflicts) are present between motor vehicles speeds of 25 mph are preferable to reduce the risk of severe collisions. Where separated space is provided for vulnerable road users and severe conflicts between vehicles are managed, speed limits above 25 mph can be considered.

Cost $

Other Reference Information
TRB Study on Setting Speed Limits; also Richard, C. M., Magee, K., Bacon-Abdelmoteleb, P., & Brown, J. L. (2018, April). Countermeasures that work: A highway safety countermeasure guide for State Highway Safety Offices, Ninth edition (Report No. DOT HS 812 478). Washington, DC: National Highway Traffic Safety Administration.

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	Tier 4
	Reduce Vehicle Speeds		Increase Attentiveness and Awareness

RURAL HIGHWAYS SAFETY PLAN

OTHER

Upgrade Lighting to LED

Upgrading Lighting to LED replaces high-pressure sodium light bulbs with LED light bulbs in street lights. Upgrading Lighting to LED increases the visibility of pedestrians in crosswalks through greater color contrast and larger areas of light distribution. In designated Dark Sky areas, lighting should be downward directed and Dark Sky friendly.

Cost $$

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	Tier 4
			Increase Attentiveness and Awareness

RURAL HIGHWAYS SAFETY PLAN

OTHER

Daytime Headlights Signage

Signs in areas with dense tree coverage requiring that all vehicles turn on their headlights regardless of time of day. Where tree coverage limits sunlight and darkens roads, headlights can help with visibility.

Cost $$

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	Tier 4
			Increase Attentiveness and Awareness

Appendix H. RHSP Project List

Project Description					Prioritization													Project Recommendations
								Profiles										
Project ID	State Route	Description	Cross Street 1	Cross Street 2	Place Type	KSI Density	Risk Factor Score	Excessive Speed	Pedestrian Crashes	Turns on Transitional Streets	Weekend Driving on Undeveloped Non-Mountainous Roads	DUIs on Undeveloped Mountainous Roads	Bicyclists on Narrow Roads	Lane Departures	Pedestrians at Night	Community Input	Equity Area	Implementation Considerations	
Highway 1																			
SR1-1	SR 1	Waddell State Park	North of Skyline to Sea Trail	South of Canyon Road	Undeveloped Non-Mountainous	1	Medium	-	-	-	1	-	-	1	-	0	N	Coordination with State Parks	Add advance signage (wayfinding, pedestrian crossing warning, speed feedback signs, etc.), turn/acceleration/passing/merge lanes where appropriate, evaluate sight distance. Consider crossing improvements including crosswalks and crossing control (RRFB, PHB, or signal) and potentially pedestrian refuge island.
SR1-2	SR 1	Pelican Rock	South of Greyhound Rock Parking	South of Pelican Rock	Undeveloped Non-Mountainous	1	Medium Low	-	-	-	1	-	-	1	-	0	N	Coordination with Santa Cruz County and Coastal Commission	Formalize parking areas and scenic view points, implement advance signage (wayfinding, pedestrian crossing warning, speed feedback signs, etc.), stripe turn turn/acceleration/passing/merge lanes where appropriate, evaluate sight distance. Consider guardrails along to better delineate parking entrance and exit and reduce conflicts with cars backing into oncoming traffic.
Safety Enhancement Concept (SEC) 1	SR 1	Scott Creek	South of Scott Creek	South of Scott Creek Informal Parking	Undeveloped Non-Mountainous	2	Medium Low	-	1	-	4	-	-	1	-	0	N	Coordination with Scott Creek Bridge replacement project. Coordinate with BLM and Coastal Commission	Potentially formalize parking on the west side of Highway 1 with striping and an access lane. Install speed feedback signs. Realign vehicle through lanes to the east. Remove informal parking on the east side to reduce pedestrians crossing the highway.
SR1-3	SR 1	Davenport Landing	Swanton Road	Waren Ella Road	Transitional	5	High	5	-	-	4	-	-	2	-	7	N	Turning lane study, coordination with BLM and Caltrans	Add advance signage (wayfinding, pedestrian crossing warning, speed feedback signs, etc.), turn turn/acceleration/passing/merge lanes where appropriate, evaluate sight distance.
SEC 2	SR 1	Davenport	Marine View Ave	San Vicente Creek	Main Street	2	High	8	1	-	-	-	-	4	1	6	N	Coordination with Rail Trail Project.	Provide gateway improvements and traffic calming measures. Install rolled curbs with sidewalks to delineate pedestrian space. Improve pedestrian crossing at Highway 1 and Ocean St. to increase visibility. Enhance transit stops to support existing and future transit service. Create connections for pedestrians and bicyclists through Davenport.

Project Description					Prioritization													Project Recommendations
								Profiles										
Project ID	State Route	Description	Cross Street 1	Cross Street 2	Place Type	KSI Density	Risk Factor Score	Excessive Speed	Pedestrian Crashes	Turns on Transitional Streets	Weekend Driving on Undeveloped Non-Mountainous Roads	DUIs on Undeveloped Mountainous Roads	Bicyclists on Narrow Roads	Lane Departures	Pedestrians at Night	Community Input	Equity Area	Implementation Considerations	
SR1-4	SR 1	Shark Fin Cove	North of Rancho Las Palmas driveway	South of Shark Fin Cove Parking	Transitional	2	Medium	-	-	-	5	-	-	3	-	6	N	Coordination with Santa Cruz County/BLM and Coastal Commission	Formalize parking areas and scenic view points, implement advance signage (wayfinding, pedestrian crossing warning, speed feedback signs, etc.), stripe turn turn/acceleration/passing/merge lanes where appropriate, evaluate sight distance. Consider guardrails along to better delineate parking entrance and exit and reduce conflicts with cars backing into oncoming traffic.
SR1-5	SR 1	Rodoni Farms	North of Rodoni Farms	South of Rodoni Farms	Undeveloped Non-Mountainous	2	Medium	1	-	-	4	-	-	1	-	2	N		Formalize parking areas and scenic view points, implement advance signage (wayfinding, pedestrian crossing warning, speed feedback signs, etc.), stripe turn turn/acceleration/passing/merge lanes where appropriate, evaluate sight distance. Consider guardrails along to better delineate parking entrance and exit and reduce conflicts with cars backing into oncoming traffic. Consider crossing improvements including crosswalks and crossing control (RRFB, PHB, or signal) and potentially pedestrian refuge island.
SR1-6	SR 1	Laguna Creek	Laguna Creek Parking	Laguna Road	Undeveloped Non-Mountainous	2	High	-	1	-	-	-	-	-	-	3	N	Coordination with Santa Cruz County/BLM and Coastal Commission	Formalize parking areas and scenic view points, implement advance signage (wayfinding, pedestrian crossing warning, speed feedback signs, etc.), stripe turn turn/acceleration/passing/merge lanes where appropriate, evaluate sight distance. Consider guardrails along to better delineate parking entrance and exit and reduce conflicts with cars backing into oncoming traffic.
SR1-7	SR 1	Four Mile Beach	Baldwin Loop Trailhead	Baldwin Loop Parking	Undeveloped Non-Mountainous	3	High	10	1	-	3	-	-	2	1	4		Coordination with Santa Cruz County/BLM and Coastal Commission	Formalize parking areas and scenic view points, implement advance signage (wayfinding, pedestrian crossing warning, speed feedback signs, etc.), stripe turn turn/acceleration/passing/merge lanes where appropriate, evaluate sight distance. Consider guardrails along to better delineate parking entrance and exit and reduce conflicts with cars backing into oncoming traffic.
SEC 3	SR 1	Dimeo Lane/Transfer Station	North of Dimeo Lane	South of Dimeo Lane	Undeveloped Non-Mountainous	1	High	6	-	-	1	-	-	-	-	1	N		Restripe turn lanes and passing lanes to discourage passing at the intersection and address sight distance concerns. Add pork chop islands to help facilitate turn movements and improve visibility. Narrow vehicle lanes. Maintain shoulders for bike access.

Project Description					Prioritization													Project Recommendations
								Profiles										
Project ID	State Route	Description	Cross Street 1	Cross Street 2	Place Type	KSI Density	Risk Factor Score	Excessive Speed	Pedestrian Crashes	Turns on Transitional Streets	Weekend Driving on Undeveloped Non-Mountainous Roads	DUIs on Undeveloped Mountainous Roads	Bicyclists on Narrow Roads	Lane Departures	Pedestrians at Night	Community Input	Equity Area	Implementation Considerations	
SR1-8	SR 1	Wilder State Park	Coast Road	Coast Road	Undeveloped Non-Mountainous	5	High	3	2	-	4	-	-	2	1	2	N	Coordination with State Parks	Formalize parking areas and scenic view points, implement advance signage (wayfinding, pedestrian crossing warning, speed feedback signs, etc.), stripe turn turn/acceleration/passing/merge lanes where appropriate, evaluate sight distance. Consider guardrails along to better delineate parking entrance and exit and reduce conflicts with cars backing into oncoming traffic. Consider crossing improvements including crosswalks and crossing control (RRFB, PHB, or signal) and potentially pedestrian refuge island.
Highway 9																			
SR9-1	SR 9	Near County Line	Achistaca Trailhead	SR 35	Undeveloped Mountainous	7	Medium	7	-	-	-	2	1	10	-	6	N	Narrow ROW	Add speed feedback signage and speed activated signage, rumble strips, and vegetation management.
SEC 4	SR 9	Waterman Gap Hairpin Curve	-	-	Undeveloped Mountainous	1	Medium	-	-	-	-	-	-	2	-	0	N		Install centerline rumble strips. Manage vegetation to maintain visibility. Install speed feedback signs to encourage slower travel speeds. Enhance speed enforcement opportunities.
SR9-2	SR 9	Riverside Grove	Fern Drive	Shadeland Road	Undeveloped Mountainous	5	Medium	6	-	-	-	1	1	6	-	2	N		Provide continuous width shoulder or Class II bike lane on SR 9 and add walking paths (sidewalk or parallel off-street path) where possible. Upgrade crossings near transit stops and schools to include curb extensions, high-visibility striping, signage, and potentially RRFBs. Upgrade transit stops with loading pads and stop amenities. Manage landscaping to improve visibility. Consider additional traffic calming measures such as rumble strips, medians, and speed feedback signs at areas with high vehicle speeds (near Camp Campbell/Camp Heron and Hubbard Gulch).

Project Description					Prioritization														Project Recommendations
								Profiles											
Project ID	State Route	Description	Cross Street 1	Cross Street 2	Place Type	KSI Density	Risk Factor Score	Excessive Speed	Pedestrian Crashes	Turns on Transitional Streets	Weekend Driving on Undeveloped Non-Mountainous Roads	DUIs on Undeveloped Mountainous Roads	Bicyclists on Narrow Roads	Lane Departures	Pedestrians at Night	Community Input	Equity Area	Implementation Considerations	
SR9-3	SR 9	Wildwood	Old County Hwy	Pleasant Way	Transitional	6	Medium	13	1	-	-	-	-	6	-	0	N	Coordination with SLV Plans. See SLV Complete Streets Corridor Plan project 28 and SLV PID Segment 6	Provide continuous width shoulder or Class II bike lane on SR 9 and add walking paths (sidewalk or parallel off-street path) where possible. Upgrade crossings near transit stops and schools to include curb extensions, high-visibility striping, signage, and potentially RRFBs. Upgrade transit stops with loading pads and stop amenities. Manage landscaping to improve visibility and install speed feedback signage.
SEC 5	SR 9	Boulder Creek	Bear Creek Road	North of Mountain Road	Main Street	10	Medium	20	11	-	-	-	-	2	4	3	N	Coordination with Boulder Creek Complete Streets PAED	Provide gateway treatments such as medians, landscaping, and signage. Install speed feedback signs to encourage slower travel speeds. Enhance intersection and pedestrian crossings with RRFBs and high-visibility crosswalks. Improve transit stops by adding waiting areas and signage/furniture. Build sidewalk connections to close gaps. Add bike sharrows and signage within vehicle lanes.
SR9-4	SR 9	Brookdale	Irwin Way	Western Avenue	Transitional	8	Medium	-	-	5	-	-	1	20	-	2	N	Coordination with SLV Plans	Install gateway treatments, add pedestrian facilities (sidewalks) and crossing treatments (crosswalks, RRFBs, pedestrian refuge islands, curb extensions). Designate shared use shoulders. Consider pedestrian refuge island at Pacific St./Clear St. and Larkspur St. intersections. Evaluate turn lanes at Irwin Wy. intersection (see SLV Complete Streets Corridor Plan).
SR9-5	SR 9	Brookdale	Pike Road	California Drive/ Middle Drive	Transitional	2	Medium Low	-	-	1	-	-	1	3	1	21	N	Coordination with SLV Plans	Evaluate and add guardrails along curve where appropriate to maintain existing ingress and egress points (driveways intersecting roads). Manage vegetation to maintain visibility. Install speed feedback signs to encourage slower travel speeds. Enhance speed enforcement opportunities.

Project Description					Prioritization														Project Recommendations
								Profiles											
Project ID	State Route	Description	Cross Street 1	Cross Street 2	Place Type	KSI Density	Risk Factor Score	Excessive Speed	Pedestrian Crashes	Turns on Transitional Streets	Weekend Driving on Undeveloped Non-Mountainous Roads	DUIs on Undeveloped Mountainous Roads	Bicyclists on Narrow Roads	Lane Departures	Pedestrians at Night	Community Input	Equity Area	Implementation Considerations	
SEC 6	SR 9	Ben Lomond	South of Marshall Creek Court	Hillside Avenue	Main Street	3	High	16	2	-	-	-	-	9	2	4	N		Support existing crossing demand by squaring intersections. Ensure crosswalks are at right angles to shorten crossing distances and improve visibility. Add high visibility crosswalks, RRFBs, and curb extensions. Provide gateway treatments including median islands, landscaping, and signage. Improve transit stops by adding waiting areas and signage / furniture. Narrow vehicle lanes and add bikeable shoulders where possible. Build sidewalk connections to close gaps include mountable curbs at fire station and in front of driveways and parking areas to maintain access.
SR9-6	SR 9	Ben Lomond	Lorenzo Avenue	High Lands County Park (Holiday Lane)	Transitional	5	High	6	-	4	-	-	-	16	6	5	N	Coordination with SLV Plans	Provide continuous width shoulder or Class II bike lane on SR 9 and add walking paths (sidewalk or parallel off-street path) where possible. Ensure that bike lanes are connected and provide access from Highland Park south to Glen Arbor Rd. Upgrade crossings to include curb extensions, high-visibility striping, signage, and potentially RRFBs. Upgrade transit stops with loading pads and stop amenities. Consider vegetation management strategies and advanced warning signage at areas with limited sight distance such as at Park Drive.
SR9-7	SR 9	North Felton	Glen Arbor Drive (southern intersection)	El Soloyo Heights Drive	Transitional	4	Medium	6	1	1	-	-	1	7	1	12	N	Coordination with SLV Plans. See SLV Schools Access Study Highway 9 North Concept	Provide continuous width shoulder or Class II bike lane on SR 9. Install continuous sidewalks and add crossing improvements at Willowbrook Dr./SR 9 including crosswalks, curb extensions, and RRFB. Evaluate transit stop locations and provide stop improvements such as enhanced pedestrian access (crosswalks and sidewalks), loading pads, and stop amenities. Consider improvements to redesign southern Town Bridge to account for turning radii.

Project Description					Prioritization													Project Recommendations
								Profiles										
Project ID	State Route	Description	Cross Street 1	Cross Street 2	Place Type	KSI Density	Risk Factor Score	Excessive Speed	Pedestrian Crashes	Turns on Transitional Streets	Weekend Driving on Undeveloped Non-Mountainous Roads	DUIs on Undeveloped Mountainous Roads	Bicyclists on Narrow Roads	Lane Departures	Pedestrians at Night	Community Input	Equity Area	Implementation Considerations	
SR9-8	SR 9	San Lorenzo Valley Schools	Lazy Woods Rd	Fall Creek Drive	Main Street	4	Medium	14	2	-	-	-	-	5	1	4	N	Coordination with SLV Plans. See Caltrans Felton Safety Project (05-1M400) and transit stop improvements (05-1K890)	Ensure continuous sidewalks and bike lane/shoulder. Plan sidewalk on the southbound side of street and bikeable shoulders between San Lorenzo Valley High School and Fall Creek Drive (see SLV Schools Access Study). Ensure sidewalks provide connections to transit stops. Add bus loading areas and bus stop facilities as appropriate to improve visibility and comfort. Upgrade crosswalks at school entrance to high-visibility crosswalks and add curb extensions where possible. Evaluate access to and from school driveways to SR 9 per SLV Schools Access Study and address changes to school entrance circulation. Pave pathways to school entrances to provide ADA compliant connections between schools. Add school zone signage and speed feedback signs.
SR9-9	SR 9	Felton	Fall Creek Drive	San Lorenzo Avenue	Main Street	8	Medium Low	28	4	-	-	-	-	12	3	9	N	Coordination with SLV Plans. See Caltrans Felton Safety Project (05-1M400) and , Caltrans Felton CAPM Project 05-1K890	Install gateway treatments, add pedestrian facilities (sidewalks or multiuse path). Suggest prioritizing on southbound side of highway between Laurel Dr. and San Lorenzo Ave. crossing treatments (crosswalks, RRFBs, pedestrian refuge islands, curb extensions). Focus on refuge islands and midblock crossings throughout town center. Add RRFBs at striped uncontrolled crossings where appropriate. Designate shared use shoulders. Expand pedestrian and bicycle facilities south, consider add new crosswalk near San Lorenzo Avenue. Ensure bicycle facilities are continuous and extend north beyond the project area to Alba Rd.
SR9-10	SR 9	Henry Cowell State Park Access	Laurel Drive	Ox Trail Parking Area	Transitional	3	Medium Low	-	1	-	-	5	2	13	1	1	N	Coordination with SLV Plans	Formalize parking areas with signage and striping, add multi-use paths connecting parking areas and park entrances, restripe narrower lanes, and install advance warning signage. Add advance signage and wayfinding prior to park entrances.

Project Description					Prioritization														Project Recommendations
								Profiles											
Project ID	State Route	Description	Cross Street 1	Cross Street 2	Place Type	KSI Density	Risk Factor Score	Excessive Speed	Pedestrian Crashes	Turns on Transitional Streets	Weekend Driving on Undeveloped Non-Mountainous Roads	DUIs on Undeveloped Mountainous Roads	Bicyclists on Narrow Roads	Lane Departures	Pedestrians at Night	Community Input	Equity Area	Implementation Considerations	
Highway 35																			
SR35-1	SR 35	SR 9 Summit	Cal Fire Station 21 (PM 14.862)	Snow Crest Road	Undeveloped Mountainous	0	Medium	-	-	-	-	-	-	-	-	1	N		Add speed feedback signage and speed activated signage, rumble strips, and vegetation management.
SR35-2	SR 35	Bear Creek	Thompson Road (PM 4.844)	Bear Creek Road	Undeveloped Mountainous	0	Medium	-	-	-	-	-	-	-	-	0	N	Narrow ROW	Add yield signage and consider vehicle activated warning signs to signal to drivers of oncoming vehicle traffic. Add speed feedback signage and speed activated signage, rumble strips, and vegetation management.
Highway 129																			
SR129-1	SR 129	West of City Limits	Lee Road	Industrial Road	Transitional	8	Medium Low	8	-	-	-	-	-	3	1	3	Y	Coordination with City if Watsonville	Provide continuous shared use shoulders where space allows. Add centerline and edge line rumble strips. Install advance warning signs and speed feedback signs especially near City border. Evaluate intersection controls and sight distance at ramp terminals.
SEC 7	SR 129	Blackburn Street/Bridge Street	Bridge Street	West of Lakeview Road	Transitional	4	Medium Low	21	3	-	-	1	-	8	3	2	Y	Coordination with City of Watsonville and Caltrans PID 1Q980 / 1P110	Provide bikeable shoulders. Build sidewalk connections to close gaps. Install center medians. Add high-visibility crosswalks to help improve pedestrian visibility. Consider a roundabout to address speeds and conflict severity; potentially build additional roundabouts at other locations along Highway 129 with the goal of systemically managing speeds.
SR129-2	SR 129	Carlton Road	Coward Road	Silliman Road	Undeveloped Mountainous	5	Medium	40	-	-	-	4	-	6	-	2	Y		Provide continuous shared use shoulders, re-stripe lanes and shoulders where faded, evaluate intersections and delineate or remove pavement outside the desired traveled way to tighten turn radii. Consider possibility for consecutive roundabouts.
SEC 8	SR 129	Murphy Road	West of Murphy Road	East of Murphy Road	Undeveloped Mountainous	1	Medium Low	7	-	-	-	-	-	4	-	1	Y		Delineate or remove pavement outside the desired traveled way. Install bike lane marking. Consider a roundabout to address speeds and conflict severity; potentially build additional roundabouts at other locations along Highway 129 with the goal of systemically managing speeds.

Project Description					Prioritization													Project Recommendations
								Profiles										
Project ID	State Route	Description	Cross Street 1	Cross Street 2	Place Type	KSI Density	Risk Factor Score	Excessive Speed	Pedestrian Crashes	Turns on Transitional Streets	Weekend Driving on Undeveloped Non-Mountainous Roads	DUIs on Undeveloped Mountainous Roads	Bicyclists on Narrow Roads	Lane Departures	Pedestrians at Night	Community Input	Equity Area	Implementation Considerations	
SR129-3	SR 129	Pajaro River	West of Pajaro Riverbend (PM 5.440)	East of Pajaro Riverbend (PM 7.482)	Undeveloped Mountainous	4	Medium	19	-	-	-	5	15	1	-	1	Y		Provide continuous shared use shoulders, re-stripe lanes and shoulders where faded and consider edge rumble strips while maintaining bikeable shoulders. Evaluate intersections delineate or remove pavement outside the desired traveled way to tighten turn radii. Consider possibility for consecutive roundabouts including at Rogge Ln.
SR129-3	SR 129	Chittenden	Soda Lake Access Road	Old Chittenden Road	Undeveloped Mountainous	8	Medium	25	-	-	-	4	-	15	-	2	Y	Narrow ROW due to adjacent rail line.	Provide continuous shared use shoulders where space allows. Add centerline and edge line rumble strips. Install advance warning signs and speed feedback signs.
Highway 152																			
SR152-2	SR 152	Watsonville Border	Wagner Street	Holohan Road	Main Street	5	Medium Low	5	-	-	-	-	1	2	-	5	Y	Coordination with City of Watsonville and Caltrans PID 05-0T770	Ensure pedestrian and bicycle connections such as a Class I multi-use path or sidewalk and bikeable shoulders to connect to planned facilities on Holohan Rd. and on SR 152 north of Holohan Rd. and existing Levee path.
SEC 9	SR 152	Lakeview/St. Francis to Fairgrounds	Holohan Road	Fairgrounds	Main Street/Transitional	48	High	68	4	1	0	0	5	16	2	8	Y		Build a Class I multi-use path parallel to Highway 152 along the segment to connect to schools and fairgrounds. Add traffic control such as a Pedestrian Hybrid Beacon (PHB) or traffic signal with high visibility crosswalks at the driveway to St. Francis High School. Enhance School Zone signage to notify drivers of multiple school locations and pedestrian activity. Complete sidewalk gap closures, including Class I trail connections. Consolidate driveways where feasible. Add updated and new transit stops at College Rd and ensure adequate pedestrian access to the stops through crosswalks, RRFBs, curb extensions, and medians.
SR152-2	SR 152	Hecker Pass	Casserly Road	County border	Undeveloped Mountainous	24	Medium	-	-	-	-	24	-	66	-	2	Y	Narrow ROW	Add speed feedback signage and speed activated signage, rumble strips, and vegetation management. Add limited truck access signage in advance. Consider roundabout (preferred) or signal, if necessary, at Casserly Rd/Carlton Rd.

Project Description					Prioritization													Project Recommendations
								Profiles										
Project ID	State Route	Description	Cross Street 1	Cross Street 2	Place Type	KSI Density	Risk Factor Score	Excessive Speed	Pedestrian Crashes	Turns on Transitional Streets	Weekend Driving on Undeveloped Non-Mountainous Roads	DUIs on Undeveloped Mountainous Roads	Bicyclists on Narrow Roads	Lane Departures	Pedestrians at Night	Community Input	Equity Area	Implementation Considerations	
Highway 236																			
SR236-1	SR 236	Big Basin State Park	China Grade Road	Sky Meadow Road	Undeveloped Mountainous	0	Medium	-	-	-	-	-	-	-	-	1	N	Coordination with State Parks and Big Basin Master Plan	Install centerline rumble strips. Manage vegetation to maintain visibility. Install speed feedback signs to encourage slower travel speeds. Enhance speed enforcement opportunities. Formalize parking areas with signage and striping, add multi-use paths connecting parking areas and park entrances where space allows. Add advance signage and wayfinding prior to park entrances.
SR236-2	SR 236	Boulder Creek	Ridge Drive	Chipmunk Hollow Road	Transitional	2	Medium	-	-	8	-	-	-	12	-	0	N	Narrow ROW	Provide continuous width shoulder or Class II bike lane and add walking paths (sidewalk or parallel off-street path) where possible. Upgrade crossings to include curb extensions, high-visibility striping, signage, and potentially RRFBs. Upgrade transit stops with loading pads and stop amenities.
SR236-3	SR 236	Boulder Creek	Laurel Drive	SR 9	Main Street	1	Medium	-	1	-	-	-	-	-	-	1	N	Coordination with Boulder Creek Complete Streets PAED, Boulder Creek Complete Street Improvements Project, and SLV Plans	Add sidewalks and bike lanes along segment on both sides of the highway. Install crosswalks with curb extensions at Oak St. Intersection improvements at intersection with SR 9 should be coordinated with SEC 5 and Boulder Creek Complete Streets PAED.

Project Description					Prioritization													Project Recommendations
								Profiles										
Project ID	State Route	Description	Cross Street 1	Cross Street 2	Place Type	KSI Density	Risk Factor Score	Excessive Speed	Pedestrian Crashes	Turns on Transitional Streets	Weekend Driving on Undeveloped Non-Mountainous Roads	DUIs on Undeveloped Mountainous Roads	Bicyclists on Narrow Roads	Lane Departures	Pedestrians at Night	Community Input	Equity Area	Implementation Considerations	
SR236-4	SR 236	Boulder Creek	Kings Highway	Jamison Creek Road	Transitional	1	Medium Low	1	1	–	–	–	–	–	–	1	N	Coordination with SLV Plans	Install advance signage (pedestrian crossing warning, speed feedback signs, school bus stop signage etc.). Upgrade crossings to include curb extensions, high-visibility striping at all intersection approaches, signage, and potentially RRFBs. At the Hilton Dr. intersection, add curbs on the northwest side of intersection and curb extensions at all other approaches. Evaluate all-way stop control. Add concrete platform for East Hilton transit stop.

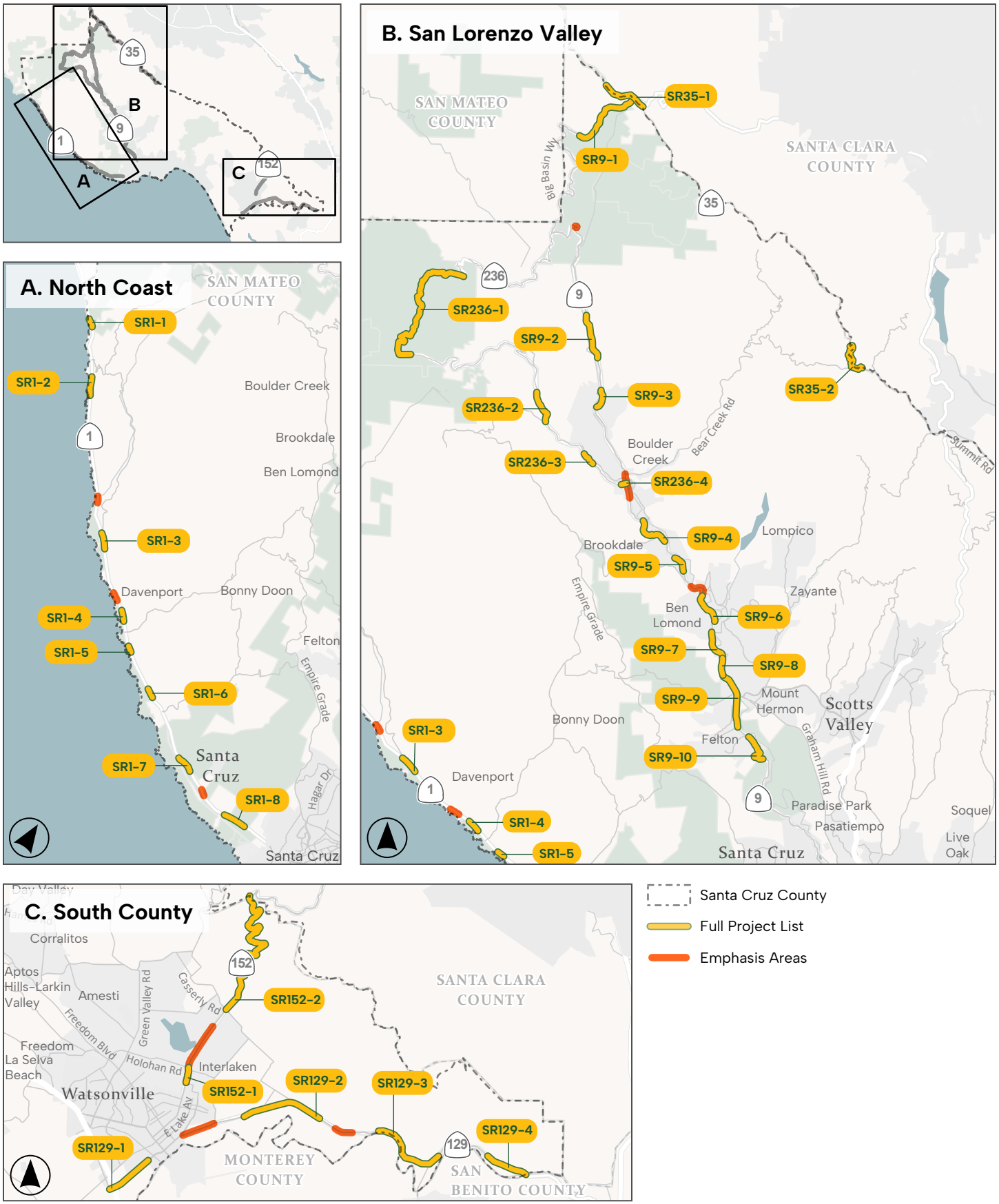


FIGURE H-1

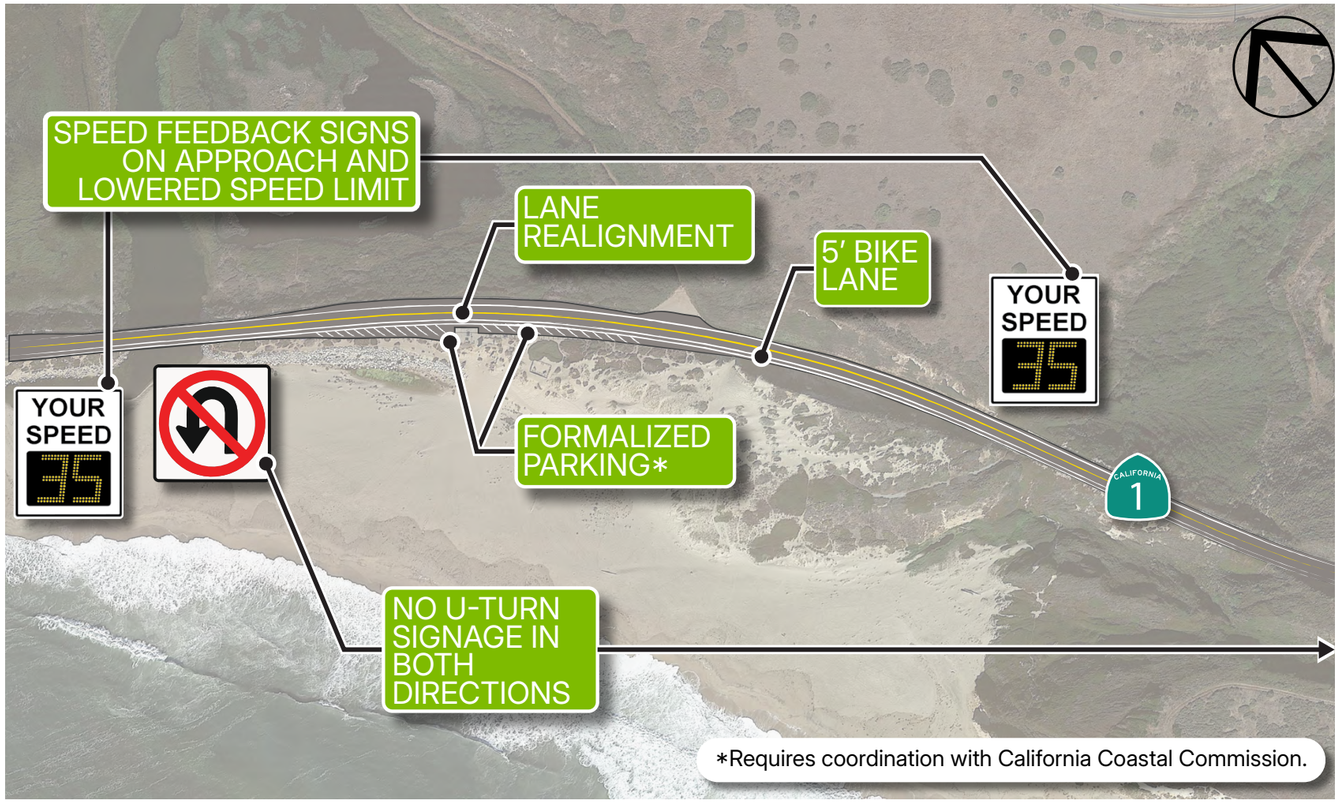
RHSP Project Locations

Appendix I. Safety Enhancement Concepts

FIGURE 24

Highway 1: Scott Creek | Managing turning and parking at visitor destinations

Highway 1 at Scott Creek is designated as an Undeveloped Non-Mountainous place type and serves as a key access point to coastal parking areas. Like many other locations on Highway 1 in within the study limits, the parking areas are informal and can make it challenging to maneuver. The corridor experiences many crashes related to weekend driving that are associated with high volumes of recreational users driving, biking, and walking.



PLANNING-LEVEL COST ESTIMATE (2026 DOLLARS)

$ Scott Creek **$345,000**

KEY ENHANCEMENTS

- Potentially formalize parking on the west side of Highway 1 with striping and an access lane
- Install speed feedback signs
- Realign vehicle through lanes to the east
- Remove informal parking on the east side to reduce pedestrians crossing the highway

PLACE TYPE

Rural Non-Mountainous

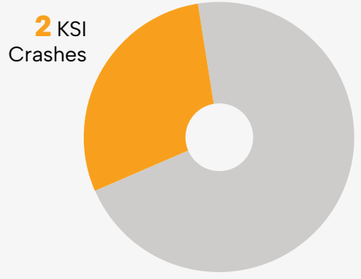
SEGMENT LENGTH

1,000 Feet

PROFILES ADDRESSED

Weekend Driving on Undeveloped Non Mountainous Roads

CRASH OUTCOMES



CRASH BY MODE

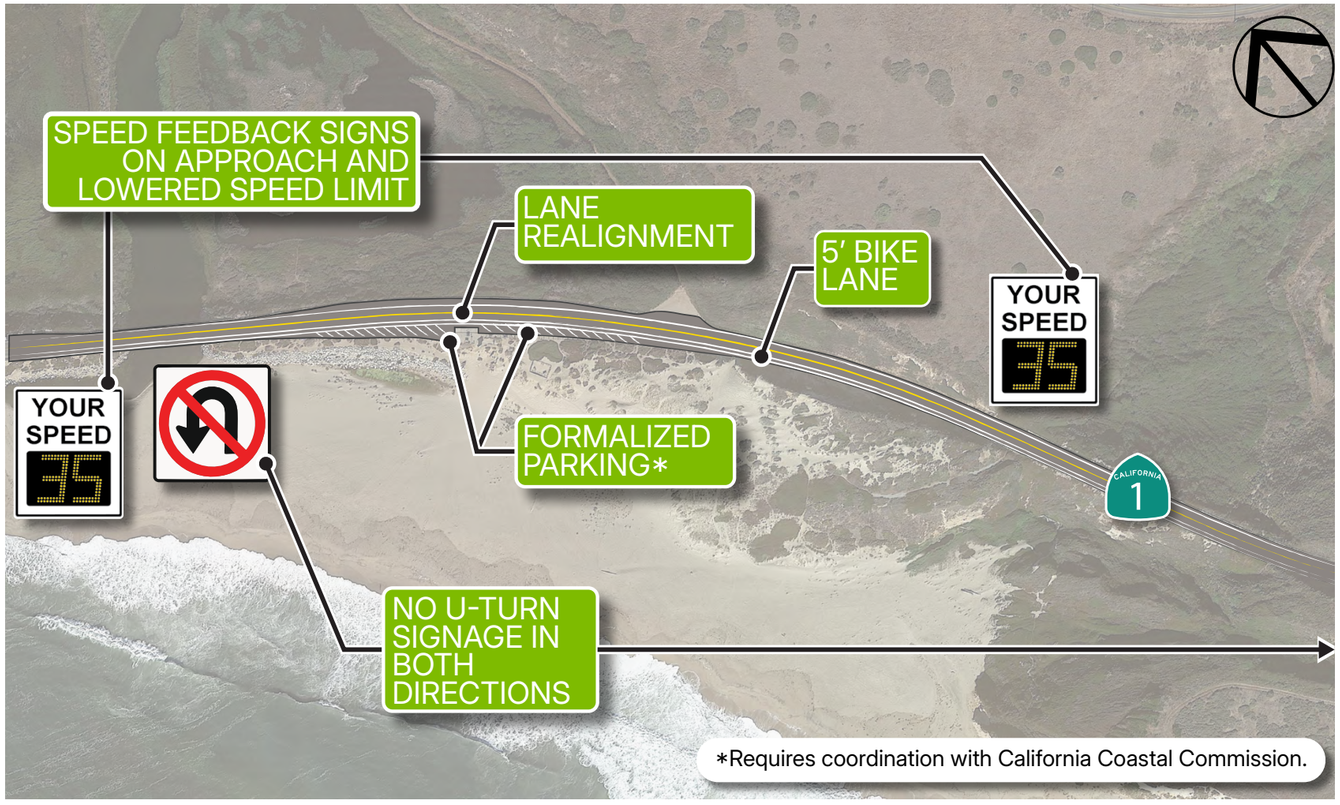
Pedestrian Crashes **0**

Bicycle Crashes **3**

FIGURE 24

Highway 1: Scott Creek | Managing turning and parking at visitor destinations

Highway 1 at Scott Creek is designated as an Undeveloped Non-Mountainous place type and serves as a key access point to coastal parking areas. Like many other locations on Highway 1 in within the study limits, the parking areas are informal and can make it challenging to maneuver. The corridor experiences many crashes related to weekend driving that are associated with high volumes of recreational users driving, biking, and walking.



PLANNING-LEVEL COST ESTIMATE (2026 DOLLARS)

$ Scott Creek **$345,000**

KEY ENHANCEMENTS

- Potentially formalize parking on the west side of Highway 1 with striping and an access lane
- Install speed feedback signs
- Realign vehicle through lanes to the east
- Remove informal parking on the east side to reduce pedestrians crossing the highway

PLACE TYPE

Rural Non-Mountainous

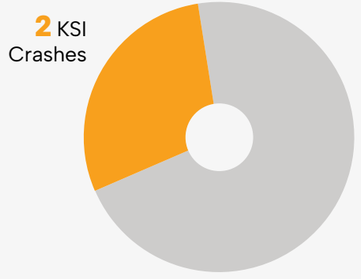
SEGMENT LENGTH

1,000 Feet

PROFILES ADDRESSED

Weekend Driving on Undeveloped Non Mountainous Roads

CRASH OUTCOMES



CRASH BY MODE

Pedestrian Crashes **0**

Bicycle Crashes **3**

FIGURE 25

Highway 1: Davenport | Incorporating pedestrian/bicycle facilities and crossing improvements along Main Streets

Highway 1 in Davenport is characterized as a Main Street place type with high pedestrian and vehicle volumes. Highway 1 in Davenport is characterized as a Main Street place type with high pedestrian and vehicle volumes. This section serves as a main access point to Davenport shops and restaurants, elementary school, and beaches with frequent crossings across Highway 1. The corridor experiences many excessive speeding and lane departure crashes.

PLANNING-LEVEL COST ESTIMATE (2026 DOLLARS)

Davenport	**$3,567,000**

KEY ENHANCEMENTS

- Provide gateway improvements and traffic calming measures
- Install rolled curbs with sidewalks to delineate pedestrian space
- Improve pedestrian crossing at Highway 1 and Ocean Street to increase visibility
- Enhance transit stops to support existing and future transit service
- Create connections for pedestrians and bicyclists through Davenport

PLACE TYPE

Main Street

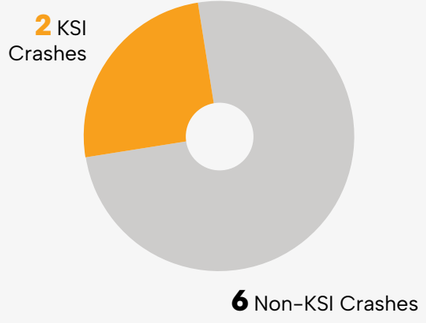
SEGMENT LENGTH

1,500 Feet

PROFILES ADDRESSED

Excessive Speed, Lane Departure

CRASH OUTCOMES



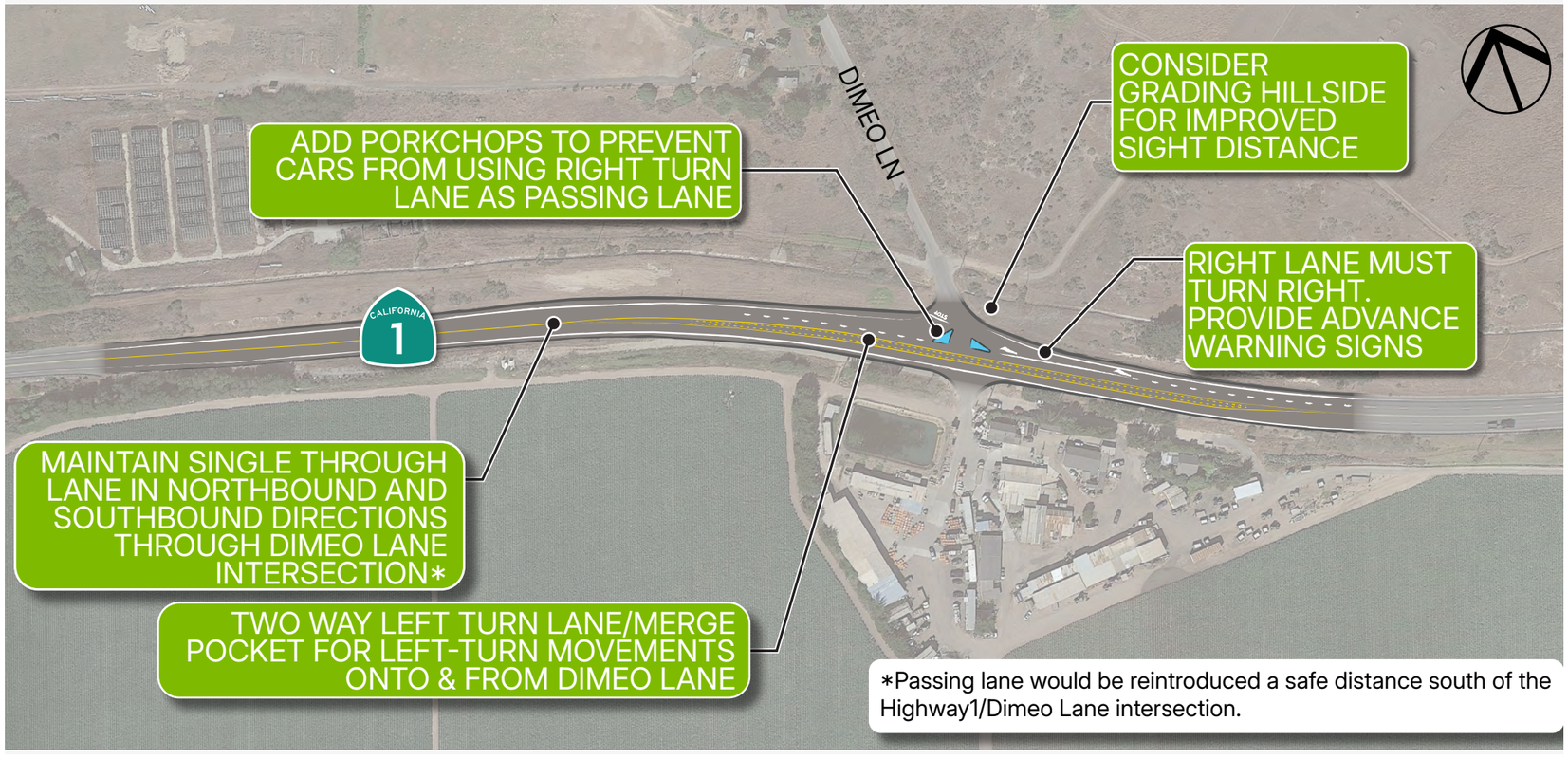
CRASH BY MODE

Pedestrian Crashes	**1**
Bicycle Crashes	**1**

FIGURE 26

Highway 1: Dimeo Lane/Transfer Station | Managing turns at locations with high truck and heavy vehicle volumes

Highway 1 at Dimeo Lane is designated as an Undeveloped Non-Mountainous place type and is primarily affected by excessive vehicle speeds and heavy vehicles traveling to/from the City of Santa Cruz Resource Recovery Facility. The intersection geometry of this location is representative of other areas on Highway 1 with visibility challenges and high vehicle and truck volumes. Intersection improvements should be designed to accommodate all turning movements for vehicle types including semi-trucks.



PLANNING-LEVEL COST ESTIMATE (2026 DOLLARS)

$ Dimeo Lane & Transfer Station **$1,066,000**

KEY ENHANCEMENTS

- Restripe turn lanes and passing lanes to discourage passing at the intersection and address sight distance concerns
- Add pork chop islands to help facilitate turn movements and improve visibility
- Narrow vehicle lanes
- Maintain shoulders for bike access

PLACE TYPE

Undeveloped Non-Mountainous

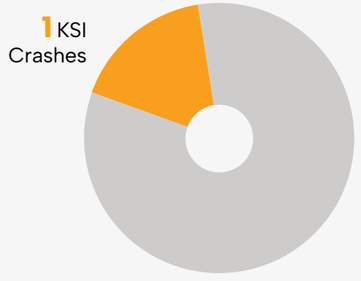
SEGMENT LENGTH

1,000 Feet

PROFILES ADDRESSED

Excessive Speed

CRASH OUTCOMES



CRASH BY MODE

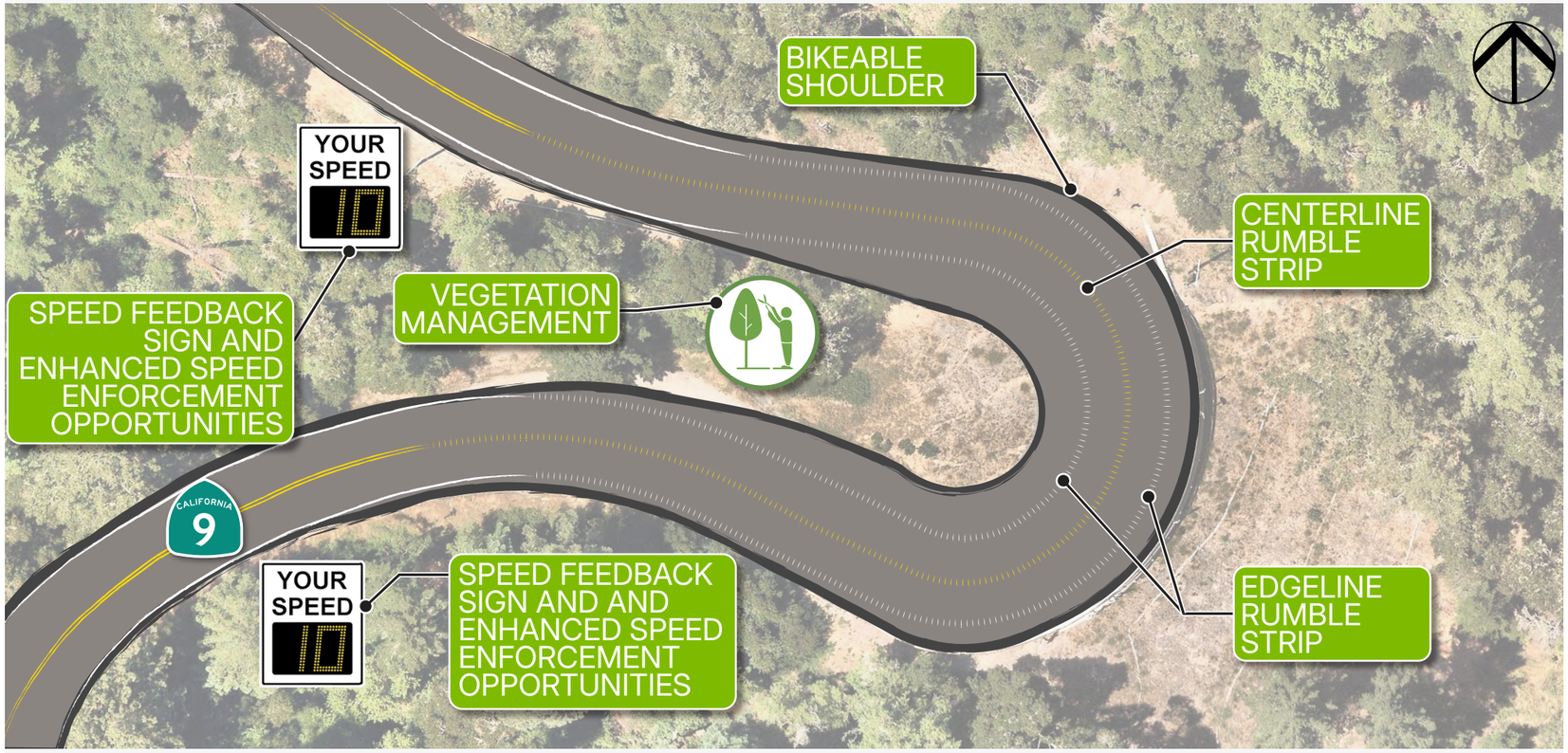
Pedestrian Crashes **0**

Bicycle Crashes **0**

FIGURE 27

Highway 9: Waterman Gap Hairpin Curve | Reducing vehicle speeds on narrow, curved, and mountainous locations

This segment of Highway 9, located at a hairpin turn south of the intersection with SR 236 and north of Saratoga Toll Road, is classified as Undeveloped Mountainous. The road is narrow with horizontal and vertical curves that present challenges related to sight distance, especially navigating tight or compounding curves. Anecdotal reports of speeding and racing on this portion of Highway 9 were shared in the community feedback. Although observed speed data shows average speeds of approximately 30 MPH, the corridor has a history of lane departure and DUI-related crashes.



PLANNING-LEVEL COST ESTIMATE (2026 DOLLARS)

Waterman Gap Hiairpin Curve **$211,000**

KEY ENHANCEMENTS

- Install centerline rumble strips
- Manage vegetation to maintain visibility
- Install speed feedback signs to encourage slower travel speeds
- Enhance speed enforcement opportunities

PLACE TYPE

Undeveloped Mountainous

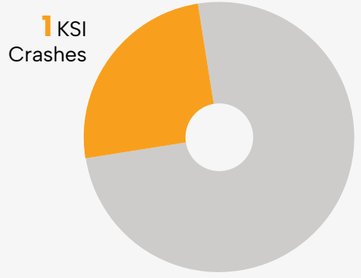
SEGMENT LENGTH

500 Feet

PROFILES ADDRESSED

Lane Departures, DUIs on Undeveloped Mountainous Roads

CRASH OUTCOMES



CRASH BY MODE

Pedestrian Crashes **0**

Bicycle Crashes **0**

FIGURE 28

Highway 9: Boulder Creek | Accommodating all road users within town centers

Highway 9 through Boulder Creek, from Bear Creek Road to Mountain Street, is characterized as a Main Street place type with a mix of narrow roads approaching downtown Boulder Creek and a more generous right-of-way with on-street parking within downtown. The area generally has limited sight distances and high levels of pedestrian activity. The corridor experiences many crashes falling into the excessive speeding and pedestrian crashes at night crash profiles.

KEY ENHANCEMENTS

- Provide gateway treatments such as medians, landscaping, and signage
- Install speed feedback signs to encourage slower travel speeds
- Enhance intersection and pedestrian crossings with Rectangular Rapid Flashing Beacons (RRFBs) and high-visibility crosswalks
- Improve transit stops by adding waiting areas and signage/ furniture
- Build sidewalk connections to close gaps
- Include dedicated bike facilities or bikeable shoulders according to context where feasible

PLACE TYPE

Main Street

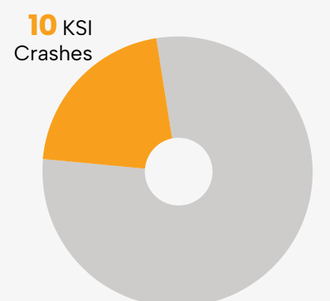
SEGMENT LENGTH

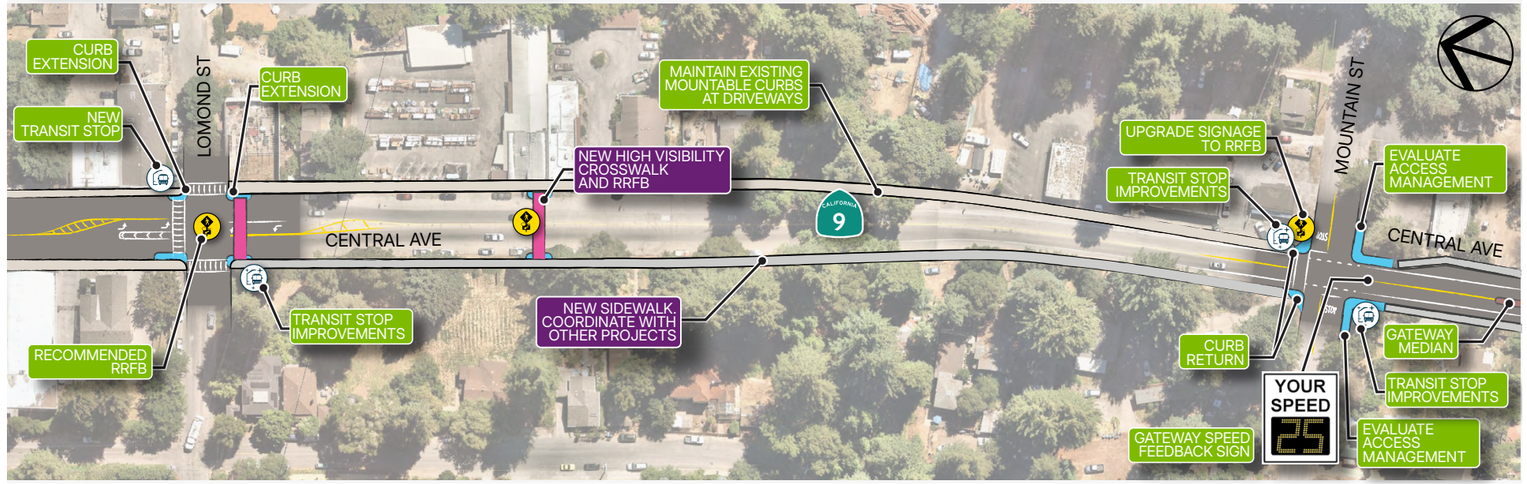
2,500 Feet

PROFILES ADDRESSED

Excessive Speed, Pedestrian Crashes, Pedestrians at Night

CRASH OUTCOMES





PLANNING-LEVEL COST ESTIMATE (2026 DOLLARS)

Boulder Creek	$4,978,000

CRASH BY MODE

Pedestrian Crashes	16
Bicycle Crashes	44

FIGURE 29

Highway 9: Ben Lomond (1 of 2) | Managing vehicle and pedestrian access through town centers

The Highway 9 segment through downtown Ben Lomond is a Main Street corridor with narrow curves, limited sight distance, and high pedestrian volumes. The area is affected by excessive speeds and frequent lane departure crashes. Enhancements will build on previous planning and design work done in the area including the San Lorenzo Valley (SLV) Complete Streets Plan and the Complete Streets Safety Assessment in Ben Lomond.

KEY ENHANCEMENTS

- Support existing crossing demand by right-sizing intersections and adding high visibility crosswalks, RRFBs, and curb extensions
- Provide gateway treatments including median islands, landscaping, and signage
- Improve transit stops by adding waiting areas and signage / furniture
- Narrow vehicle lanes
- Build sidewalk connections to close gaps

PLACE TYPE

Main Street

SEGMENT ENGTH

2,500 Feet

PROFILES ADDRESSED

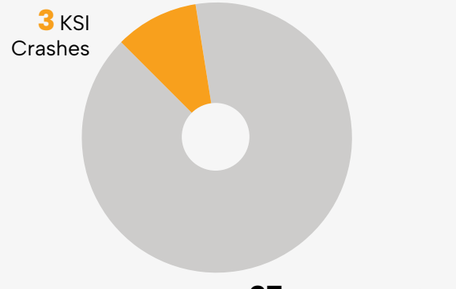
Excessive Speed, Lane Departure

PLANNING-LEVEL COST ESTIMATE

(2026 DOLLARS)

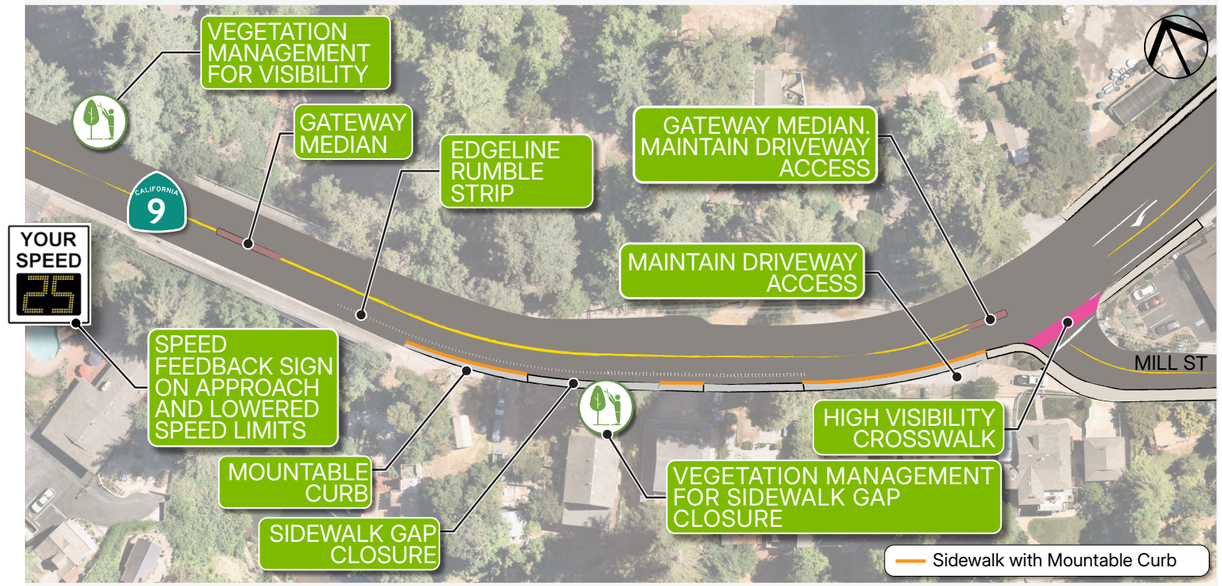
Ben Lomond	**$4,309,000**

CRASH OUTCOMES



CRASH BY MODE

Pedestrian Crashes	**0**
Bicycle Crashes	**10**



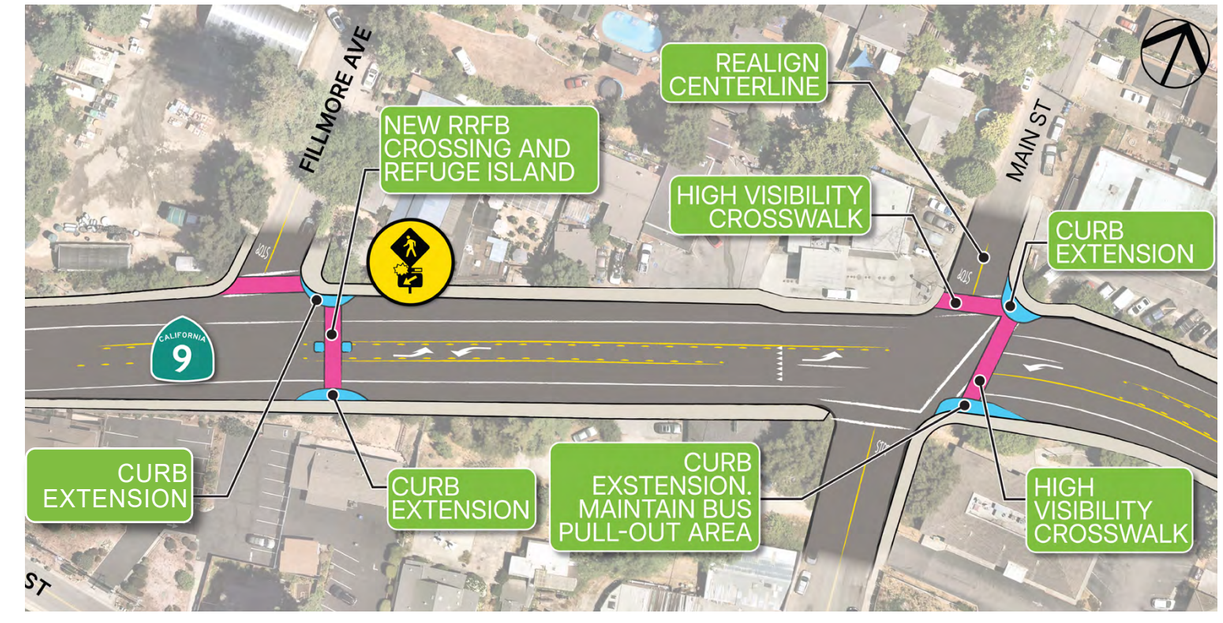


FIGURE 30

Highway 9: Ben Lomond (2 of 2) | Managing vehicle and pedestrian access through town centers

The Highway 9 segment through downtown Ben Lomond is a Main Street corridor with narrow curves, limited sight distance, and high pedestrian volumes. The area is affected by excessive speeds and frequent lane departure crashes. Enhancements will build on previous planning and design work done in the area including the San Lorenzo Valley (SLV) Complete Streets Plan and the Complete Streets Safety Assessment in Ben Lomond.

KEY ENHANCEMENTS

- Support existing crossing demand by right-sizing intersections and adding high visibility crosswalks, RRFBs, and curb extensions
- Provide gateway treatments including median islands, landscaping, and signage
- Improve transit stops by adding waiting areas and signage / furniture
- Narrow vehicle lanes
- Build sidewalk connections to close gaps

PLACE TYPE

Main Street

SEGMENT ENGTH

2,500 Feet

PROFILES ADDRESSED

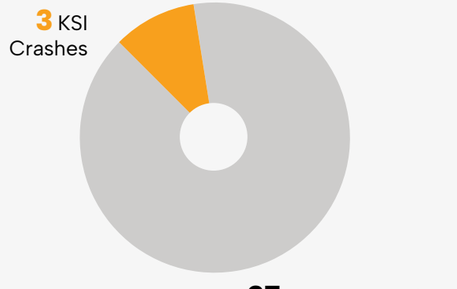
Excessive Speed, Lane Departure

PLANNING-LEVEL COST ESTIMATE

(2026 DOLLARS)

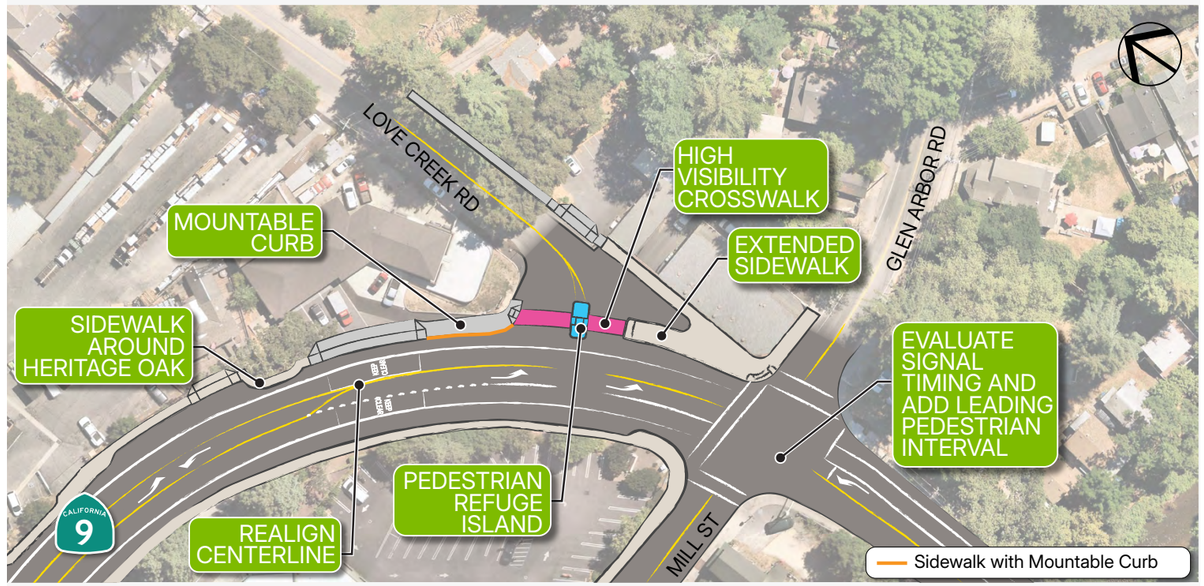
Ben Lomond	**$4,309,000**

CRASH OUTCOMES



CRASH BY MODE

Pedestrian Crashes	**0**
Bicycle Crashes	**10**



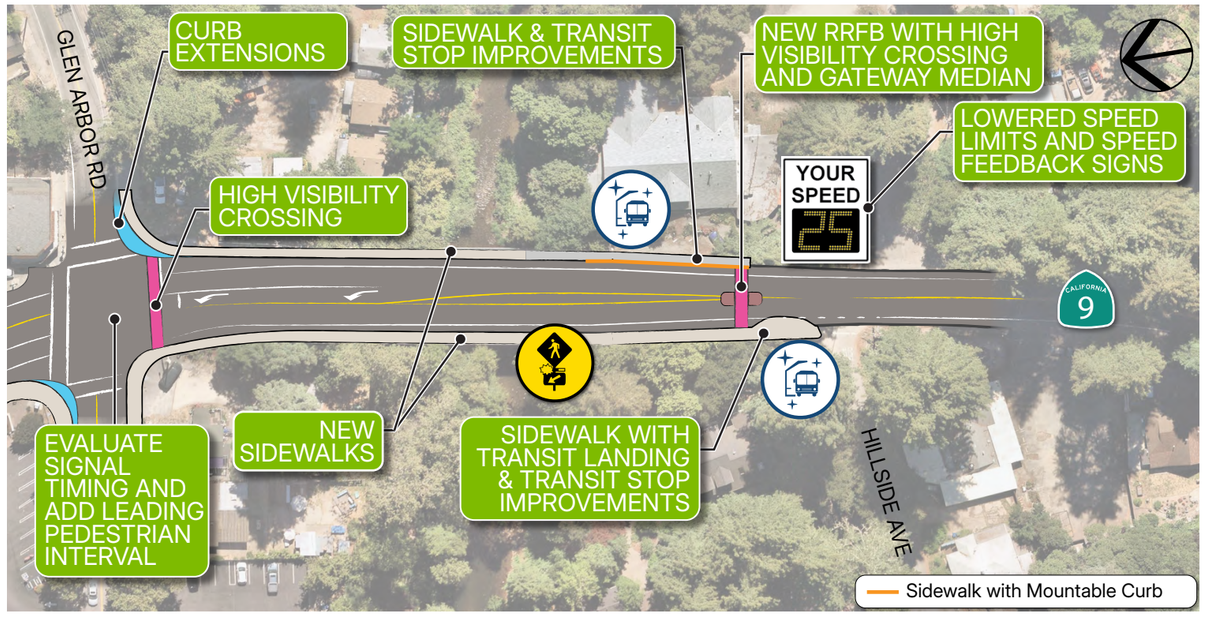
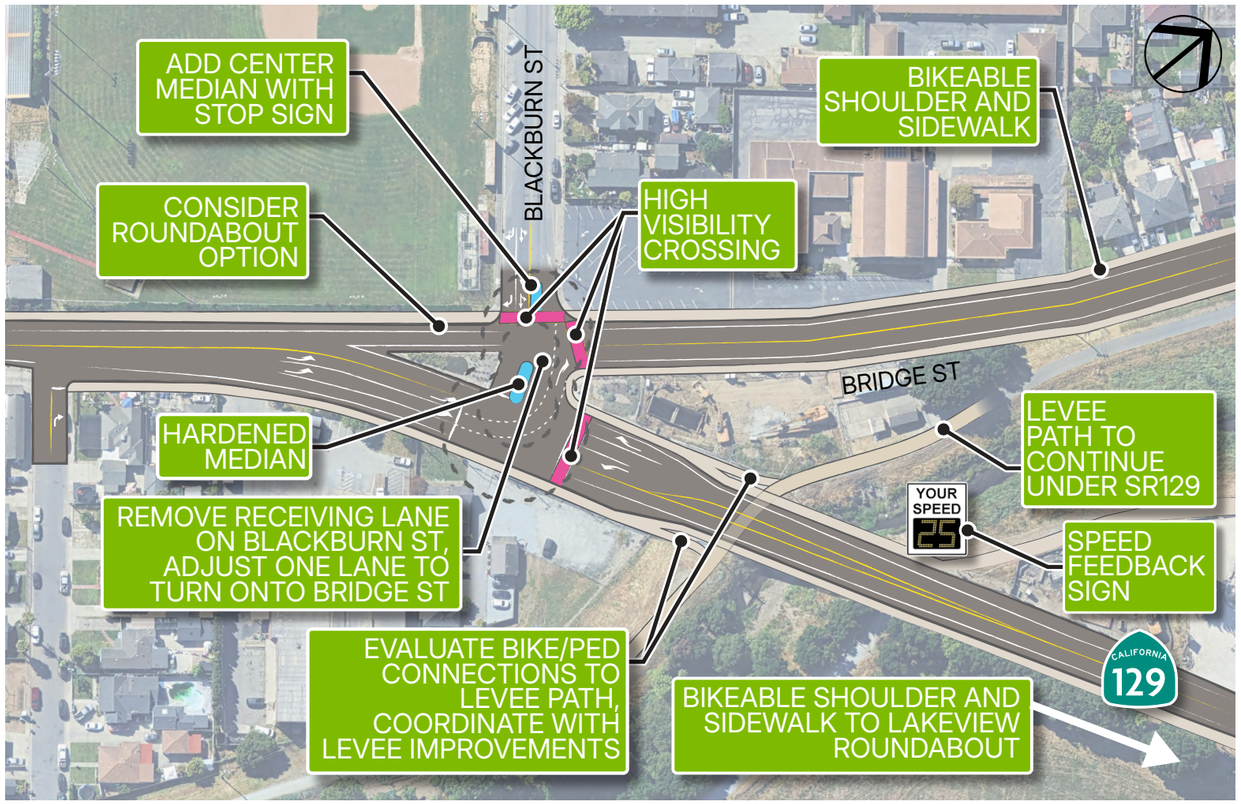


FIGURE 31

Highway 129: Blackburn Street/Bridge Street | Reducing conflicts at complex intersections in Transitional areas

Highway 129 near the eastern edge of the City of Watsonville is a Transitional place type and designated truck route with a diverse vehicle mix. While the project location is within the City of Watsonville, intersection treatments here can help to systemically manage speeds throughout the corridor, particularly in the segment just east of the City limits between this intersection and the Highway 129/Lakeview Road intersection. This segment provides access to agriculture lands and sees higher than typical heavy vehicle volumes, including trucks and farm equipment. Pedestrians and bicyclists on the corridor are typically a mix of people traveling to employment sites or participating in recreational activities. There is a history of excessive speeding and pedestrian-involved crashes.



PLANNING-LEVEL COST ESTIMATE (2026 DOLLARS)

$ Blackburn & Bridge **$24,084,000**

KEY ENHANCEMENTS

- Provide bikeable shoulders
- Build sidewalk connections to close gaps
- Install center medians
- Add high-visibility crosswalks to help improve pedestrian visibility
- Consider a roundabout to address speeds and conflict severity; potentially build additional roundabouts at other locations along Highway 129 with the goal of systemically managing speeds

PLACE TYPE

Transitional

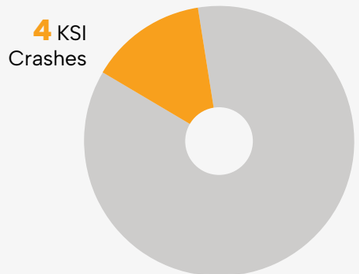
SEGMENT LENGTH

5,000 Feet

PROFILES ADDRESSED

Excessive Speed, Lane Departures

CRASH OUTCOMES



CRASH BY MODE

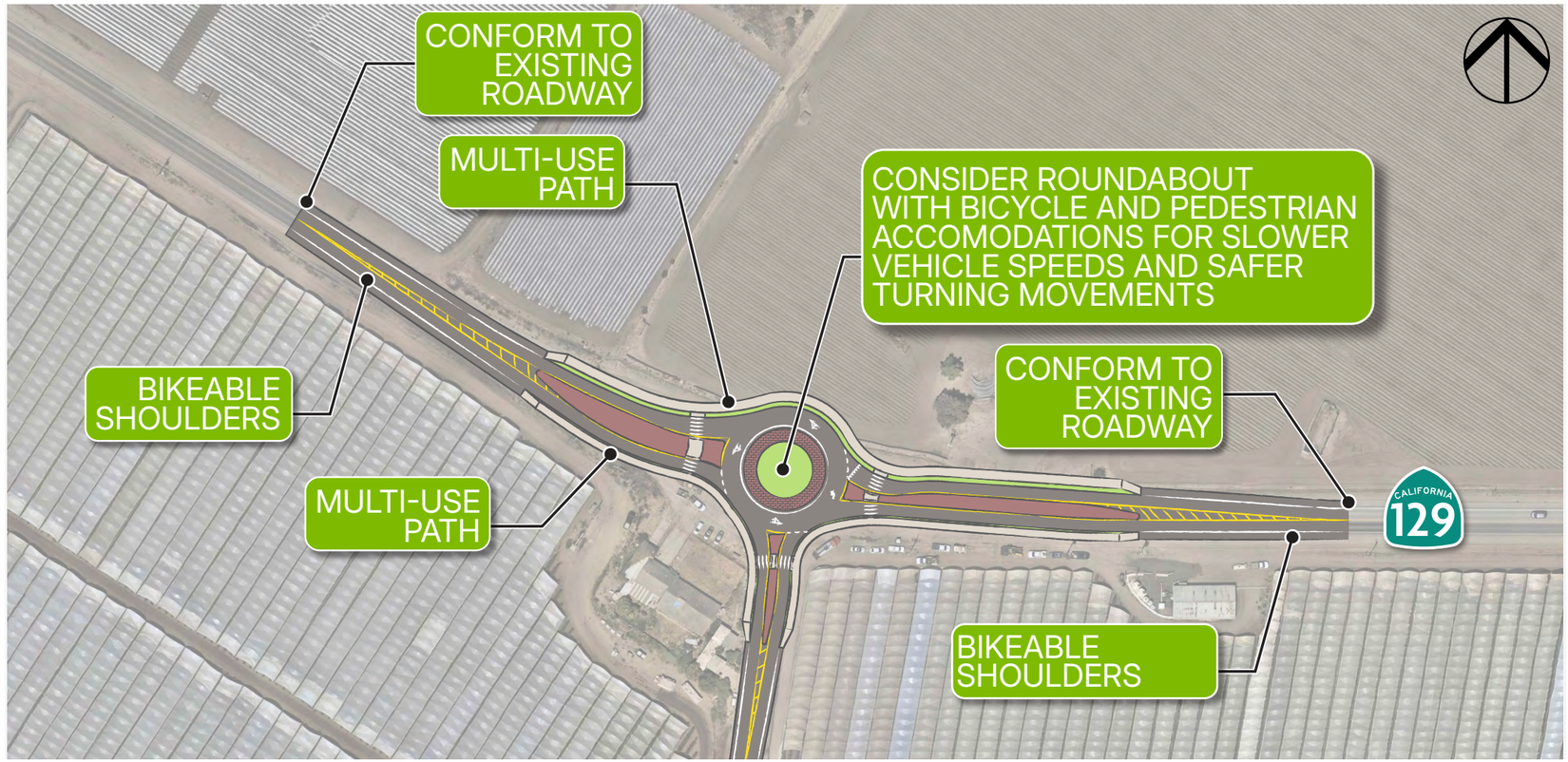
Pedestrian Crashes **7**

Bicycle Crashes **21**

FIGURE 32

Highway 129: Murphy Road | Reducing speeds on roads near agricultural uses

Near Murphy Road, Highway 129 is characterized as an Undeveloped Mountainous place type with agricultural rural characteristics. At the intersection, historical realignments of Highway 129 have created excess pavement that is no longer required as part of the traveled way but is not suitably delineated or separate to discourage use. Feedback indicated that the large paved areas near the intersection can lead to higher travel speeds, especially for turns. The corridor is affected by excessive speeds and lane departure crashes.



PLANNING-LEVEL COST ESTIMATE (2026 DOLLARS)

$ Murphy Rd **$7,298,000**

KEY ENHANCEMENTS

- Delineate or remove pavement outside the desired traveled way
- Install bike lane marking
- Consider a roundabout to address speeds and conflict severity; potentially build additional roundabouts at other locations along Highway 129 with the goal of systemically managing speeds

PLACE TYPE

Undeveloped Mountainous

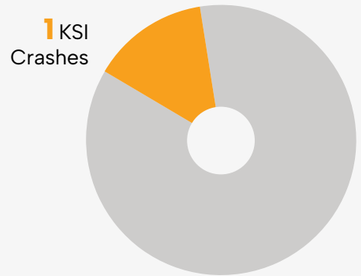
SEGMENT LENGTH

1,500 Feet

PROFILES ADDRESSED

Excessive Speed, Lane Departure

CRASH OUTCOMES



CRASH BY MODE

Pedestrian Crashes **0**

Bicycle Crashes **0**

FIGURE 33

Highway 152: Lakeview Middle School/St. Francis High/Fairgrounds Access | Designing for safe pedestrian and bicycle access near schools or other key destinations

Highway 152 northeast of Watsonville includes two key segments with distinct safety concerns. The Holohan Road segment, from the edge of the City to St. Francis High School, is a Main Street corridor that experiences unpredictable driveway movements and lane departure crashes. This segment includes both a middle school and high school that generate high vehicle and pedestrian volumes. There are many pedestrians crossing midblock to access the school and the church.

The Fairgrounds segment is a Transitional corridor with concerns related to long queues and high vehicle volumes during Fairgrounds events. Enhancements and improvements are focused on ingress and egress for all modes, including enhanced active transportation access that may reduce demand for vehicular travel during events.

KEY ENHANCEMENTS

- Build a Class I multi-use path parallel to Highway 152 along the segment
- Add traffic control such as a Pedestrian Hybrid Beacon (PHB) or traffic signal with high visibility crosswalks at the driveway to St. Francis High School
- Enhance School Zone signage to notify drivers of multiple school locations and pedestrian activity
- Complete sidewalk gap closures, including Class I trail connections
- Consolidate driveways where feasible

PLACE TYPE

Main Street, Transitional

SEGMENT LENGTH

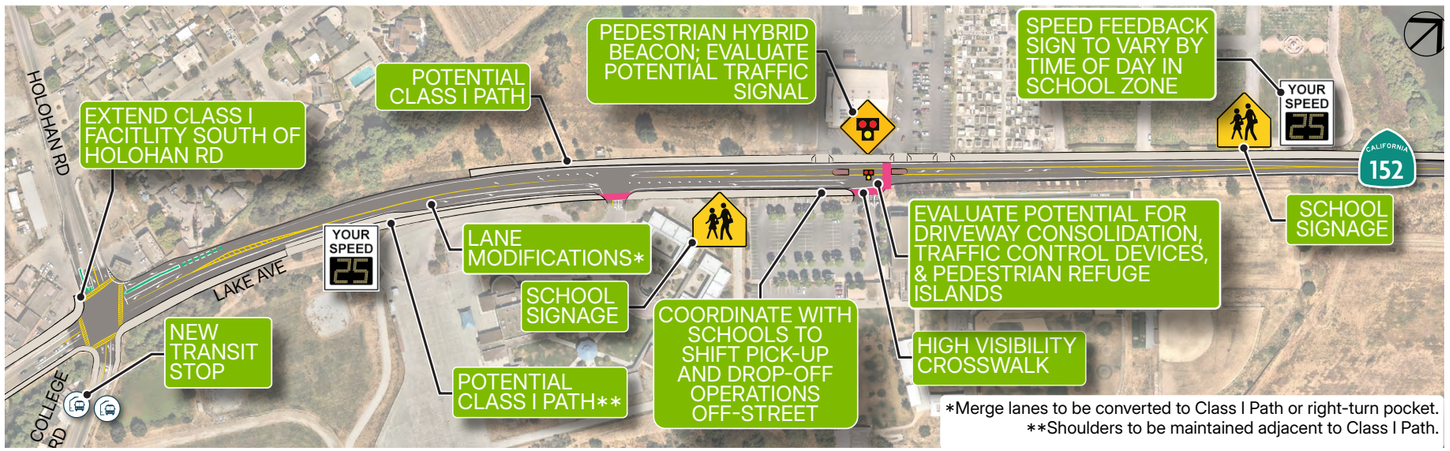
6,600 Feet

PROFILES ADDRESSED

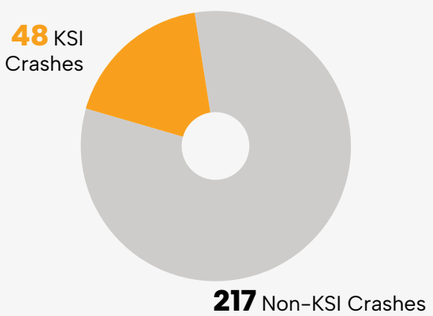
Excessive Speed, Lane Departures, Bicyclists on Narrow Roads, Turns on Transitional Roads

PLANNING-LEVEL COST ESTIMATE (2026 DOLLARS)

$ Lakeview Middle School/St. Francis High **$14,703,000**



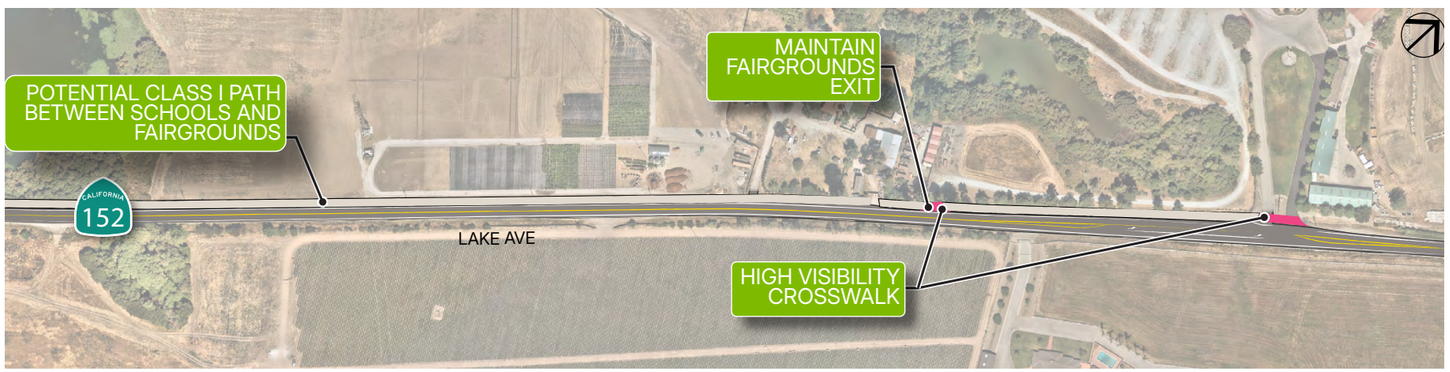
CRASH OUTCOMES



CRASH BY MODE

Pedestrian Crashes **78**

Bicycle Crashes **115**



Fehr & Peers

Attachment I-1: Planning Level Cost Estimates

Rural Highway Safety Plan
Highway 1: Scott Creek

MARK THOMAS

ITEM No.	BEES	ITEM DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	TOTAL
ROADWAY						
1	120100	TRAFFIC CONTROL SYSTEM	LS	1	$ 10,000	$ 10,000
2	130100	JOB SITE MANAGEMENT	LS	1	$ 5,000	$ 5,000
3	377501	SLURRY SEAL	TON	73	$ 1,000	$ 73,000
4		SIGNING AND STRIPING	LS	1	$ 30,000	$ 30,000
5	871400A	RADAR SPEED FEEDBACK SIGN SYSTEMS	EA	2	$ 15,000	$ 30,000
					ROADWAY SUBTOTAL	$ 148,000
6		MINOR ITEMS (10%)	LS	1	$ 15,000.00	$ 15,000
7		MOBILIZATION (10%)	LS	1	$ 16,000.00	$ 16,000
					CONSTRUCTION SUBTOTAL=	$ 179,000
					CONTINGENCY (30%)=	$ 54,000
					CONSTRUCTION TOTAL=	$ 233,000
					ENVIRONMENTAL SUPPORT=	$ 20,000.00
					PS&E SUPPORT=	$ 50,000.00
					CONSTRUCTION SUPPORT=	$ 41,940.00
					TOTAL SUPPORT COST=	$ 111,940.00
					TOTAL PROJECT COST=	$ 344,940.00

Rural Highway Safety Plan
Highway 1: Davenport

MARK THOMAS

ITEM No.	BEES	ITEM DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	TOTAL
ROADWAY						
1	120100	TRAFFIC CONTROL SYSTEM	LS	1	$ 30,000	$ 30,000
2	130100	JOB SITE MANAGEMENT	LS	1	$ 10,000	$ 10,000
3	130201	WATER POLLUTION CONTROL PROGRAM	LS	1	$ 3,000	$ 3,000
4	130201A	WATER POLLUTION CONTROL	LS	1	$ 50,000	$ 50,000
5	170103	CLEARING AND GRUBBING (LS)	LS	1	$ 50,000	$ 50,000
6	190101	ROADWAY EXCAVATION	CY	800	$ 100	$ 80,000
7	260203	CLASS 2 AGGREGATE BASE (CY)	CY	310	$ 200	$ 62,000
8	377501	SLURRY SEAL	TON	40	$ 1,000	$ 40,000
9	390132	HOT MIX ASPHALT (TYPE A)	TON	140	$ 250	$ 35,000
10	510060	RETAINING WALL	LS	1	$ 300,000	$ 300,000
11	730020A	MINOR CONCRETE (MOUNTABLE CURB) (CY)	CY	40	$ 1,500	$ 60,000
12	731504	MINOR CONCRETE (CURB AND GUTTER)	CY	80	$ 1,500	$ 120,000
13	731521	MINOR CONCRETE (SIDEWALK)	CY	300	$ 1,000	$ 300,000
14		SIGNING AND STRIPING	LS	1	$ 70,000	$ 70,000
15		BUS STOP	EA	2	$ 30,000	$ 60,000
16	870800	PEDESTRIAN HYBRID BEACON SYSTEMS	EA	1	$ 300,000	$ 300,000
17	871400A	RADAR SPEED FEEDBACK SIGN SYSTEMS	EA	1	$ 15,000	$ 15,000
					ROADWAY SUBTOTAL	$ 1,585,000
18		MINOR ITEMS (10%)	LS	1	$ 159,000.00	$ 159,000
19		MOBILIZATION (10%)	LS	1	$ 174,000.00	$ 174,000
					CONSTRUCTION SUBTOTAL=	$ 1,918,000
					CONTINGENCY (30%)=	$ 576,000
					CONSTRUCTION TOTAL=	$ 2,494,000
					ENVIRONMENTAL SUPPORT=	$ 150,000.00
					PS&E SUPPORT=	$ 473,860.00
					CONSTRUCTION SUPPORT=	$ 448,920.00
					TOTAL SUPPORT COST=	$ 1,072,780.00
					TOTAL PROJECT COST=	$ 3,566,780.00

Rural Highway Safety Plan
Highway 1: Dimeo Lane/Transfer Station

MARK THOMAS

ITEM No.	BEES	ITEM DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	TOTAL
ROADWAY						
1	120100	TRAFFIC CONTROL SYSTEM	LS	1	$ 50,000	$ 50,000
2	130100	JOB SITE MANAGEMENT	LS	1	$ 20,000	$ 20,000
3	130201	WATER POLLUTION CONTROL PROGRAM	LS	1	$ 3,000	$ 3,000
4	130201A	WATER POLLUTION CONTROL	LS	1	$ 25,000	$ 25,000
5	170103	CLEARING AND GRUBBING (LS)	LS	1	$ 10,000	$ 10,000
6	190101	ROADWAY EXCAVATION	CY	250	$ 200	$ 50,000
7	260203	CLASS 2 AGGREGATE BASE (CY)	CY	100	$ 200	$ 20,000
8	390132	HOT MIX ASPHALT (TYPE A)	TON	20	$ 250	$ 5,000
9	377501	SLURRY SEAL	TON	150	$ 1,000	$ 150,000
10	730020	MINOR CONCRETE (CURB) (CY)	CY	10	$ 1,500	$ 15,000
11	731530	MINOR CONCRETE (TEXTURED PAVING)	CY	10	$ 1,500	$ 15,000
12		SIGNING AND STRIPING	LS	1	$ 50,000	$ 50,000
					ROADWAY SUBTOTAL	$ 413,000
13		MINOR ITEMS (10%)	LS	1	$ 41,000.00	$ 41,000
14		MOBILIZATION (10%)	LS	1	$ 45,000.00	$ 45,000
					CONSTRUCTION SUBTOTAL=	$ 499,000
					CONTINGENCY (30%)=	$ 150,000
					CONSTRUCTION TOTAL=	$ 649,000
					ENVIRONMENTAL SUPPORT=	$ 150,000.00
					PS&E SUPPORT=	$ 200,000.00
					CONSTRUCTION SUPPORT=	$ 116,820.00
					TOTAL SUPPORT COST=	$ 416,820.00
					TOTAL PROJECT COST=	$ 1,065,820.00

Rural Highway Safety Plan
Highway 9: Waterman Gap Hairpin Curve

MARK THOMAS

ITEM No.	BEES	ITEM DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	TOTAL
ROADWAY						
1	120100	TRAFFIC CONTROL SYSTEM	LS	1	$ 5,000	$ 5,000
2	130100	JOB SITE MANAGEMENT	LS	1	$ 5,000	$ 5,000
3	170103	CLEARING AND GRUBBING (LS)	LS	1	$ 7,500	$ 7,500
4	377501	SLURRY SEAL	TON	22	$ 1,000	$ 22,000
5		SIGNING AND STRIPING	LS	1	$ 12,000	$ 12,000
6	846046	6" RUMBLE STRIP (ASPHALT CONCRETE PAVEMENT)	STA	15	$ 500	$ 7,500
7	871400A	RADAR SPEED FEEDBACK SIGN SYSTEMS	EA	2	$ 15,000	$ 30,000
					ROADWAY SUBTOTAL	$ 89,000
8		MINOR ITEMS (10%)	LS	1	$ 9,000.00	$ 9,000
9		MOBILIZATION (10%)	LS	1	$ 10,000.00	$ 10,000
					CONSTRUCTION SUBTOTAL=	$ 108,000
					CONTINGENCY (30%)=	$ 33,000
					CONSTRUCTION TOTAL=	$ 141,000
					ENVIRONMENTAL SUPPORT=	$ 20,000.00
					PS&E SUPPORT=	$ 25,000.00
					CONSTRUCTION SUPPORT=	$ 25,380.00
					TOTAL SUPPORT COST=	$ 70,380.00
					TOTAL PROJECT COST=	$ 211,380.00

Rural Highway Safety Plan
Highway 9: Ben Lomond

MARK THOMAS

ITEM No.	BEES	ITEM DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	TOTAL
ROADWAY						
1	120100	TRAFFIC CONTROL SYSTEM	LS	1	$ 75,000	$ 75,000
2	130100	JOB SITE MANAGEMENT	LS	1	$ 30,000	$ 30,000
3	130201	WATER POLLUTION CONTROL PROGRAM	LS	1	$ 3,000	$ 3,000
4	130201A	WATER POLLUTION CONTROL	LS	1	$ 25,000	$ 25,000
5	170103	CLEARING AND GRUBBING (LS)	LS	1	$ 25,000	$ 25,000
6	190101	ROADWAY EXCAVATION	CY	1,800	$ 60	$ 108,000
7	260203	CLASS 2 AGGREGATE BASE (CY)	CY	680	$ 200	$ 136,000
8	377501	SLURRY SEAL	TON	150	$ 1,000	$ 150,000
9	390132	HOT MIX ASPHALT (TYPE A)	TON	590	$ 250	$ 147,500
10	730020	MINOR CONCRETE (CURB) (CY)	CY	10	$ 1,500	$ 15,000
11	731504	MINOR CONCRETE (CURB AND GUTTER)	CY	260	$ 1,500	$ 390,000
12	731521	MINOR CONCRETE (SIDEWALK)	CY	410	$ 1,000	$ 410,000
13	730020A	MINOR CONCRETE (MOUNTABLE CURB) (CY)	CY	20	$ 1,500	$ 30,000
14	731530	MINOR CONCRETE (TEXTURED PAVING)	CY	10	$ 2,600	$ 26,000
15		BUS STOP	EA	2	$ 30,000	$ 60,000
16	650000A	DRAINAGE	LS	1	$ 100,000	$ 100,000
17	846046	6" RUMBLE STRIP (ASPHALT CONCRETE PAVEMENT)	STA	12	$ 750	$ 9,000
18		GATEWAY MEDIAN	LS	1	$ 15,000	$ 15,000
19		SIGNING AND STRIPING	LS	1	$ 175,000	$ 175,000
20	870700A	RECTANGULAR RAPID FLASHING BEACON SYSTEMS	EA	6	$ 20,000	$ 120,000
21	871400A	RADAR SPEED FEEDBACK SIGN SYSTEMS	EA	1	$ 15,000	$ 15,000
					ROADWAY SUBTOTAL	$ 1,929,500
22		MINOR ITEMS (10%)	LS	1	$ 193,000.00	$ 193,000
23		MOBILIZATION (10%)	LS	1	$ 212,000.00	$ 212,000
					CONSTRUCTION SUBTOTAL=	$ 2,334,500
					CONTINGENCY (30%)=	$ 701,000
					CONSTRUCTION TOTAL=	$ 3,035,500
					ENVIRONMENTAL SUPPORT=	$ 150,000.00
					PS&E SUPPORT=	$ 576,745.00
					CONSTRUCTION SUPPORT=	$ 546,390.00
					TOTAL SUPPORT COST=	$ 1,273,135.00
					TOTAL PROJECT COST=	$ 4,308,635.00

Rural Highway Safety Plan
Highway 9: Boulder Creek

MARK THOMAS

ITEM No.	BEES	ITEM DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	TOTAL
ROADWAY						
1	120100	TRAFFIC CONTROL SYSTEM	LS	1	$ 100,000	$ 100,000
2	130100	JOB SITE MANAGEMENT	LS	1	$ 30,000	$ 30,000
3	130201	WATER POLLUTION CONTROL PROGRAM	LS	1	$ 3,000	$ 3,000
4	130201A	WATER POLLUTION CONTROL	LS	1	$ 25,000	$ 25,000
5	190101	ROADWAY EXCAVATION	CY	1,700	$ 60	$ 102,000
6	260203	CLASS 2 AGGREGATE BASE (CY)	CY	900	$ 200	$ 180,000
7	377501	SLURRY SEAL	TON	80	$ 1,000	$ 80,000
8	390132	HOT MIX ASPHALT (TYPE A)	TON	480	$ 250	$ 120,000
9	650000A	DRAINAGE	LS	1	$ 200,000	$ 200,000
10	730020	MINOR CONCRETE (CURB) (CY)	CY	10	$ 1,500	$ 15,000
11	731504	MINOR CONCRETE (CURB AND GUTTER)	CY	280	$ 1,500	$ 420,000
12	731521	MINOR CONCRETE (SIDEWALK)	CY	470	$ 1,000	$ 470,000
13		SIGNING AND STRIPING	LS	1	$ 125,000	$ 125,000
14		BUS STOP	EA	4	$ 30,000	$ 120,000
15	870700A	RECTANGULAR RAPID FLASHING BEACON SYSTEMS	EA	12	$ 20,000	$ 240,000
16	871400A	RADAR SPEED FEEDBACK SIGN SYSTEMS	EA	2	$ 15,000	$ 30,000
					ROADWAY SUBTOTAL	$ 2,260,000
17		MINOR ITEMS (10%)	LS	1	$ 226,000.00	$ 226,000
18		MOBILIZATION (10%)	LS	1	$ 249,000.00	$ 249,000
					CONSTRUCTION SUBTOTAL=	$ 2,735,000
					CONTINGENCY (30%)=	$ 821,000
					CONSTRUCTION TOTAL=	$ 3,556,000
					ENVIRONMENTAL SUPPORT=	$ 106,680.00
					PS&E SUPPORT=	$ 675,640.00
					CONSTRUCTION SUPPORT=	$ 640,080.00
					TOTAL SUPPORT COST=	$ 1,422,400.00
					TOTAL PROJECT COST=	$ 4,978,400.00

Rural Highway Safety Plan
Highway 129: Blackburn St & Bridge St

MARK THOMAS

ITEM No.	BEES	ITEM DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	TOTAL
ROADWAY						
1	100100	DEVELOP WATER SUPPLY	LS	1	$ 20,000	$ 20,000
2	120100	TRAFFIC CONTROL SYSTEM	LS	1	$ 400,000	$ 400,000
3	130100	JOB SITE MANAGEMENT	LS	1	$ 10,000	$ 10,000
4	130301	STORMWATER POLLUTION PREVENTION PLAN	LS	1	$ 5,000	$ 5,000
5	130201A	WATER POLLUTION CONTROL	LS	1	$ 100,000	$ 100,000
6	170103	CLEARING AND GRUBBING (LS)	LS	1	$ 20,000	$ 20,000
7	190101	ROADWAY EXCAVATION	CY	5,400	$ 60	$ 324,000
8	198010	IMPORTED BORROW (CY)	CY	35,000	$ 50	$ 1,750,000
9	260203	CLASS 2 AGGREGATE BASE (CY)	CY	2,800	$ 125	$ 350,000
10	390132	HOT MIX ASPHALT (TYPE A)	TON	3,100	$ 150	$ 465,000
11	510060	RETAINING WALL	LS	1	$ 950,000	$ 950,000
12	650000A	DRAINAGE	LS	1	$ 300,000	$ 300,000
13	730020	MINOR CONCRETE (CURB) (CY)	CY	10	$ 1,500	$ 15,000
14	731504	MINOR CONCRETE (CURB AND GUTTER)	CY	150	$ 1,500	$ 225,000
15	731521	MINOR CONCRETE (SIDEWALK)	CY	230	$ 1,000	$ 230,000
16		SIGNING AND STRIPING	LS	1	$ 200,000	$ 200,000
17	871400A	RADAR SPEED FEEDBACK SIGN SYSTEMS	EA	1	$ 15,000	$ 15,000
18	870400	SIGNAL AND LIGHTING SYSTEM	LS	1	$ 1,000,000	$ 1,000,000
					ROADWAY SUBTOTAL	$ 6,359,000
STRUCTURES						
21		FLOOD WALL	LS	1	$ 1,150,000	$ 1,150,000
22		SR 129 OVER SALSIPUEDES CREEK BRIDGE REPLACEMENT	LS	1	$ 3,580,000	$ 3,580,000
					STRUCTURES SUBTOTAL	$ 4,730,000
19		MINOR ITEMS (10%)	LS	1	$ 1,109,000.00	$ 1,109,000
20		MOBILIZATION (10%)	LS	1	$ 1,220,000.00	$ 1,220,000
					CONSTRUCTION SUBTOTAL=	$ 13,418,000
					CONTINGENCY (30%)=	$ 4,026,000
					CONSTRUCTION TOTAL=	$ 17,444,000
					ENVIRONMENTAL SUPPORT=	$ 800,000.00
					PS&E SUPPORT=	$ 2,700,000.00
					CONSTRUCTION SUPPORT=	$ 3,139,920.00
					TOTAL SUPPORT COST=	$ 6,639,920.00
					TOTAL PROJECT COST=	$ 24,083,920.00

Rural Highway Safety Plan
Highway 129: Murphy Road

MARK THOMAS

ITEM No.	BEES	ITEM DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	TOTAL
ROADWAY						
1	120100	TRAFFIC CONTROL SYSTEM	LS	1	$ 200,000	$ 200,000
2	130100	JOB SITE MANAGEMENT	LS	1	$ 50,000	$ 50,000
3	130301	STORMWATER POLLUTION PREVENTION PLAN	LS	1	$ 10,000	$ 10,000
4	130201A	WATER POLLUTION CONTROL	LS	1	$ 100,000	$ 100,000
5	170103	CLEARING AND GRUBBING (LS)	LS	1	$ 50,000	$ 50,000
6	190101	ROADWAY EXCAVATION	CY	8,400	$ 60	$ 504,000
7	198010	IMPORTED BORROW (CY)	CY	4,000	$ 50	$ 200,000
8	260203	CLASS 2 AGGREGATE BASE (CY)	CY	5,000	$ 125	$ 625,000
9	390132	HOT MIX ASPHALT (TYPE A)	TON	2,600	$ 150	$ 390,000
10	730020	MINOR CONCRETE (CURB) (CY)	CY	40	$ 1,500	$ 60,000
11	731504	MINOR CONCRETE (CURB AND GUTTER)	CY	100	$ 1,500	$ 150,000
12	731519A	MINOR CONCRETE (TRUCK APRON)	CY	80	$ 1,500	$ 120,000
13	731521	MINOR CONCRETE (SIDEWALK)	CY	180	$ 1,000	$ 180,000
14	731530	MINOR CONCRETE (TEXTURED PAVING)	CY	110	$ 1,500	$ 165,000
15	846046	6" RUMBLE STRIP (ASPHALT CONCRETE PAVEMENT)	STA	15	$ 500	$ 7,500
16		SIGNING AND STRIPING	LS	1	$ 150,000	$ 150,000
					ROADWAY SUBTOTAL	$ 2,961,500
17		MINOR ITEMS (10%)	LS	1	$ 296,000.00	$ 296,000
18		MOBILIZATION (10%)	LS	1	$ 326,000.00	$ 326,000
					CONSTRUCTION SUBTOTAL=	$ 3,583,500
					CONTINGENCY (30%)=	$ 1,076,000
					CONSTRUCTION TOTAL=	$ 4,659,500
					ENVIRONMENTAL SUPPORT=	$ 300,000.00
					PS&E SUPPORT=	$ 1,500,000.00
					CONSTRUCTION SUPPORT=	$ 838,710.00
					TOTAL SUPPORT COST=	$ 2,638,710.00
					TOTAL PROJECT COST=	$ 7,298,210.00

Rural Highway Safety Plan
Highway 152: Lakeview Middle School/
St. Francis High School/Fairgrounds Access

MARK THOMAS

ITEM No.	BEES	ITEM DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	TOTAL
ROADWAY						
1	120100	TRAFFIC CONTROL SYSTEM	LS	1	$ 200,000	$ 200,000
2	130100	JOB SITE MANAGEMENT	LS	1	$ 75,000	$ 75,000
3	130301	STORMWATER POLLUTION PREVENTION PLAN	LS	1	$ 10,000	$ 10,000
4	130201A	WATER POLLUTION CONTROL	LS	1	$ 100,000	$ 100,000
5	170103	CLEARING AND GRUBBING (LS)	LS	1	$ 50,000	$ 50,000
3	190101	ROADWAY EXCAVATION	CY	7,300	$ 60	$ 438,000
4	260203	CLASS 2 AGGREGATE BASE (CY)	CY	2,600	$ 100	$ 260,000
5	377501	SLURRY SEAL	TON	230	$ 1,000	$ 230,000
6	390132	HOT MIX ASPHALT (TYPE A)	TON	1,320	$ 150	$ 198,000
7	650000A	DRAINAGE	LS	1	$ 500,000	$ 500,000
8	730020	MINOR CONCRETE (CURB) (CY)	CY	10	$ 1,500	$ 15,000
9	731504	MINOR CONCRETE (CURB AND GUTTER)	CY	750	$ 1,500	$ 1,125,000
10	731521	MINOR CONCRETE (SIDEWALK)	CY	2,900	$ 1,000	$ 2,900,000
11		SIGNING AND STRIPING	LS	1	$ 200,000	$ 200,000
12		BUS STOP	EA	2	$ 30,000	$ 60,000
13	870800	PEDESTRIAN HYBRID BEACON SYSTEMS	EA	1	$ 300,000	$ 300,000
14	871400A	RADAR SPEED FEEDBACK SIGN SYSTEMS	EA	1	$ 15,000	$ 15,000
					ROADWAY SUBTOTAL	$ 6,676,000
15		MINOR ITEMS (10%)	LS	1	$ 668,000.00	$ 668,000
16		MOBILIZATION (10%)	LS	1	$ 734,000.00	$ 734,000
					CONSTRUCTION SUBTOTAL=	$ 8,078,000
					CONTINGENCY (30%)=	$ 2,424,000
					CONSTRUCTION TOTAL=	$ 10,502,000
					ENVIRONMENTAL SUPPORT=	$ 315,060.00
					PS&E SUPPORT=	$ 1,995,380.00
					CONSTRUCTION SUPPORT=	$ 1,890,360.00
					TOTAL SUPPORT COST=	$ 4,200,800.00
					TOTAL PROJECT COST=	$ 14,702,800.00

Appendix J. Equity Memo

APPENDIX J

Equity Analysis

Originally Submitted on September 17, 2024

The Rural Highway Safety Plan (RHSP) will be informed by various demographic factors commonly applied as part of state and federal equity analysis tools that assist local jurisdictions in identifying disadvantaged communities. This memo provides an overview of household income and race/ethnicity data for the census tracts within Santa Cruz County as well as a review of equity-related designations established through one federal mapping tool (the Safe Streets and Roads for All Underserved Communities Tool) and two tools specific to California (the California Healthy Places Index and the Climate Investments Priority Populations Mapping Tool). The memo is intended to serve as a starting point and complement ongoing efforts by the Santa Cruz County Regional Transportation Commission (RTC) to identify underserved communities within the county where residents may be at disproportionate risk for negative traffic safety outcomes.

HOUSEHOLD INCOME

Based on 2023 American Community Survey (ACS) data, Santa Cruz County census tracts have a mean household income of $150,630 and a median household income of $112,244. The mean exceeds both the California median ($95,521) and the U.S. median ($77,719) household incomes. The county's median income, which is less influenced by outliers, is also higher than state and national figures, as shown in *Table 1*.

Table 1: Household incomes for Santa Cruz County and California (2023 ACS 5-year estimates)

	Santa Cruz County	California
Mean Household Income	$150,630	$134,491
Median Household Income	$112,244	$95,521

The 200% of Federal Poverty Level (FPL) is a common income threshold used in the U.S. to assess eligibility for various public assistance programs. It represents two times the FPL and is often used as a benchmark for low-income status. Based on a household size of three, which is roughly equivalent to Santa Cruz County's median household size of 2.6, the 200% FPL is about $53,300 (*Table 2*). The county's median household income is more than double this amount, indicating some level of overall economic prosperity. However, the difference between the mean and median in Santa Cruz County also points to income inequality, with some households earning significantly more than the median household.

Table 2: 200% of the Federal Poverty Level for household sizes (2025 Poverty Guidelines)

Number of Persons in Family/Household	200% of Federal Poverty Level (effective through 9/30/2025)
1	$31,300
2	$42,300
3	$53,300
4	$64,300
5	$75,300
6	$86,300
7	$97,300
8	$108,300

Out of 69 census tracts in Santa Cruz County, 23 tracts (33%) have a median household income below California's median of $95,521, and one tract (1%) falls below 200% FPL for a family of three (approximately $53,300), highlighting pockets of economic vulnerability despite the county's overall high median income.

Figure 1 provides a map of census tracts gradated by color in quintiles according to median household income, with the darkest shades indicating census tracts with the lowest incomes in the county. Lower-income census tracts are generally concentrated near the Brookdale community and the cities of Santa Cruz and Watsonville.

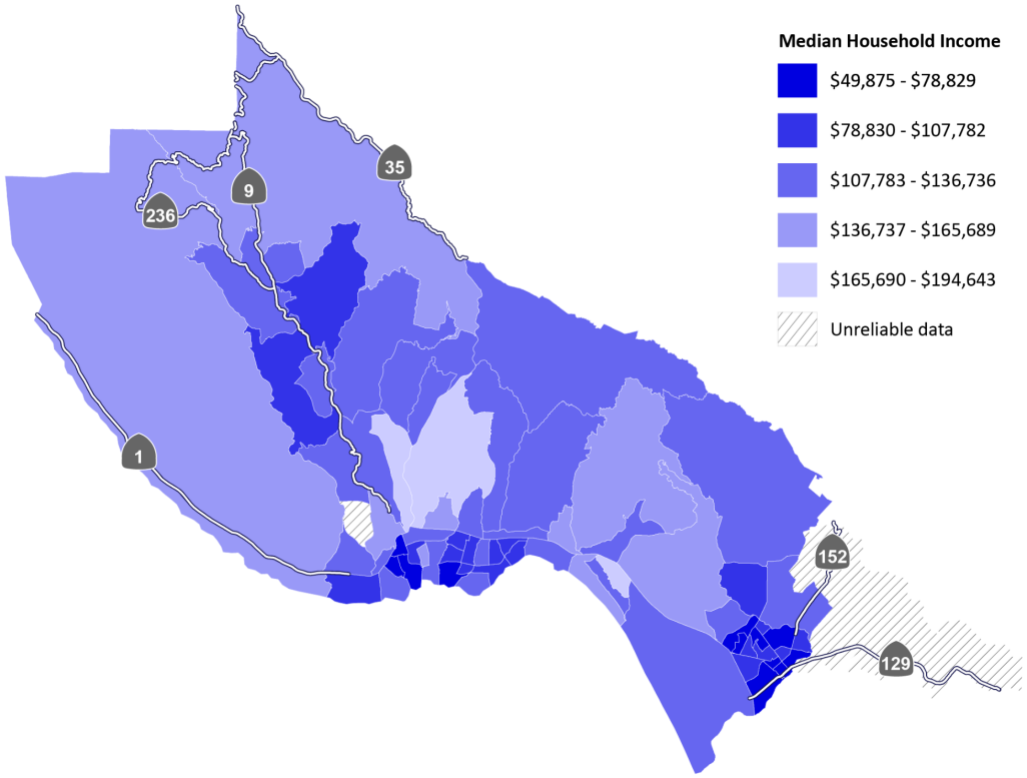


Figure 1: Santa Cruz County census tracts by median household income

RACE AND ETHNICITY

Based on 2020 Decennial Census data, Santa Cruz County is less racially diverse than California as a whole as summarized in *Table 3*. It has a higher proportion of non-Hispanic White residents (54%) and a lower representation of Asian, Black, and Hispanic/Latino populations (46%) compared to the state averages (35% and 65%, respectively). Overall, people of color make up a smaller share of the population in Santa Cruz than they do statewide, reflecting more limited racial diversity. The racial composition suggests a somewhat more homogeneous population in Santa Cruz relative to the broader diversity seen across California.

Table 3: Race and ethnicity for Santa Cruz County and California (2020 Decennial Census data)

	Santa Cruz County	California
Hispanic or Latino	35%	39%
White alone*	54%	35%
Black or African American alone*	1%	5%
Native alone*	0.3%	0.4%
Asian alone*	5%	15%
Pacific Islander alone*	0.1%	0.4%
Other race alone*	0.6%	0.6%
Two or more races*	4%	5%

**Not Hispanic or Latino*

Race and ethnicity are often used as factors used by agencies to identify underserved communities as exemplified through mapping tools developed by other Regional Transportation Planning Agencies. For example, the Metropolitan Transportation Commission's Equity Priority Communities criteria for the San Francisco Bay Area identifies underserved census tracts using eight different factors including a 70% people of color threshold. Additionally, the Los Angeles County Metropolitan Transportation Authority's Equity-Focus Communities criteria identifies High Need and Very High Need communities using three criteria including the community's percentage of Black, Indigenous, and People of Color.

Figure 2 provides a map of Santa Cruz County census tracts gradated by color in quintiles according to percentage of people of color with the darkest shades indicating census tracts with the highest percentages. For purposes of this memo, "people of color" is defined as non-White residents according to 2020 Decennial Census data. Census tracts with the highest percentages of people of color are generally located near the cities of Santa Cruz and Watsonville as well as at the University of California, Santa Cruz.

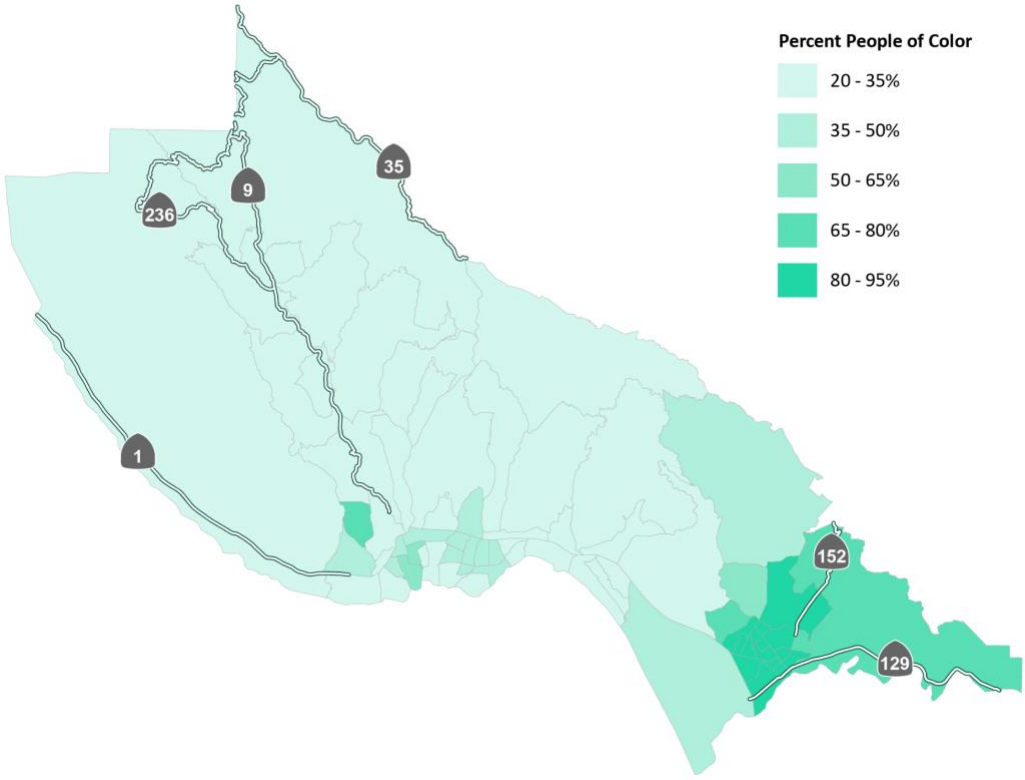


Figure 2: Santa Cruz County census tracts by percentage of people of color

EXISTING EQUITY TOOLS REVIEW

This section provides an overview of findings and trends based on three common equity-related mapping and planning tools:

- Safe Streets and Roads for All (SS4A) Underserved Communities Mapping Tool
- California Healthy Places Index
- California Climate Investments Priority Populations Mapping Tool 4.0

Safe Streets and Roads for All (SS4A) Underserved Communities Mapping Tool

The U.S. Department of Transportation's Safe Streets and Roads for All (SS4A) Grant Program provides funding to local jurisdictions to support planning, infrastructure, and other transportation initiatives designed to prevent serious injuries and fatalities for all roadway users. The program's selection criteria consider the ability of an applicant's project to provide benefits to Underserved Communities, which are identified using the Infrastructure Investment and Jobs Act definition of Areas of Persistent Poverty (APP) as determined by poverty rates. The Underserved Communities Mapping Tool assists applicants to the SS4A Grant Program in identifying APPs. Per *Figure 3,* the tool identifies several census tracts near the cities of Santa Cruz and Watsonville as underserved communities.

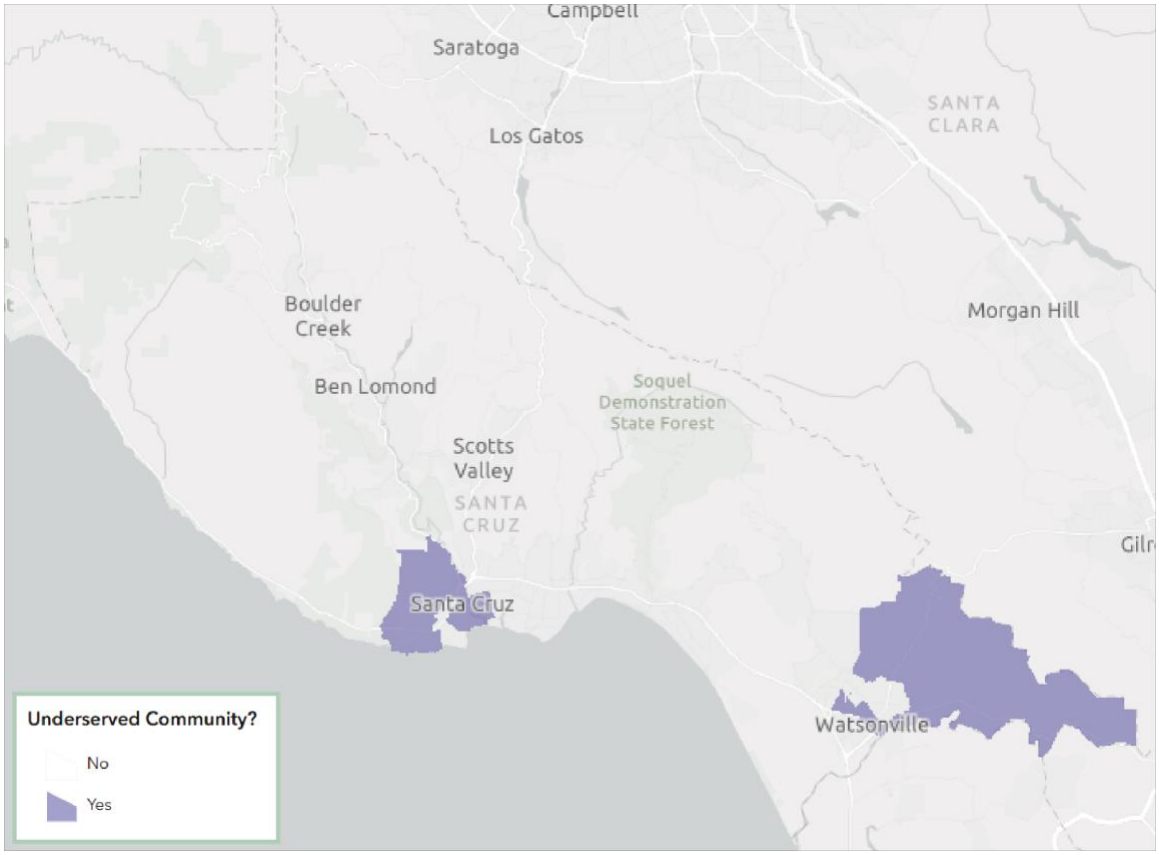


Figure 3: Screenshot of Santa Cruz County using the Safe Streets 4 All Underserved Communities Tool

California Healthy Places Index

The California Healthy Places Index (HPI) was developed in 2018 by the Public Health Alliance of Southern California to provide information on the health of communities throughout the state. Using 23 different factors related to topics such as education, housing, transportation, jobs, and environment, the HPI assigns a score ranking from 1 to 99, with higher scores indicating healthier community conditions. HPI is notably used by the California Transportation Commission to identify disadvantaged communities as part of its scoring criteria for the Active Transportation Program (ATP), which awards hundreds of millions of grant dollars to support walking and biking initiatives every few years. Using the HPI mapping tool, one census tract in Santa Cruz County scored below 25, and 10 census tracts scored between 25 and 50, with most of these tracts being located in or near the city of Watsonville.

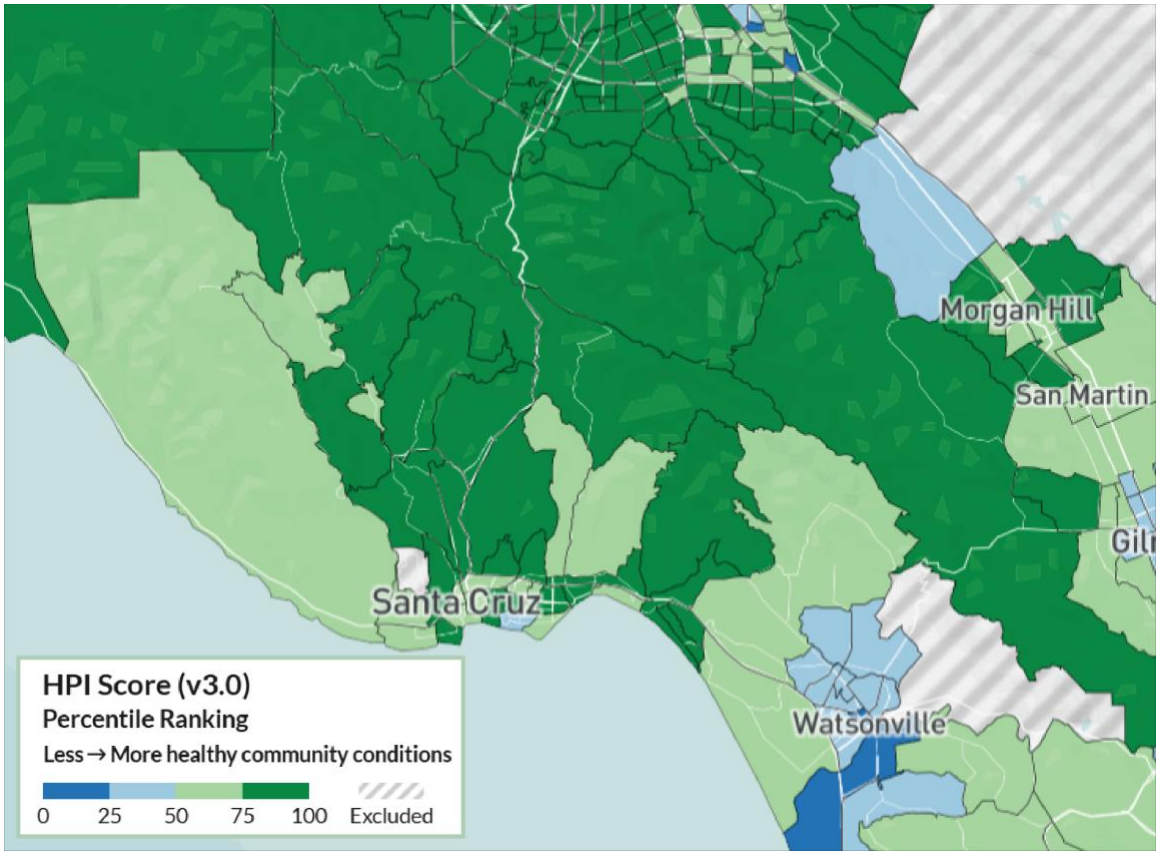


Figure 4: Screenshot of Santa Cruz County using California Healthy Places Index

California Climate Investments Priority Populations Mapping Tool 4.0

The Climate Investments Priority Populations Mapping Tool 4.0 identifies disadvantaged communities and low-income communities across the state to support aligning climate investments with the requirements of Senate Bill 535 and Assembly Bill 1550, which require a minimum of 35% California Climate Investments to go towards underserved populations. The mapping tool has been utilized as part of state grant programs, including the Caltrans Reconnecting Communities: Highways to Boulevards Program which allowed applicants to identify eligible projects areas using the tool.

The Priority Populations mapping tool provides the most low-income and disadvantaged communities designations in Santa Cruz County of all the tools reviewed in this memo including several sparsely populated census tracts located northwest of the city of Santa Cruz. Similar to the other mapping tools, Priority Populations identifies census tracts near the cities of Santa Cruz and Watsonville as either low-income or disadvantaged.

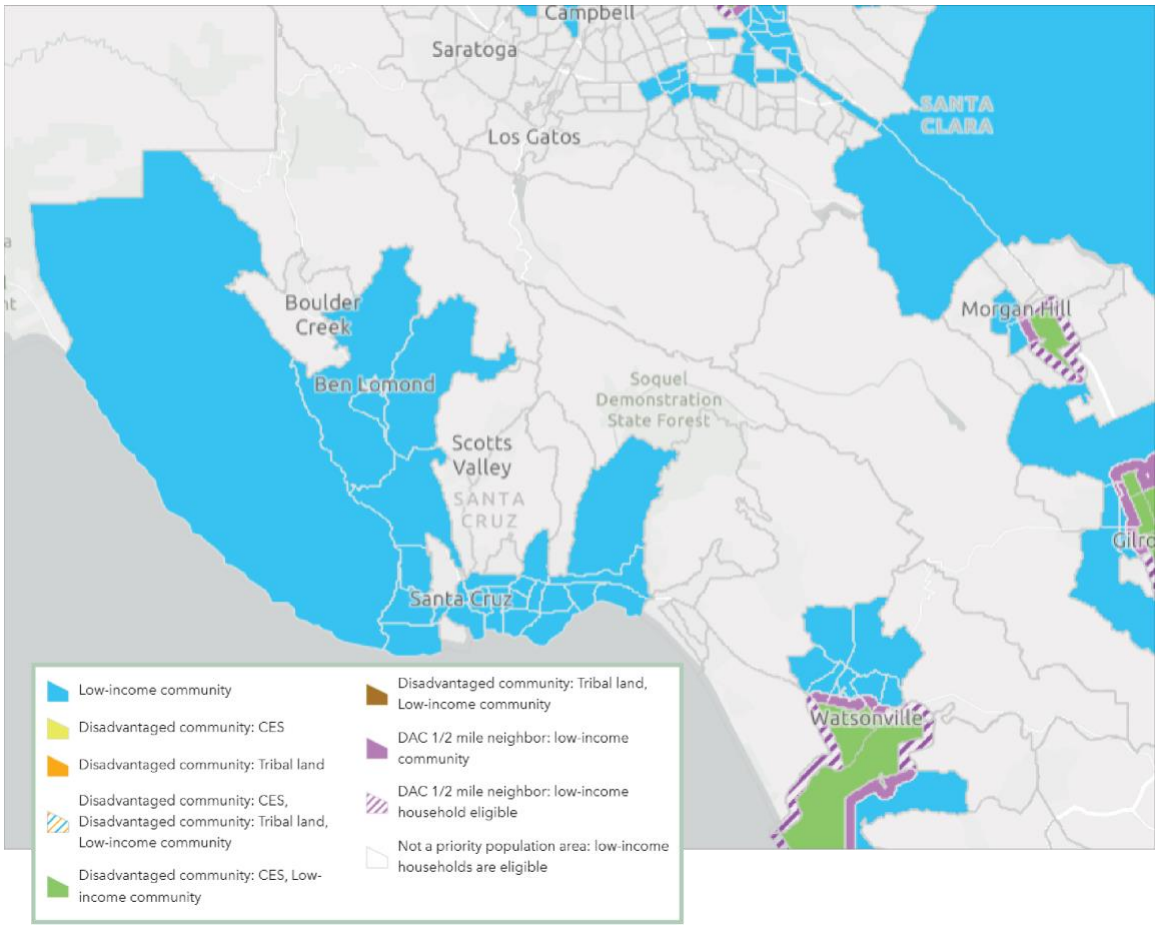


Figure 5: Screenshot of Santa Cruz County using California Climate Investments Priority Populations Mapping Tool 4.0

KEY TAKEAWAYS AND CONCLUSIONS

Based on a high-level review of household income data, race/ethnicity data, and existing equity mapping tools, the consultant team identified three key takeaways:

- **Many of the most underserved communities in Santa Cruz County are likely located in and near the cities of Santa Cruz and Watsonville and the community of Brookdale.** Census tracts within these areas appear in most or all of the datasets reviewed as part of this memo, indicating that these communities qualify as underserved using a variety of metrics.
- **Given the large sizes of many census tracts throughout the county, there may be additional pockets of disadvantaged communities outside of the aforementioned areas as indicated by the Priority Populations mapping tool in areas along the coast and inland**. Additional study and/or surveys are needed at a scale smaller than the census tract to identify specific locations where these pockets may exist.
- **The relatively high average income and the low percentages of people of color in most of the county, as compared to state and federal metrics, suggest the**

need for a comprehensive, context-sensitive planning process to formally establish a definition of underserved communities for Santa Cruz County. This process should consider factors beyond income and race, such as student eligibility for free/reduced-price meals, unemployment, and access to transportation. This definition would both support the county's efforts to invest resources in neighborhoods with the most need and position the county for future statewide and federal grants that allow applicants to put forth regional definitions of underserved communities for consideration as part of the program's project evaluation processes.

Appendix K. SS4A Checklist

Safe Streets and Roads for All
Self-Certification Eligibility Worksheet

All applicants should follow the instructions in the NOFO to correctly apply for a grant. See the SS4A website for more information.

Table 1 of the SS4A NOFO describes eight components of an Action Plan, which correspond to the questions in this worksheet. Applicants should use this worksheet to determine whether their existing plan(s) contains the required components to be considered an eligible Action Plan for SS4A.

This worksheet is required for all SS4A **Implementation Grant** applications and any **Planning and Demonstration Grant applications to conduct Supplemental Planning/Demonstration Activities only**. Please complete the form in its entirety, do not adjust the formatting or headings of the worksheet, and upload the completed PDF with your application.

Eligibility

An Action Plan is considered eligible for an SS4A application for an Implementation Grant or a Planning and Demonstration Grant to conduct Supplemental Planning/Demonstration Activities if the following two conditions are met:

- You can answer "YES" to Questions **3, 7,** and **9** in this worksheet; *and*
- You can answer "YES" to **at least four of the six remaining** Questions, **1, 2, 4, 5, 6**, and **8.**

If both conditions are not met, an applicant is still eligible to apply for a Planning and Demonstration Grant to fund the creation of a new Action Plan or updates to an existing Action Plan to meet SS4A requirements.

Applicant Information

Lead Applicant: _____ **UEI:** _____

Action Plan Documents

In the table below, list the relevant Action Plan and any additional plans or documents that you reference in this form. Please provide a hyperlink to any documents available online or indicate that the Action Plan or other documents will be uploaded in Valid Eval as part of your application. Note that, to be considered an eligible Action Plan for SS4A, the plan(s) coverage must be broader than just a corridor, neighborhood, or specific location.

Document Title	Link	Date of Most Recent Update

Action Plan Components

For each question below, answer "YES" or "NO." If "YES," list the relevant plan(s) or supporting documentation that address the condition and the specific page number(s) in each document that corroborates your response. This form provides space to reference multiple plans, but please list only the most relevant document(s).

1. Leadership Commitment and Goal Setting

Are **BOTH** of the following true?

- A high-ranking official and/or governing body in the jurisdiction publicly committed to an eventual goal of zero roadway fatalities and serious injuries; and
- The commitment includes either setting a target date to reach zero OR setting one or more targets to achieve significant declines in roadway fatalities and serious injuries by a specific date.

☐ **YES**

☐ **NO**

Note: This may include a resolution, policy, ordinance, executive order, or other official announcement from a high-ranking official and the official adoption of a plan that includes the commitment by a legislative body.

If "YES," please list the relevant document(s) and page number(s) that corroborate your response.

Document Title	Page Number(s)

2. Planning Structure

To develop the Action Plan, was a committee, task force, implementation group, or similar body established and charged with the plan's development, implementation, and monitoring?

☐ **YES**

☐ **NO**

Note: This should include a description of the membership of the group and what role they play in the development, implementation, and monitoring of the Action Plan.

If "YES," please list the relevant document(s) and page number(s) that corroborate your response.

Document Title	Page Number(s)

3. Safety Analysis

Does the Action Plan include **ALL** of the following?

- Analysis of existing conditions and historical trends to provide a baseline level of crashes involving fatalities and serious injuries across a jurisdiction, locality, Tribe, or region;
- Analysis of the location where there are crashes, the severity, as well as contributing factors and crash types;
- Analysis of systemic and specific safety needs, as needed (e.g., high-risk road features or specific safety needs of relevant road users); and,
- A geospatial identification (geographic or locational data using maps) of higher risk locations.

☐ **YES**

☐ **NO**

Note: Availability and level of detail of safety data may vary greatly by location. The Fatality and Injury Reporting System Tool (FIRST) provides county- and city-level data. When available, local data should be used to supplement nationally available data sets.

If "YES," please list the relevant document(s) and page number(s) that corroborate your response.

Document Title	Page Number(s)

4. Engagement and Collaboration

Did the Action Plan development include **ALL** of the following activities?

- Engagement with the public and relevant stakeholders, including the private sector and community groups;
- Incorporation of information received from the engagement and collaboration into the plan; and
- Coordination that included inter- and intra-governmental cooperation and collaboration, as appropriate.

☐ **YES**

☐ **NO**

Note: This should be a description of public meetings, participation in public and private events, and proactive meetings with stakeholders.

If "YES," please list the relevant document(s) and page number(s) that corroborate your response.

Document Title	Page Number(s)

5. Equity Considerations

Did the Action Plan development include **ALL** of the following?

- Considerations of equity using inclusive and representative processes;
- The identification of underserved communities through data; and
- Equity analysis developed in collaboration with appropriate partners, including population characteristics and initial equity impact assessments of proposed projects and strategies.

☐ **YES**

☐ **NO**

Note: This should include data that identifies underserved communities and/or reflects the impact of crashes on underserved communities, prioritization criteria that consider equity, or a description of meaningful engagement and collaboration with appropriate stakeholders.

If "YES," please list the relevant document(s) and page number(s) that corroborate your response.

Document Title	Page Number(s)

6. Policy and Process Changes

Are **BOTH** of the following true?

- The plan development included an assessment of current policies, plans, guidelines, and/or standards to identify opportunities to improve how processes prioritize safety; and
- The plan discusses implementation through the adoption of revised or new policies, guidelines, and/or standards.

☐ **YES**

☐ **NO**

Note: This may include existing and/or recommended Complete Streets policy, guidelines for community engagement and collaboration, policy for prioritizing areas of greatest need, local laws (e.g., speed limit), design guidelines, and other policies and processes that prioritize safety.

If "YES," please list the relevant document(s) and page number(s) that corroborate your response.

Document Title	Page Number(s)

7. Strategy and Project Selections

Does the plan identify a comprehensive set of projects and strategies to address the safety problems in the Action Plan, with information about time ranges when projects and strategies will be deployed, and an explanation of project prioritization criteria?

☐ **YES**
☐ **NO**

Note: This should include one or more lists of community-wide multi-modal and multi-disciplinary projects that respond to safety problems and reflect community input and a description of how your community will prioritize projects in the future.

If "YES," please list the relevant document(s) and page number(s) that corroborate your response.

Document Title	Page Number(s)

8. Progress and Transparency

Does the plan include **BOTH** of the following?

- A description of how progress will be measured over time that includes, at a minimum, outcome data.
- The plan is posted publicly online.

☐ **YES**
☐ **NO**

Note: This should include a progress reporting structure and list of proposed metrics.

If "YES," please list the relevant document(s) and page number(s) that corroborate your response.

Document Title	Page Number(s)

9. Action Plan Date

Was at least one of your plans finalized and/or last updated between 2019 and April 30, 2024?

☐ **YES**
☐ **NO**

Note: Updates may include major revisions, updates to the data used for analysis, status updates, or the addition of supplemental planning documents, including but not limited to an Equity Plan, one or more Road Safety Audits conducted in high-crash locations, or a Vulnerable Road User Plan.

If "YES," please list your most recent document(s), date of finalization, and page number(s) that corroborate your response.

Document Title	Date of Most Recent Update	Page Number(s)