Local Road Safety Plan

Sonoma County

2020

Sonoma County
Department of Transportation and Public Works
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1 INTRODUCTION

The Fixing America's Surface Transportation Act (FAST) was signed into law on December 4, 2015. The Highway Safety Improvement Program (HSIP) is one of the programs created by the FAST Act. HSIP is a federal-aid program that aims to achieve a significant reduction in fatalities and serious injuries on public roadways. HSIP provides municipalities with funding for projects that have the sole purpose of reducing crashes and improving roadway safety. Local HSIP projects must be identified on the basis of crash severity, crash potential, crash rate, or other data-supported means. Beginning 2022, a Local Road Safety Plan (LRSP) will be required for an agency to be eligible to apply for HSIP funds. Due to this requirement and the County's commitment to improving transportation safety for all users on local roadways, the Sonoma County Department of Transportation and Public Works has developed this LRSP.

The purpose of this LRSP report is to identify 'hotspot' collision areas on roadways within the County and explore potential short term and long term corrective measures that may reduce collision rates and improve roadway safety. This report focuses on the past five years (2015-2019) of collisions within the County. During this timeframe, the County has experienced 5,542 reported collisions, 78 of which were fatal (resulting in 84 fatalities total, i.e. some collisions resulted in multiple fatalities). Based on the five years of data, there has been an average of 1,108 collisions/year and 16 fatalities/year on the County roadways.

For comparison, unincorporated Napa County had 1,675 collisions resulting in 20 fatalities and unincorporated Marin County had 1,975 collisions resulting in 19 fatalities for the same time period. Compared to these two counties, Sonoma County has a much higher number of collisions and fatalities. However one should be cautious when drawing conclusions from these statistics, due to the counties being different sizes, having different population densities, commute patterns, and different total miles of roadway.

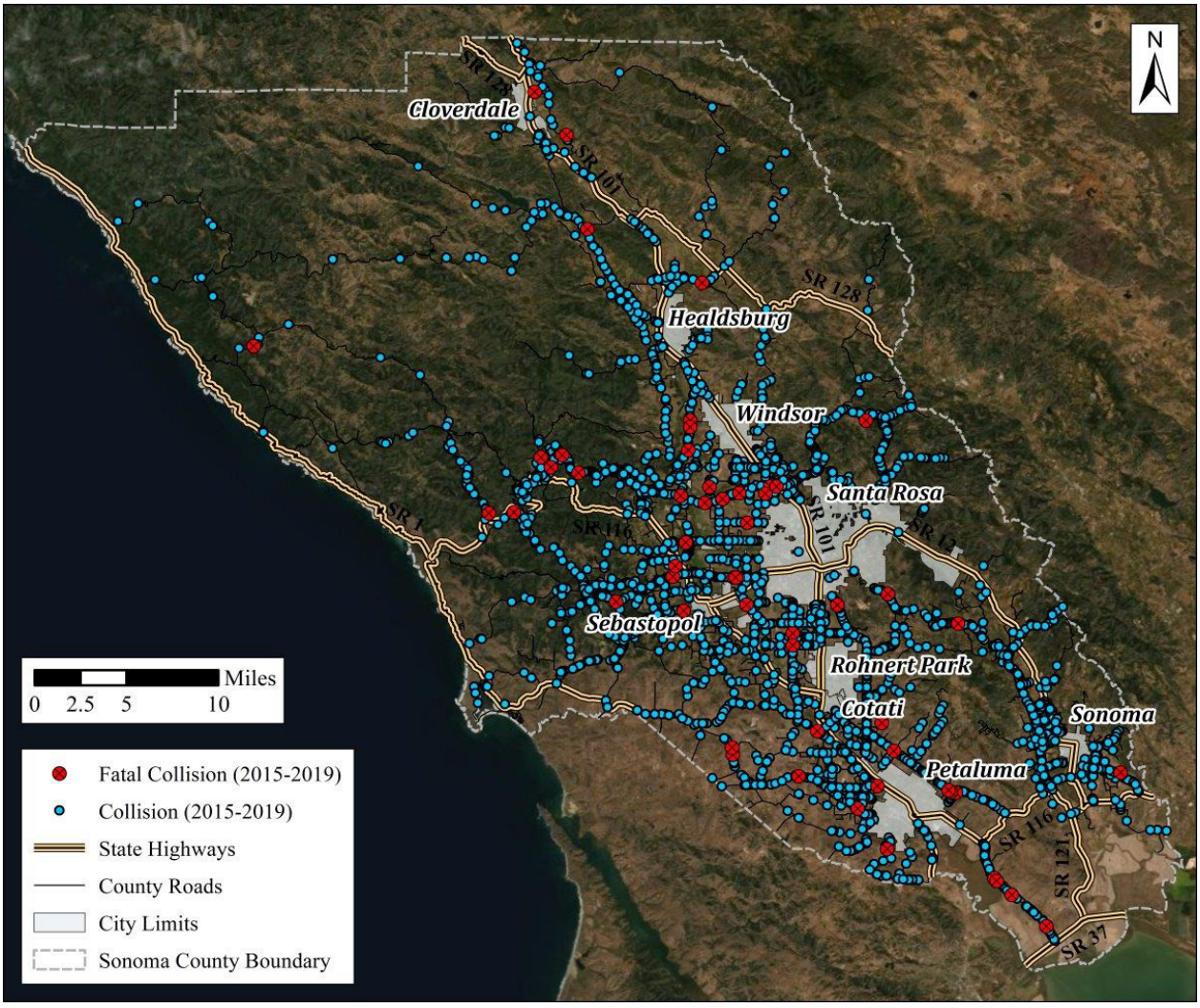


Figure 1: Map of all collisions within unincorporated county

Sonoma County has approximately 1,400 miles of roadway under its jurisdiction. This report focuses solely on roadways within the unincorporated portions of the County and therefore all analyses and statistics are based on collisions that occurred on unincorporated County roadways. Collisions from cities and other jurisdictions are not included in this report.

This report is divided into the following sections:

- visions and goals of the LRSP,
- safety partners,
- existing County efforts to improve roadway safety,
- collision data analysis methodologies,
- presentation of results from analyses,
- further discussion of results based on hotspots identified,
- implementation of proposed improvements,
- and envisioned future iterations of this LRSP.

2 VISION & GOALS

Sonoma County's vision for this LRSP is to advance roadway safety within the County by reducing fatal and serious injury collisions.

The goals of the LRSP are:

- Identify areas of concern
- Apply proven safety solutions systematically to reduce fatal and severe crashes.
- Reduce the number of fatal crashes to zero by 2030.
- Implement a holistic approach within the County to promote traffic safety and Zero Deaths strategies that involves multiple divisions (land development, traffic, design, etc.).

3 SAFETY PARTNERS

A vital part of developing and implementing a LRSP is partnering with other agencies and jurisdictions and seeking public input. Additional public input will be included in the LRSP based on the Vision Zero program being spearheaded by Sonoma County Health Services and the Transportation Authority. The following list of partners were consulted in the development of this plan:

- California Highway Patrol (CHP)
- County of Sonoma
    - Permit and Resource Management Department (PRMD)
    - Department of Transportation and Public Works (DTPW)
        - Engineering
        - Traffic
        - Land Development
        - Road Maintenance
    - Department of Health Services
    - Transportation Authority (SCTA)
- Sonoma County Bicycle and Pedestrian Committee
- Sonoma County Vision Zero Advisory Committee

4 EXISTING EFFORTS

Sonoma County is continuously evaluating the safety of the roadways to reduce the number of collisions. The following are actions that the Department of Transportation and Public Works currently undertakes to improve roadway safety:

- Weekly traffic meetings between staff and the department director to discuss current roadway issues and potential solutions.
- Inclusion of bicycle and pedestrian improvements into roadway improvement projects and paving projects when feasible.
- Recent installation of rumble strip and high reflective striping on Lakeville Rd.
- Coordination with CHP to target high collision areas and discuss possible solutions.
- Radar trailer program to target high speeding areas.
- Proactive approach with land development projects to implement safety improvements.
- Proactive sign installation and replacement approach.
- Retro-reflectivity testing and replacement program for sign panels.

- Active policy to address public comments/concerns regarding roadway safety issues within the County.

5 LRSP COLLISION ANALYSIS METHODOLOGY

For this LRSP report, collision records for the time period of 2015-2019 were analyzed within GIS and Microsoft Excel to determine hotspot collision locations. Note that the statistics in this report are based solely on collisions that occurred within unincorporated County jurisdiction; collisions that occurred in cities or other jurisdictions were not included in this analysis.

The data used in this report comes from California Highway Patrol (CHP) collision reports. The County receives paper copies of all collision reports that occur within the County. These reports are reviewed and input into a GIS database. This report used the County GIS database of collisions for the following analyses.

The Transportation Injury Mapping System (TIMS) was also queried for collisions involving bicycles or pedestrians that occurred during the study period. TIMS was developed by the Safe Transportation Research and Education Center at the University of California, Berkeley as a means to analyze data from the Statewide Integrated Traffic Records System (SWITRS). TIMS contains all fatal and injury collisions, but does not include collisions where only property damage occurred. TIMS was used for the pedestrian and bicycle collision analyses because it allowed for easier identification of these types of collisions. The TIMS data source (CHP collision reports) is the same as the County's GIS database but includes additional fields allowing for more efficient querying of pedestrian/bike collisions. The data in this report is limited in scope since only collisions that generated a collision report via CHP are included in the analyses. Furthermore, some data may be inaccurate or missing due to human error, e.g. a collision was inputted incorrectly or omitted.

Due to the random nature of collisions and the high number of variables involved, five different analysis methods were used to better understand the data and identify collision hotspot locations. Each methodology is described in the following subsections. The results of the analyses are presented in Sections 6 and 7.

5.1 Analysis by Entire Roadway

The road analysis method gives a broad overview of which roads as a whole warrant applying county resources towards reducing collisions. All collisions were summed along each entire roadway over the five year study period and each road was ranked by number of overall collisions.

The roadway analysis does not incorporate traffic volume or roadway length. In general, a longer, busier road will have a greater statistical likelihood of having a higher number of collisions than a short, less-traveled road simply due to more vehicles traveling along it. This analysis is limited in scope as there is no differentiation of where the collisions occurred along the roadway.

5.2 Analysis by Collision Hotspot

A collision hotspot analysis was performed using GIS to achieve a more detailed analysis. The collision hotspot analysis pinpoints specific segments of roadway that have a high number of collisions. The 'hotspot analysis' tool was used within ArcGIS and identified statistically

significant spatial clusters of high values (collision hotspots) within 500 feet of each other. The collision hotspots were ranked by number of collisions. Hotspots near an intersection were omitted as intersections are analyzed under a separate section of this report. Hotspots that were within 500 feet of each other were combined into a single hotspot that covered a longer roadway segment.

The collision hotspot analysis does not directly account for traffic volumes. Higher volume roadways have a greater statistical likelihood of a collision occurring than lower volume roadways.

5.3 Analysis by Injury Hotspot

The injury hotspot analysis used the same methods as the collision hotspot analysis, but focused on the injuries incurred instead of solely that a collision had occurred. A GIS analysis was performed of all the collisions in the county over the five year study period identifying clusters of collisions within 500 feet of each other that involved injuries. Hotspots near an intersection were omitted as intersections were analyzed under a separate section of this report. The intent of this analysis was to capture specific roadway locations where more dangerous collisions occur.

Similar to the collision hotspot analysis, the injury hotspot analysis does not directly account for traffic volumes.

5.4 Analysis by Roadway Segment and Collision Rate

For the roadway segment analysis, roadways were broken into segments based on the County's most recent post mile map published in 2018. The road segment lengths vary and are random in nature as the segment lengths were determined by roadway features within the post mile map. The collision rate was calculated for each segment.

The collision rate equation (see Appendix Section 10.2) uses traffic volumes and segment lengths to calculate the rate of collisions per million vehicle-miles of travel (c/mvm). Collision rate can be a useful metric because it normalizes variables and produces a rate that incorporates traffic volume and segment length. Since the likelihood of a collision occurring increases with traffic volume and roadway length, collision rate can be a useful tool for comparing roadways of varying characteristics. However there are limitations to the equation as well. The equation becomes very sensitive when short segments and/or low volumes are used. The results should always be examined with the underlying knowledge of the inputs used to calculate the rate and should be interpreted with some caution.

Once the collision rates were calculated, the 20 highest collision rate segments were verified in GIS. If collisions occurred near an intersection, the segment was omitted from the results of this analysis as intersections were analyzed under a separate section in this report. Segments with less than five collisions were also omitted from the analysis since a misleadingly high collision rate can occur when there is a low traffic volume coupled with a short road segment. Traffic volumes were not available for all roadway segments; therefore, only segments with volumes available were included in the analysis.

5.5 Analysis by Intersection

The intersection analysis examined collisions where two or more roadways intersect and identified intersections with a high number of collisions. The highest collision intersections were identified

using the same methodology as the hotspot analyses. The intersections were then verified using GIS and ranked by number of collisions. The intersection analysis does not directly account for traffic volumes.

5.6 Analysis for Bicycle and Pedestrian Collisions

The analysis for bicycle and pedestrian collisions used the Transportation Injury Mapping System (TIMS) to query collisions involving bicycles or pedestrians that occurred during the study period. The database was queried for collisions that involved either a pedestrian or a bicyclist. Each resulting dataset was then imported into Excel and reviewed. Any collisions outside of the County jurisdiction (cities, state highways, etc.) were removed from the dataset. The data points were also mapped in GIS for a visual representation of the data.

6 RESULTS

The results of each analysis are presented in this section. Emphasis areas were selected based on the results and are discussed in Section 7.

6.1 Entire Roadway Analysis Results

Roadways were ranked from highest to lowest by number of collisions over the five year period of 2015-2019 and are presented in Table 1. Originally, the 10 roadways with the highest total collisions were to be reported in this section. However, the analysis resulted in 11 roads as both Calistoga Rd and Bodega Hwy had the same total number of collisions over the five year period, so 11 roads are reported in Table 1. The fatalities by road are presented in Appendix Section 10.4.

Table 1: Roads with Highest Number of Collisions (2015-2019)

	Collisions						
Road Name	**2015**	**2016**	**2017**	**2018**	**2019**	**Total**	**Road Length (mi)**
River Rd	66	94	85	60	65	371	25.50
Arnold Dr	52	55	41	44	52	244	19.30
Stony Point Rd	37	57	57	45	41	237	24.59
Adobe Rd	45	45	44	37	33	204	19.49
Petaluma Hill Rd	31	43	47	34	34	191	19.69
Bennett Valley Rd	25	31	31	50	37	171	19.88
Mark West Springs Rd	39	39	43	21	31	173	14.20
Lakeville Rd	27	40	38	28	24	158	16.97
Old Redwood Hwy	25	37	29	31	28	151	20.94
Bodega Hwy	28	30	34	25	31	148	19.27
Calistoga Rd	25	32	32	27	32	148	17.13

Over the analysis timeframe, these 11 roads accounted for 40% of all roadway collisions and 38% of all roadway fatalities countywide. All these roads also have high traffic volumes. As these 11 roads only account for 15% of the total lane miles within the county, investing in safety improvements on these roadways would have a high benefit per dollar spent in making the roads in the County safer.

When looking strictly at number of incidents, River Rd had by far the highest number of both collisions and fatalities. River Rd accounted for 7% of the collisions and 14% of the fatalities during the study period.

6.2 Collision Hotspot Analysis Results

The collision hotspots were ranked in order of highest to lowest by number of collisions within an area. The five highest hotspots are presented in Table 2. The five areas with the highest collision hotpots were located on four county roads: Bennett Valley Rd, Calistoga Rd, Porter Creek Rd, and Bodega Hwy. Over the study period, there were 172 collisions and two fatalities at these five sites accounting for 3% of all collisions and 3% of fatalities in the County. All five hotspots were located on curves.

Table 2: Highest Collision Hotspot Locations (2015-2019)

Road Name	Road ID	PM[1] Beg	PM[1] End	Length (mi)	Volume (ADT)	Collisions	Fatalities	Collision Rate
Bennett Valley Rd	6604	12.70	13.6	0.90	5857	71	1	7.38
Calistoga Rd	7703	15.95	16.45	0.50	unavailable	36	0	unavailable
Porter Creek Rd	8801B	18.66	18.86	0.20	7013	25	1	9.77
Calistoga Rd	7703	11.85	12.07	0.22	unavailable	23	0	unavailable
Bodega Hwy	6904	16.65	16.78	0.13	6394	17	0	11.21

[1]PM = post mile

6.3 Injury Hotspot Analysis Results

The collision hotspots with injuries were ranked in order of highest to lowest by number of collisions with injuries within an area. The five highest hotspots are presented in Table 3. The top two injury hotspot locations were both located on Lakeville Rd. Lakeville Rd in its entirety accounted for 3% of all collisions and 8% of roadway fatalities over the five year study period in the County. Lakeville Rd has a relatively low collision rate overall when compared to its high traffic volume; however, the nature of the collisions which occur on the roadway are more extreme as noted by this injury analysis.

Table 3: Highest Injury Hotspot Locations (2015-2019)

Road Name	Road ID	PM[1] Beg	PM[1] End	Length (mi)	Volume (ADT)	Collisions	Injuries	Fatalities	Collision Rate
Lakeville Rd	3601	14.72	15.03	0.31	18053	9	18	3	0.88
Lakeville Rd	3601	10.89	11.11	0.22	18053	12	15	1	1.66
Stony Point Rd	6803	22.51	22.56	0.05	11713	5	9	0	4.68
Arnold Dr	5603	10.29	10.31	0.02	12387	2	7	0	4.42
Petrified Forest Rd	8801C	22.48	22.52	0.04	10898	3	7	0	3.77

[1]PM = post mile

6.4 Roadway Segment and Collision Rate Analysis Results

Additional collision hotspot locations were identified and examined by roadway segment in the roadway collision rate analysis. The road segments were ranked in order of highest to lowest by collision rate. The five road segments with the highest collision rates are presented in Table 4. For comparison, the California statewide average collision rate for a 2- or 3-lane road is 1.05 c/mvm (Collision Data on California State Highways, Caltrans 2018).

Collision rates are a useful metric, but it is important to understand the underlying values used to calculate the rate. The rate can vary greatly with low traffic roadways or short road segments causing high collision rates. Because of these factors, extra scrutiny is required when using collision rates countywide for an application such as a Local Road Safety Plan. Collison rates provide valuable information, but should not be the sole basis for identifying potential hotspots. As mentioned in the methodology for this analysis, the length of the road segments was based from the County's post mile map and the lengths of each road segment vary greatly.

Table 4: Road Segments with Highest Collision Rates (2015-2019)

Road Name	Road ID	PM Beg	PM End	Length (mi)	Volume (ADT)	Collisions	Collision Rate
Porter Creek Rd	8801B	18.7	18.72	0.02	7,013	12	46.88
Mark West Springs Rd	8801A	10.18	10.23	0.05	21,633	18	9.12
Scenic Ave	68061A	11.57	11.95	0.38	1,489	8	7.75
Mark West Station Rd	89010	10	11.42	1.42	416	8	7.42
Faught Rd	8807	10.42	11.42	1	878	10	6.24

6.5 Intersection Analysis Results

The intersection collision hotspots were ranked in order of highest to lowest by number of collisions near an intersection and were analyzed in detail to determine if trends in the collisions exist. Intersections with greater than 30 collisions were identified as emphasis areas and are presented in Table 5. The intersections with the highest number of collisions over the study period are presented in Appendix Section 10.6.

Table 5: Intersections with greater than 30 Collisions (2015-2019)

Description	Collisions	Volume (ADT)	Collision Rate
Todd Rd at Santa Rosa Ave	36	27,170[a]	0.72
Adobe Rd at Frates Rd	36	unavailable	-
Old Redwood Hwy N at E. Railroad	31	unavailable	-

[a] Land Development file PLP18-0050

Collisions have a greater statistical likelihood of occurring near an intersection due to conflicting turning movements. This report looked strictly at intersections with high number of collisions. Traffic volume and turning counts were not incorporated into the analysis and therefore the results are limited in scope. This analysis may warrant further review in the future since the analysis does not incorporate traffic volumes for all intersections. Some peak hour traffic counts for intersections were obtained from recent land development projects. When volume data was available, a collision rate was calculated for the intersection with the assumption that 10% of average daily trip (ADT) traffic occurs during afternoon peak hours.

The county does not currently have a means of collecting intersection traffic volumes. Future versions of the Sonoma LRSP should acquire intersection traffic volume data and incorporate it into subsequent reports.

6.6 Bicycle Collisions

There were 169 collisions that involved bicyclists during the five year study period. Of those 169 collisions, 9 were fatalities and 57 resulted in severe injury (see Table 12, Section 10.7). The five roads with the highest bicyclist collisions are presented in Table 6. River Rd had the highest number of collisions involving a bicyclist followed by Old Redwood Highway.

Many of the collisions occurred at intersections or on roadways with limited or no bicycle

infrastructure. There was no clear geographic pattern to where the collisions occurred along the roadways, indicating that the roads overall may warrant improvements to facilitate bicycle traffic.

Table 6: Roads with Highest Number of Collisions involving a Bicyclist (2015-2019)

Road Name	Number of Bicycle Collisions	Bicyclists Killed	Number of Cyclists Severely Injured
River Rd	14	1	3
Old Redwood Hwy	8	0	2
Occidental Rd	6	1	3
Coleman Valley Rd	6	0	2
Graton Rd	6	0	3

6.7 Pedestrian Collisions

There were 63 collisions involving pedestrians during the five year study period, 11 of which resulted in a fatality (see Table 14, Section 0). The roads with three or more pedestrian collisions are presented in Table 7. As with the bicycle collisions, there was no clear geographic pattern to where the collisions occurred along the roadways. Roughly 25% of the pedestrian collisions involved alcohol, and 90% of the pedestrian collisions occurred outside of a crosswalk.

Table 7: Roads with Three or More Pedestrian Collisions (2015-2019)

Road Name	Collisions w/Pedestrian	Fatalities	Injuries
River Rd	7	2	5
Old Redwood Hwy	5	1	3
Santa Rosa Ave	5	0	5
Mark West Springs Rd	3	0	3
Petaluma Hill Rd	3	1	2
Stony Point Rd	3	0	3

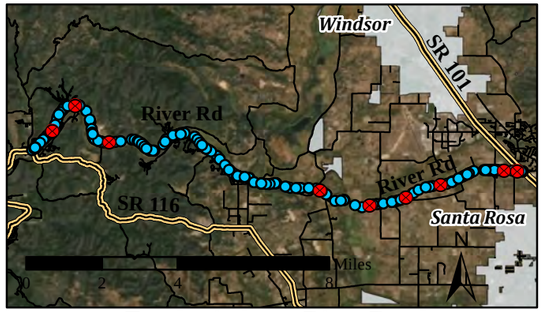
Due to the volume of pedestrians in comparison to the volume of vehicles, all collisions involving a pedestrian are significant. All 63 of the pedestrian collisions should be further examined for underlying causes and possible solutions.

7 EMPHASIS AREAS

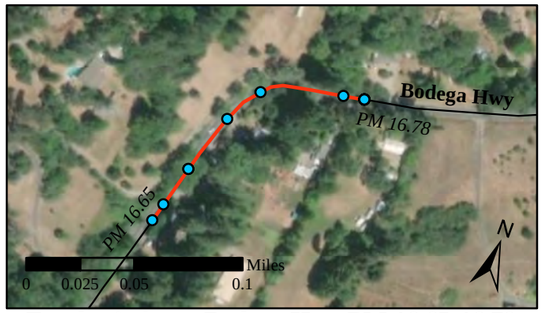
Based on the results from the previous section, ten emphasis areas were identified. These emphasis areas are comprised of roads and intersections that were continuously highlighted as collision hotspots in all the analyses performed. Emphasis area characteristics, goals, and strategies for improvement are discussed in this section. A summary table of these emphasis areas is presented in Appendix Section 10.1. The emphasis areas for the 2020 Sonoma County LRSP are:

- River Rd (Entire Roadway)
- Lakeville Rd (Entire Roadway)
- Bennett Valley Rd Segment (PM 12.70-13.60)
- Porter Creek Rd Hotspot (PM 18.66-18.86)
- Calistoga Rd Segments (PM 11.85-12.07 and PM 15.95-16.45)
- Bodega Hwy Hotspot PM (16.65-16.78)
- Intersection of Todd Rd and Santa Rosa Ave
- Intersection of Adobe Rd and Frates Rd
- Intersection of Old Redwood Hwy and East Railroad Ave
- Pedestrian and Bicycle Collisions

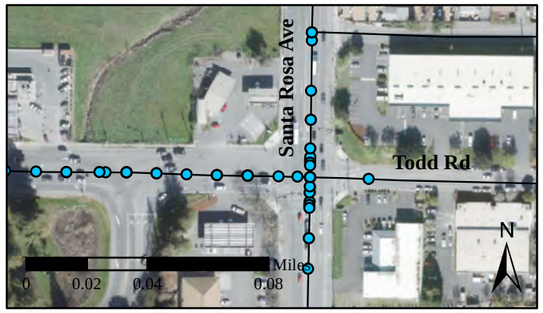
Emphasis Areas for Sonoma County LRSP 2020



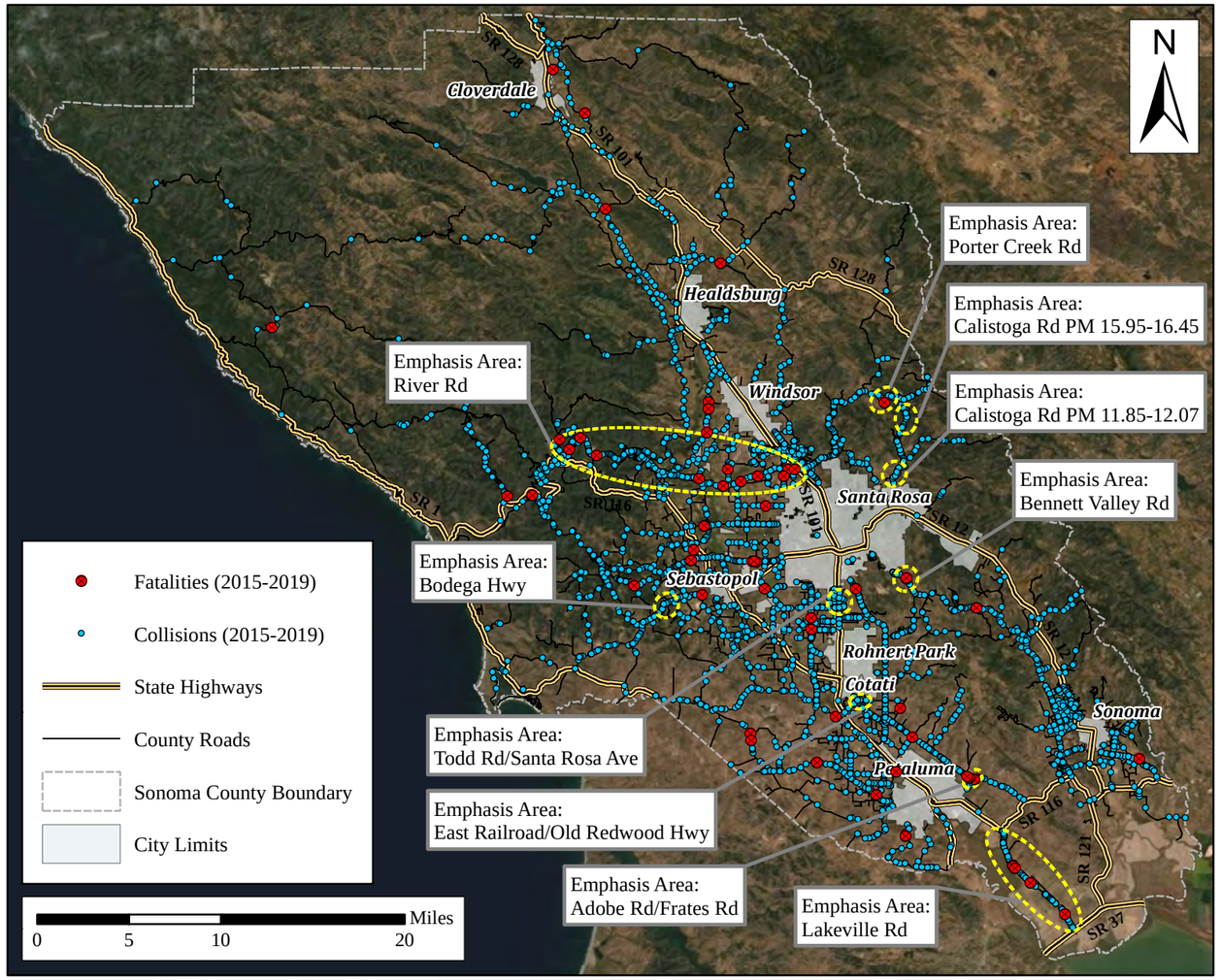
Emphasis Area: River Road



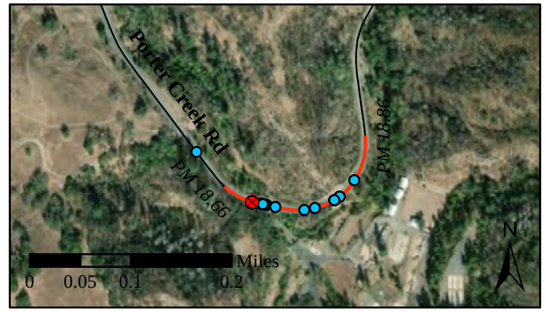
Emphasis Area: Bodega Hwy PM 16.65-16.78



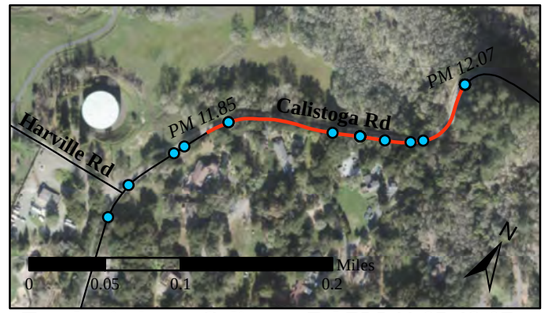
Emphasis Area: Todd Rd & Santa Rosa Ave Intersection



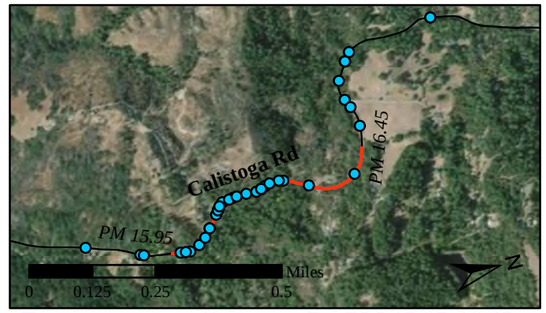
Collisions and Fatalities on Sonoma County Roadways (2015-2019) with Emphasis Areas



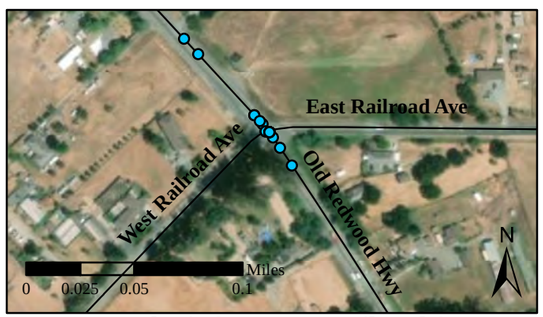
Emphasis Area: Porter Creek Rd PM 18.66-18.86



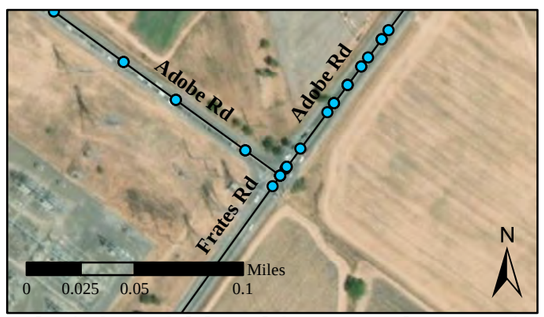
Emphasis Area: Calistoga Rd PM 11.85-12.07



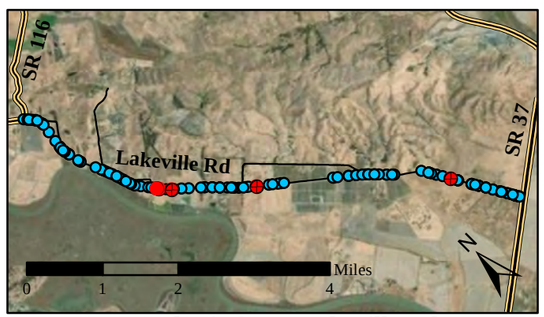
Emphasis Area: Calistoga Rd PM 15.95-16.45



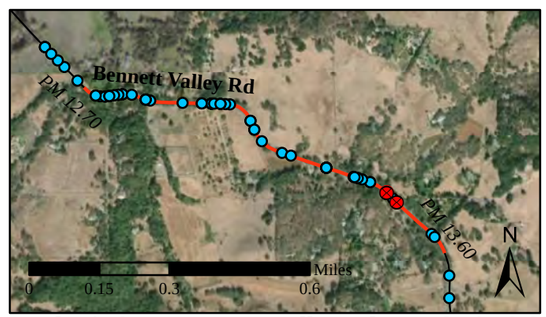
Emphasis Area: East Railroad & Old Redwood Hwy Intersection



Emphasis Area: Adobe Rd & Frates Rd Intersection



Emphasis Area: Lakeville Rd



Emphasis Area: Bennett Valley Rd PM 12.70-13.60

Data Sources:
Collisions, Fatalities, and Roads: Sonoma County Department of Transportation and Public Works (2020).
Highways, City Limits, County Boundary: Sonoma County GIS Database (2020).

7.1 River Rd (Entire Roadway)

River Road is a 25.5 mile long roadway that begins at State Route (SR) 101 and ends at SR 116 in Guerneville. It is a major thoroughfare with approximately 10,000 trips per day. The majority of the roadway is 55 miles per hour (mph).

River Road has the highest number of collisions and fatalities in the County. There were 371 collisions and 11 fatalities between 2015 and 2019. However, no single segment of River Road was identified within the hotspot analysis. This means that the collisions are spread out over the road length and the high number of collisions is likely due to the high volume of traffic on this roadway. When looking at the roadway as a whole, there is no indicative geographical trend as to where the collisions are occurring. It is therefore recommended that this roadway be studied in its entirety and that improvements be implemented on a roadway basis.

Collisions along the entire roadway were analyzed in more detail to look for trends based on collision type and pavement condition (see Table 15, Appendix Section 10.9.1). The majority of collisions (88%) on River Road occurred during dry conditions. The majority (75%) of collisions also occurred during daylight. There was no apparent trend between collision type and geographical location. The collisions were distributed randomly along the entirety of River Road.

Approximately one third of the collisions were from vehicles leaving the roadway or crossing either the centerline or edge line. Rumble strips could help mitigate for this collision type.

Broadsides and sideswipes accounted for 24% and 11% of the collisions on River Rd, respectively. Both of these collisions types are usually associated with conflicting turning movements. There are many driveways and intersections along River Rd that increase the likelihood of these collision types. Rear ends accounted for 26% of collisions. Rear ends are also often associated with intersections/driveways when vehicles slow and/or stop to turn.

River Rd had the highest number of pedestrian collisions and fatalities. During the five year study period, there were 7 pedestrian collisions and 2 fatalities. None of the pedestrian collisions occurred within a designated crossing. The locations of each pedestrian collision should be further examined for the potential of installing marked crossings and/or enhanced crossings such as a Rectangular Rapid Flash Beacon (RRFB) or a High-Intensity Activated crossWalK (HAWK) beacon.

River Rd also had the highest number of collisions involving a bicyclist. Similar to the vehicle to vehicle collisions, there was no indicative trend as to where the bicycle collisions are occurring. It is therefore recommended that any bicycle improvements be implemented on a roadway basis.

7.1.1 Goals for River Rd

- Reduce number of deaths to zero by 2030
- Reduce number of collisions by 25% by 2030

7.1.2 Strategies for River Rd

Ongoing:

- 2020 overlay between railroad tracks and Trenton-Healdsburg Road includes centerline

rumble strip installation.
- The county regularly deploys a temporary speed radar trailer to the area to attempt to slow down motorists.

Future:
- Install centerline rumble strips for the entirety of River Rd.
- Install wet-night, high visibility thermoplastic striping for the entirety of River Rd.
- Review intersections/driveways for possible improvements to mitigate collisions associated with turning movements.
- Explore potential crossing areas with high pedestrian traffic.

7.2 Lakeville Rd (Entire Roadway)

Lakeville Rd is a stretch of roadway that connects SR 37 to SR 116. The roadway spans three jurisdictions (County, Caltrans, and City of Petaluma). Lakeville Rd is one of the busiest roads in the county with a traffic volume of approximately 18,000 trips per day. The county's portion of the road is a 17-mile stretch that is fairly straight with several curves throughout. The entire length is striped as no-passing. The shoulders are narrow and the speed limit is 55 mph.

Over the study period, Lakeville Rd had 157 collisions, 6 of which were fatal. The main cause of collisions is speeding, crossing the double yellow, and leaving the roadway. The CHP has also cited multiple cases of drunk or drugged driving on this roadway.

Collisions along the entire roadway were analyzed in more detail to look for trends based on collision type and pavement condition (see Table 16, Appendix Section 10.9.2). The majority of collisions (85%) occurred during dry conditions. The majority of collisions (69%) also occurred during daylight hours. The majority of the collisions were either rear-ends (32%) or were vehicles leaving the roadway and hitting an object (38%). This indicates vehicles traveling at unsafe speeds and/or distracted drivers.

7.2.1 Goals for Lakeville Rd

- Reduce number of deaths to zero by 2030
- Reduce number of collisions by 25% by 2030

7.2.2 Strategies for Lakeville Rd

Ongoing:
- Centerline and edge line rumble strips were installed in summer 2019 using Highway Safety Improvement Program (HSIP) funding.
- The entire roadway was restriped using high intensity wet-night striping.
- Additional signage was installed directing motorists to turn on headlights during the day.
- Crash count signs have been installed warning motorists of high collision area.
- A Lakeville Rd Taskforce has been started by the CHP to focus additional efforts on the roadway.
- The county regularly deploys a temporary speed radar trailer to the area to attempt to slow down motorists.

Future:

- The County will continue to monitor this roadway and make improvements as possible.
- Additional HSIP funding may be pursued to install a median barrier along the majority of the roadway.
- Sonoma County Transportation Authority is spearheading a campaign to improve the intersection of Lakeville Rd and Hwy 116 (Stage Gulch Rd). Construction is scheduled to begin as early as 2024.

7.3 Bennett Valley Rd Segment (PM 12.70-13.60)

Bennett Valley Rd is a narrow and winding two-lane 19.88 mile long road. The shoulder width varies. The road has roughly 6,000 trips per day. Bennett Valley Rd, as a whole, had 174 collisions over the five year study period.

The 0.90 mile segment between Post Mile (PM) 12.70-13.6 had 71 reported collisions and 4 fatalities over the study period. This roadway segment accounts for 41% of all the collisions that occurred on Bennett Valley Rd during the 5 year study period. The segment is characterized by straightaways heading into curves.

Collisions along this roadway segment were analyzed in more detail to look for trends based on collision type and pavement condition (see Table 17, Appendix Section 10.9.3). The majority of collisions (72%) along this segment occurred during wet pavement conditions. Approximately 66% of the collisions were a result of vehicles leaving the roadway and hitting an object. The collision data indicates that drivers are losing control of their vehicle while navigating the curves. There is a significant increase in collisions when the pavement is wet and traction is diminished. One possible solution to mitigate collisions in this area is to increase the roadway traction using a high friction roadway surface.

7.3.1 Goals for Bennett Valley Rd

- Reduce number of deaths to zero by 2030
- Reduce number of collisions by 25% by 2030

7.3.2 Strategies for Bennett Valley Rd

Ongoing:

- Additional curve warning signage was implemented in 2019
- Crash count signs have been installed warning motorists of high collision area.
- The county regularly deploys a temporary speed radar trailer to the area to attempt to slow down motorists.

Future:

- Explore installing high friction roadway surface for the high collision curve sections.

7.4 Porter Creek Rd Hotspot (PM 18.66-18.86)

Porter Creek Rd is a narrow and winding 4.65 mile long, two-lane road. The road has roughly 7,000 trips per day. Between PM 18.66-18.86, there were 25 collisions and 1 fatality during the five year study period resulting in a collision rate of 9.77 collisions per million vehicles miles (c/mvm) for the roadway segment. This segment includes the hotspot location at PM 18.70-18.72 which had a collision rate of 46.88. This emphasis area was identified in the collision hotspot

analysis as well as the collision rate analysis.

The Porter Creek hotspot is characterized by a hairpin turn. There are currently chevron signs delineating the curve. The majority (76%) of the collisions occurred during wet conditions with the vehicles traveling at unsafe speeds and leaving the roadway (see Table 18, Appendix Section 10.9.4). One possible solution to mitigate collisions in this area is to increase the roadway traction using a high friction roadway surface.

7.4.1 Goal for Porter Creek Rd Hotspot

- Reduce number of deaths to zero by 2030
- Reduce number of collisions by 25% by 2030

7.4.2 Strategies for Porter Creek Rd Hotspot

- Explore installing high friction roadway surface for the high collision curve section.

7.5 Calistoga Rd Segments (PM 11.85-12.07 and PM 15.95-16.45)

Calistoga Rd connects northeast Santa Rosa to Petrified Forest Rd (connection to Calistoga). The road is narrow and winding in nature with minimal shoulders. Calistoga Rd was identified in multiple analysis methods. The roadway had 148 collisions recorded for the five year study period.

Two hotspot locations were identified along Calistoga Rd. The hotspots account for approximately 39% of all the collisions along the roadway, but only 3% of the overall roadway length. The hotspots along Calistoga Rd both have narrow lanes and narrow shoulders.

The majority (86%) of the collisions that occurred at the hotspot located along PM 11.85-12.07 were during wet conditions (see Table 19, Section 10.9.5). The segment of the road is near Santa Rosa City limits and is where Calistoga Rd transitions from a straight urban road to a winding rural road.

The majority (83%) of the collisions that occurred at the hotspot located along PM 15.95-16.45 were during dry conditions. Two thirds (67%) of the collisions were from vehicles leaving the roadway (see Table 20, Section 10.9.5). This section of roadway encompasses back to back curves.

7.5.1 Goal for Calistoga Rd

- Reduce number of collisions by 25% by 2030

7.5.2 Strategies for Calistoga Rd

- Explore alternative striping/signage measures that may help channel traffic more safely.
- Install wet-night, high visibility thermoplastic striping for the entirety of Calistoga Rd.
- Explore installing high friction roadway surface for the high collision curve sections.

7.6 Bodega Hwy Hotspot PM (16.65-16.78)

The 0.13 mile segment of Bodega Hwy between PM 16.65-16.78 had 17 collisions with 14 injuries, which accounts for 11% of the collisions that occurred on Bodega Hwy over the five year period. The segment is characterized by a hairpin curve leading to a box culvert with guardrail and narrow

shoulders. Water is often present on the roadway surface indicating that there may be poor drainage, which may contribute to an increased number of collisions.

An analysis of the collisions along this segment (see Table 21, Section 10.9.6) found that 71% of collisions occurred during wet pavement conditions. Approximately 47% of the collisions were a result of vehicles leaving the roadway and hitting an object. The collision data indicates that drivers are losing control of their vehicle while navigating the curves. There is a significant increase in collisions when the pavement is wet and traction is diminished.

7.6.1 Goal for Bodega Hwy

- Reduce the number of collisions by 25% by 2030.

7.6.2 Strategies for Bodega Hwy

Ongoing:

- Investigate and repair any drainage issues
- Install flashing beacon and additional signage warning of the curve ahead.

Future:

- Explore installing high friction roadway surface for the high collision curve sections.

7.7 Intersection of Todd Rd and Santa Rosa Ave

The intersection of Todd Road and Santa Rosa Avenue is a fully signalized 4-leg intersection. There were 36 collisions at this intersection over the 5 year study period. The intersection experiences high traffic volumes. The intersection is the link to SR 101 for the area. The above-average collision rate for this intersection could be due to driveways being located within 90 feet of the signalized intersection that create additional conflict zones. A collision trend analysis was not performed for this area because the County did not have detailed enough information at this time.

7.7.1 Goal for Todd Rd and Santa Rosa Ave Intersection

- Reduce the number of collisions by 25% by 2030.

7.7.2 Strategies for Todd Rd and Santa Rosa Ave Intersection

- Perform an in-depth collision analysis to look for patterns and understand if there is an underlying cause for the high collision rate.
- Explore alternative striping/signage measures that may help channel traffic more safely.
- Consolidate or remove driveways near the intersection and limit future development of driveways near intersection.

7.8 Intersection of Adobe Rd and Frates Rd

The intersection of Adobe Rd and Frates Rd is a 3-leg “all way-stop” controlled intersection. There were 36 collisions at this intersection over the 5 year study period. The intersection experiences high traffic volumes. During peak traffic times, there is significant queueing. The majority of collisions were rear-ends due to the long queue lengths. There were also a high number of sideswipes from conflicting turn movements.

7.8.1 Goal for Adobe Rd and Frates Rd Intersection

- Reduce the number of collisions by 25% by 2030.
- Reduce queue lengths

7.8.2 Strategies for Adobe Rd and Frates Rd Intersection

- Perform a more in-depth collision analysis to look for patterns and understand if there is an underlying cause for the high collision rate.
- Explore possibilities of signalization or roundabout.

7.9 Intersection of Old Redwood Hwy and East Railroad Ave

The intersection of Old Redwood Hwy and East Railroad Ave is a 4 leg intersection with 2-way stop control. There were 31 collisions at this intersection over the 5 year study period. Old Redwood Hwy is a high speed/high volume road and is the through road with no stop control. Collisions are likely occurring at this intersection due to the high speed of Old Redwood Hwy and conflicting turning movements of traffic from Railroad Ave. East Railroad Ave intersects Old Redwood Hwy at an angle that is non-perpendicular. This non-perpendicular geometry of the intersection may also be contributing to an increase in collisions.

7.9.1 Goal for Old Redwood Hwy and East Railroad Ave Intersection

- Reduce the number of collisions by 25% by 2030.

7.9.2 Strategies for Old Redwood Hwy and East Railroad Ave Intersection

- Perform an in-depth collision analysis to look for patterns and understand if there is an underlying cause for the high collision rate.
- Consider future intersection controls, including installation of a traffic signal, investigate improving line of sight with vegetation removal and investigate re-alignment of E. Railroad at intersection.

7.10 Pedestrian and Bicycle Collisions

Due to the low volume of pedestrians and cyclists in comparison to the volume of vehicles, all collisions involving a pedestrian or cyclist are considered significant. All collisions involving pedestrians or cyclists should be further examined for underlying causes and possible solutions.

The pedestrian collisions typically occurred near urban areas. Over the study period, 54% of the collisions occurred during dark conditions. Roughly 25% of the pedestrian collisions involved alcohol and 90% of pedestrian collisions occurred outside of a crosswalk.

The bicycle collisions were geographically spread out throughout the county. There did not appear to be a geographical trend as to where the bicycle collisions occurred. Sonoma County is a very popular biking destination and cyclists frequent roadways throughout the county. The majority (89%) of the bicycle collisions occurred during daylight and during clear, dry conditions.

The main causes of bicycle collisions were due to improper turning (26%), followed by unsafe speed (19%), automobile right of way (15%) and wrong side of the road (11%) (see Table 13, Section 0).

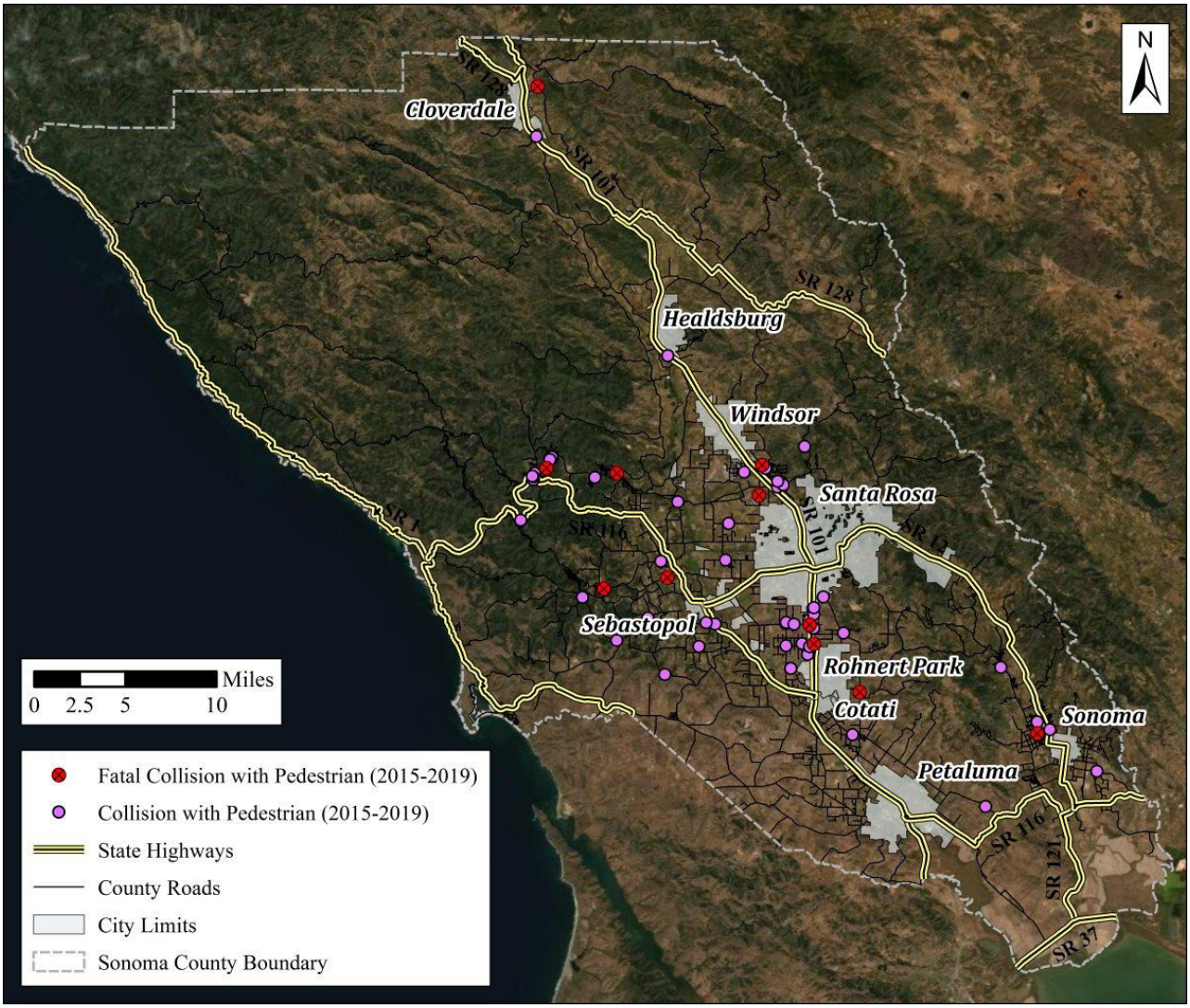


Figure 3: Location of all Pedestrian collisions

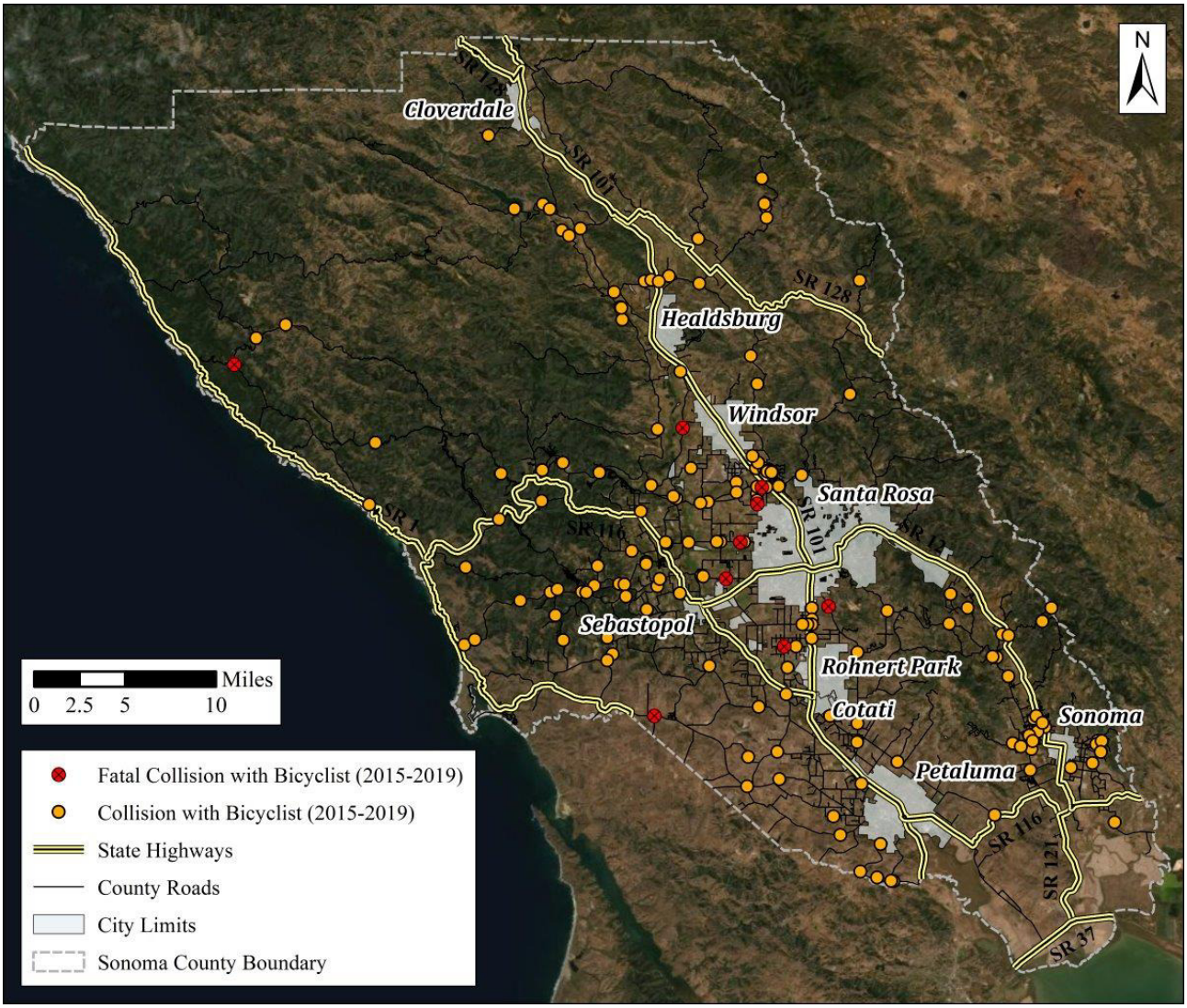


Figure 4: Location of all Bicycle collisions

7.10.1 Goal for Pedestrian and Bicycles

- Reduce the number of Pedestrian/Bicyclist collisions to zero by 2030.

7.10.2 Strategies for Pedestrian and Bicycles

- Work with the County's Bicycle and Pedestrian Plan to identify strategic locations for improvements.
- Coordinate with Sonoma County Bicycle & Pedestrian Advisory Committee (SCBPAC). to identify locations for possible safety improvements.
- Review collision reports for insight into why collisions occurred.
- Enhance existing pedestrian crossings as needed.
- Identify potential locations for new pedestrian crossings.

8 EVALUATION & IMPLEMENTATION

The Traffic Section of DTPW will pursue implementing the above strategies presented in Section 7 as viable options to meeting the goals of reducing collisions and bringing the number of fatalities to zero. The Traffic Section will coordinate with the Design and the Land Development Sections of DTPW to implement improvements with scheduled paving projects or land development projects. The Department will apply for HSIP funding where feasible to help pay for the improvements.

9 FUTURE ITERATIONS

The LRSP is a living document. The Department will continue to collect data and update this document at a minimum of every five years. Regularly updating the collision and traffic data will help track improvement progress and collision trends.

10 Appendix

10.1 Emphasis Area Summary Table

Emphasis Area	Road Name	PM	Rationale for Selection	Proposed Strategies
1	River Rd	Entire Road	River Rd had the highest number of collisions and fatalities over the 5 year study period. It accounts for 7% of the collisions and 17% of the fatalities.	• Install centerline rumble strips for the entirety of River Rd. • Install wet-night, high visibility thermoplastic striping for the entirety of River Rd.
2	Lakeville Rd	Entire Road	Lakeville Rd accounts for a large number of collisions causing serious injury or death. It was ranked as both # 1 and #2 in the injury hotspot analysis.	Ongoing: • Centerline and edge line rumble strips were installed in summer 2019 using HSIP funding. • The entire roadway was restriped using high intensity wet-night striping. • Additional signage was installed directing motorists to turn on headlights. • Collision count signs have been installed warning motorists of high collision area. • A Lakeville Rd taskforce has been started by the CHP to focus additional efforts on the roadway. • The county regularly deploys a speed radar trailer to the area to attempt to slow down motorists. Future: • The County will continue to monitor this roadway and make improvements as possible. • Additional HSIP funding may be pursued to install a median barrier along the majority of the roadway. • SCTA is spearheading a campaign to improve the intersection of Lakeville Rd and Hwy 116 (Stage Gulch Rd). Construction is scheduled to begin as early as 2024.
3	Bennett Valley Rd	12.74-13.6	The 0.86 mile segment had 64 reported collisions and 3 fatalities over the 5 year study period. Meaning 37% of the collisions that occurred on	Ongoing: • Additional curve signage has been implemented as of 2019 • Collision count signs have been installed warning motorists of high collision area. Future:

			the 19.88 mile road, happened along just 0.86 miles of the roadway.	• Explore installing high friction roadway surface for the high collision curve sections.
4	Porter Creek Rd	18.70-18.72	The .02 mile segment of Porter Creek Rd from 18.70-18.72 had the highest collision rate in the county (46.88 c/mvm).	• Research the potential of installing high friction surface treatment. • Perform an in-depth collision analysis to look for patterns and understand if there is an underlying cause for the high collision rate.
5	Calistoga Rd Hotspots	PM 11.85-12.07 and PM 15.95-16.45	Two hotspot locations were identified along Calistoga Rd. The hotspots account for approximately 39% of all the collisions along the roadway but only 3% of the overall roadway length.	• Perform an in-depth collision analysis to look for patterns and understand if there is an underlying cause for the high collision rates. • Explore alternative striping/signage measures that may help channel traffic more safely. • Install wet-night, high visibility thermoplastic striping for the entirety of Calistoga Rd.
6	Bodega Hwy Hotspot	PM 16.65-16.78	The hotspot accounts for 11% of the collisions that occurred on Bodega highway over the 5 year period (17 collisions with 14 injuries).	Ongoing: • Fix drainage issues • Install flashing beacon and additional signage warning of the curve ahead. Future: • Explore installing high friction roadway surfacing for the high collision curve sections.
7	Intersection of Todd + Santa Rosa	NA	High number of collisions within influence of intersection. Above average collision rate compared to state average for similar intersections.	• Perform an in-depth collision analysis to look for patterns and understand if there is an underlying cause for the high collision rate. • Explore alternative striping/signage measures that may help channel traffic more safely. • Consolidate or remove driveways near the intersection and limit future entries.
8	Intersection of Adobe Rd + Frates	NA	High number of collisions within influence of intersection.	• Perform an in-depth collision analysis to look for patterns and understand if there is an underlying cause for the high collision rate. • Explore possibilities of signalization or roundabout.

9	Intersection of Old Redwood Hwy + E Railroad	NA	High number of collisions within influence of intersection.	• Perform an in-depth collision analysis to look for patterns and understand if there is an underlying cause for the high collision rate.
10	Research Pedestrian and Bicycle Collisions	NA	There is a low volume of pedestrians and cyclists in comparison to the volume of vehicles, all collisions involving a pedestrian or cyclist are considered significant. All collisions involving pedestrians or cyclists should be further examined for underlying causes and possible solutions.	• Work with the County's Bicycle and Pedestrian Plan to identify strategic locations for improvements • Coordinate with Sonoma County Bicycle & Pedestrian Advisory Committee (SCBPAC) to identify locations for possible safety improvements • Review collision reports for insight into why collisions occurred • Enhance existing pedestrian crossings as needed • Identify potential locations for new pedestrian crossings.

10.2 Collision Rate Calculations[1]

Collision rates were calculated for each roadway segment and intersection using the number of collisions, average daily traffic volume data (from the County traffic count database). For the roadway segment, the length of the study segment in miles was included in the calculation.

Collision rates were calculated using the following formulas:

Intersections:

$$RI = \frac{C \times 1{,}000{,}000}{365 \times \quad \times V}$$

Roadway Segments:

$$RS = \frac{C \times 1{,}000{,}000}{365 \times V \times L \times}$$

Where:
RI = Collision Rate = Collision frequency per million vehicles entering the intersection
RS = Collision Rate = Collision frequency per million vehicle miles traveled along roadway segment
C = Number of Collisions
N = Number of years in study period
L = Length of roadway segment
V = Average daily vehicular volume for street segment or intersection

[1] 2016 Collision Data on California State Highways, CALIFORNIA STATE TRANSPORTATION AGENCY DEPARTMENT OF TRANSPORTATION DIVISION OF RESEARCH, INNOVATION, AND SYSTEM INFORMATION Sacramento, California

10.3 Collisions by Year

Table 8: Collision Numbers by Year

Year	Collisions	Injuries	Fatalities
1999	1277	848	27
2000	1303	777	21
2001	1295	735	19
2002	1266	668	8
2003	1102	564	18
2004	1138	632	16
2005	1102	578	21
2006	994	481	21
2007	1042	519	11
2008	850	405	5
2009	943	548	11
2010	982	515	12
2011	895	419	8
2012	809	467	12
2013	978	534	8
2014	1118	610	20
2015	979	534	18
2016	1200	670	19
2017	1201	643	14
2018	1044	556	14
2019	1090	547	13

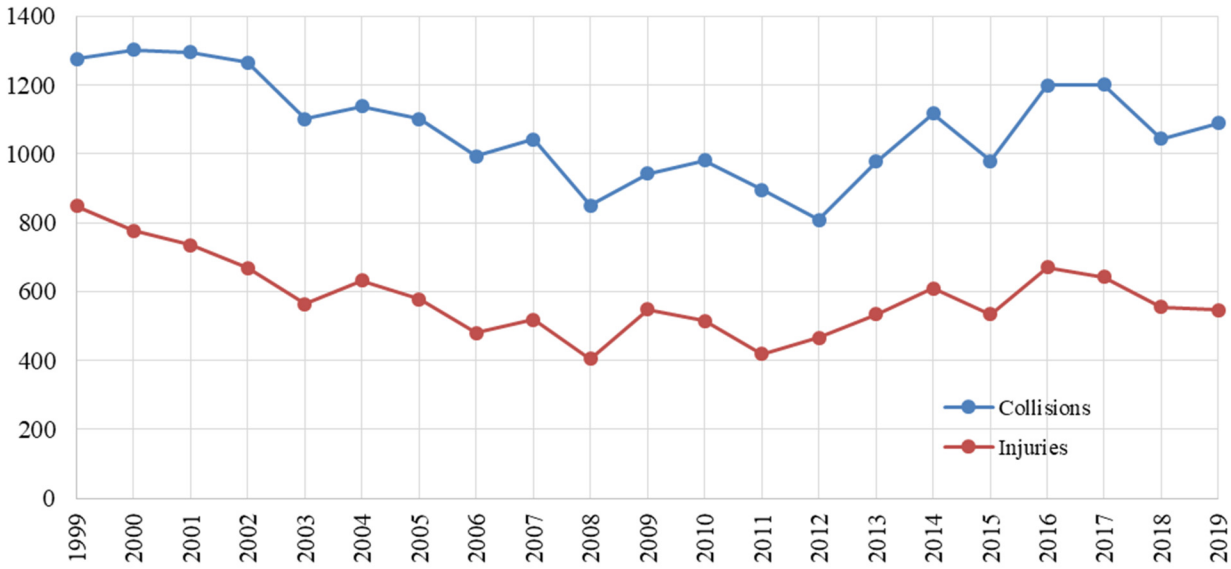


Figure 5: Collisions Trend Over 20 Years

10.4 Fatalities by Year

Table 9: Fatalities by Road

Road Name	2015	2016	2017	2018	2019	Total
River Rd	2	3	2	1	3	11
Lakeville Rd		1	3	2		6
Bennett Valley Rd	2			2		4
Eastside Rd	1	2		1		4
Occidental Rd	1	1		1	1	4
Adobe Rd	2		1			3
Petaluma Hill Rd		1			2	3
Valley Ford Rd			1	2		3
Bodega Ave				2		2
Fulton Rd		1	1			2
Guerneville Rd	1		1			2
Napa Rd		1	1			2
Old Redwood Hwy				1	1	2
Armstrong Woods Rd		1				1
Cazadero Hwy			1			1
Crocker Rd	1					1
D Street Extension				1		1
Davis Ln		1				1
Dry Creek Rd	1					1
Graton Rd					1	1
Hauser Bridge Rd	1					1
Llano Rd		1				1
Los Amigos Rd	1					1
Oak Grove Ave					1	1
Occidental Rd	1					1
Petaluma Blvd N		1				1
Petrified Forest Rd	1					1
Piner Rd	1					1
Porter Creek Rd	1					1
Stony Point Rd	1					1
Verano Ave		1				1
Westside Rd					1	1
Old Adobe Rd		1				1
Moscow Rd		1				1
Sebastopol Rd		1				1
San Antonio Rd			1			1
Hall Rd			1			1
S. Ely Rd			1			1

E. Napa Rd					1	1
Roberts Lake Rd					1	1
Alexander Valley Rd		1				1
Slusser Rd				1		1
Watertrough Rd					1	1
Total	**18**	**19**	**14**	**14**	**13**	**78**

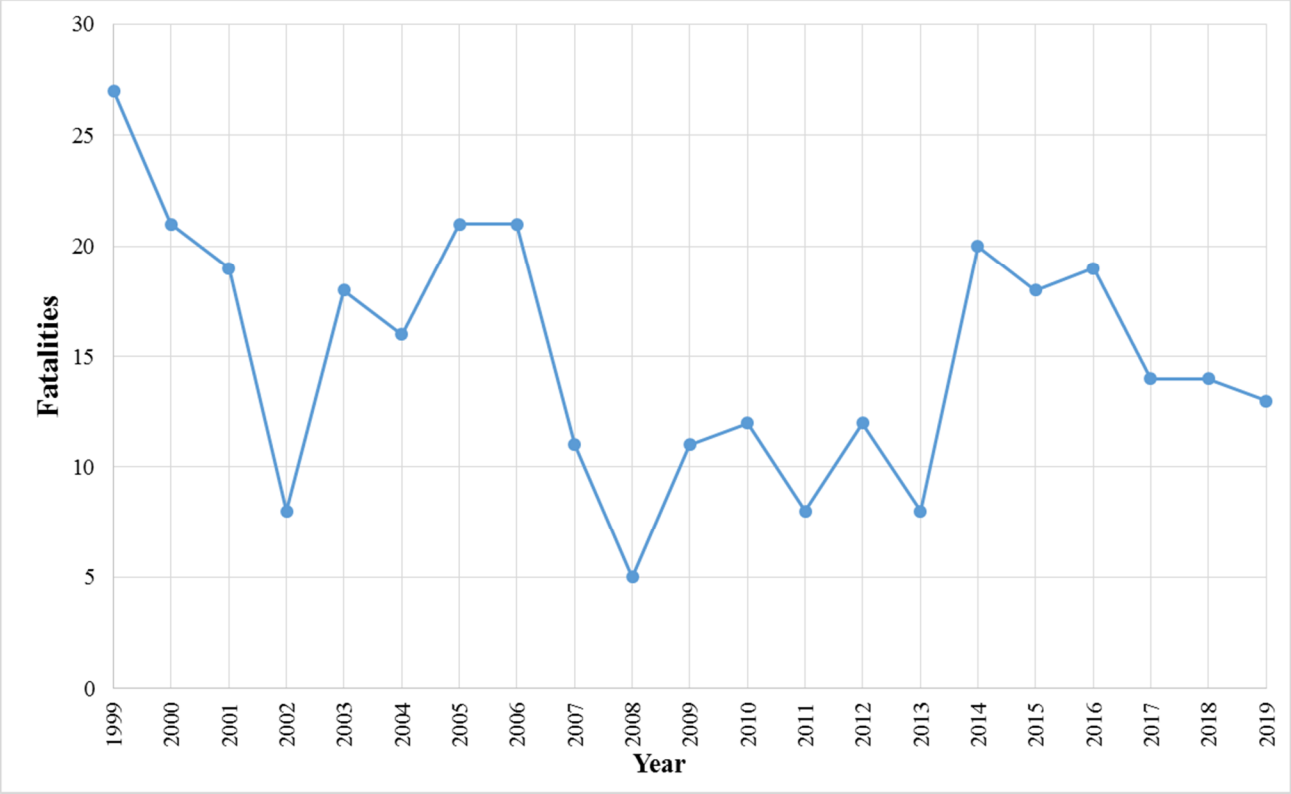


Figure 6: Fatality Trend over 20 years

10.5 Roads with Highest Collision Rates

Table 10: Road Segments with Highest Collision Rates (2015-2019)

ID	Road Name	Road ID	PM Beg	PM End	Collisions	ADT	Collision Rate	Intersection Influence
1	Porter Creek Rd	8801B	18.7	18.72	12	7013	46.88	NO
2	Todd Rd	6807A	14.63	14.71	24	11687	14.07	YES
3	Old Redwood Hwy N	5712B	13.33	13.54	6	1270	12.33	YES
4	River Rd	8802B	17.46	17.5	12	13740	11.96	YES
5	Arnold Dr	5603	12.39	12.41	5	12269	11.17	YES
6	Petaluma Hill Rd	5710B	16.87	16.89	5	13966	9.81	YES
7	Mark West Springs Rd	8801A	10.185	10.23	18	21633	9.12	Maybe
8	Adobe Rd	5602	15.75	15.82	17	16106	8.26	YES
9	Scenic Ave	68061A	11.57	11.952	8	1489	7.75	NO
10	Old Redwood Hwy N	5712B	13.2	13.33	13	7306	7.50	YES
11	Mark West Station Rd	89010	10	11.42	8	416	7.42	NO
12	Main St	5710A	10.21	10.27	6	7875	6.96	YES
13	River Rd	8802B	24.68	24.74	12	16127	6.80	YES
14	Airport Blvd	8803A	12.35	12.55	7	2963	6.47	Maybe
15	Old Redwood Hwy	7812	12.02	12.15	20	13373	6.30	Maybe
16	Faught Rd	8807	10.42	11.42	10	878	6.24	NO
17	Fulton Rd	7804B	14	14.05	7	13096	5.86	YES
18	Bennett Valley Rd	6604	18.2	19.3	37	3199	5.76	NO
19	Millbrae Ave	68060	10.69	10.91	5	2195	5.67	YES
20	Mark West Springs Rd	8801A	10.14	10.185	10	21633	5.63	YES

*Highlighted cells indicate not an intersection

10.6 Highest Intersection Collisions

Table 11: Top 10 Intersections Ranked by Number of Collisions (2015-2019)

Description	Collisions	Stop Control
Todd Rd at Santa Rosa Ave	36	Signal
Adobe Rd at Frates Rd	36	All Way Stop
Old Redwood Hwy N at E Railroad Ave	31	Two Way Stop
8th Street E at Napa Rd	29	Signal
Stony Point Rd at Todd Rd	28	Signal
Levoroni Rd at Arnold Dr	24	Signal
Adobe Rd at Casa Grande Rd	23	Single Stop
River Rd at Fulton Rd	22	Signal
Old Redwood Hwy N at Ely Rd	19	Two Way Stop
Arnold Dr at Grove St	17	Signal

10.7 Bicycle Collisions

Table 12: List of roads with collisions involving a bicyclist ranked by number of collisions (2015-2019)

Road Name	Number of Bicycle Collisions	Bicyclists Killed	Number of Cyclists Severely Injured
River Rd	14	1	3
Old Redwood Hwy	8	0	2
Occidental Rd	6	1	3
Coleman Valley Rd	6	0	2
Graton Rd	6	0	3
Guerneville Rd	5	1	1
Santa Rosa Ave	5	0	0
Arnold Dr	4	0	0
Dry Creek Rd	4	0	3
Pine Flat Rd	4	0	3
Fulton Rd	3	1	0
Lovall Valley Rd	3	0	1
Petaluma Hill Rd	3	1	1
San Antonio Rd	3	0	1
Trinity Rd	3	0	0
W Dry Creek Rd	3	0	1
Bennett Valley Rd	2	0	0
Bodega Ave	2	0	2
Bodega Hwy	2	0	0
Chalk Hill Rd	2	0	1
D St	2	0	2
Eastside Rd	2	1	1
Hauser Bridge Rd	2	1	1
Joy Rd	2	0	0
King Ridge Rd	2	0	2
Lawndale Rd	2	0	0
Lytton Springs Rd	2	0	0
Lytton Station Rd	2	0	0
Mark West Springs Rd	2	0	0
Mill Station Rd	2	0	1
Napa Rd	2	0	0
Stony Point Rd	2	1	0
Todd Rd	2	0	0
Valley Ford Rd	2	1	1
Vine Hill Rd	2	0	1
Adobe Rd	1	0	1

Airport Blvd	1	0	0
Alexander Valley Rd	1	0	0
Bloomfield Rd	1	0	1
Bohemian Highway	1	0	1
Boyes Blvd	1	0	0
Brack Rd	1	0	0
Denmark St	1	0	0
Dunbar Rd	1	0	1
Eastman Lane	1	0	1
Fort Ross Rd	1	0	1
Franz Valley Rd	1	0	0
Geysers Rd	1	0	1
Grandview Rd	1	0	0
Green Valley Rd	1	0	0
Grove St	1	0	0
Harrison Grade Rd	1	0	1
Hot Springs Rd	1	0	1
Ida Clayton Rd	1	0	1
Laughlin Rd	1	0	0
London Ranch Rd	1	0	1
Mark West Station Rd	1	0	1
Mays Canyon Rd	1	0	0
Meadowbrook Av	1	0	0
Meyers Grade Rd	1	0	1
Millbrae Ave	1	0	0
Moscow Rd	1	0	0
Northside Ave	1	0	0
Old Adobe Rd	1	0	1
Old Cazadero Rd	1	0	1
Pepper Rd	1	0	0
Petaluma Blvd North	1	0	0
Ramal Rd	1	0	0
Redwood Dr	1	0	0
Riverside Drive	1	0	0
Roblar Rd	1	0	1
Rockpile Rd	1	0	0
Rohnert Park Expy	1	0	0
Solano Ave	1	0	1
Spring Hill Rd	1	0	0
Sullivan Rd	1	0	1
Thomson Ave	1	0	0

Thornsberry Rd	1	0	1
Van Keppel Rd	1	0	0
Verano Ave	1	0	1
Walker Rd	1	0	0
Walnut Ave	1	0	0
Westside Rd	1	0	0
Wikiup Dr	1	0	0
Willow Creek Rd	1	0	1
Yoakim Bridge Rd	1	0	0
Total	**169**	**9**	**57**

10.7.1 Bicycle collisions by violation category

Table 13: Bicycle collisions per violation category

Bicycle Collisions	Violation Category	Percent
12	Unknown	7%
2	Driving or Bicycling Under the Influence of Alcohol or Drug	1%
33	Unsafe Speed	19%
1	Following Too Closely	1%
18	Wrong Side of Road	11%
3	Improper Passing	2%
1	Unsafe Lane Change	1%
45	Improper Turning	26%
26	Automobile Right of Way	15%
1	Pedestrian Right of Way	1%
4	Traffic Signals and Signs	2%
1	Lights	1%
11	Other Hazardous Violation	6%
6	Other Than Driver (or Pedestrian)	4%
1	Unsafe Starting or Backing	1%
6	Other Improper Driving	4%

10.8 Pedestrian Collisions

Table 14: List of roads with collisions involving a pedestrian ranked by number of collisions (2015-2019)

Road Name	Collisions	Fatalities	Injuries
River Rd	7	2	5
Old Redwood Hwy	5	1	3
Santa Rosa Ave	5	0	5
Mark West Springs Rd	3	0	3
Petaluma Hill Rd	3	1	2
Stony Point Rd	3	0	3
Bohemian Hwy	2	0	3
Church St	2	0	2
Graton Rd	2	1	1
Todd Rd	2	1	1
Armstrong Woods Rd	1	0	1
Arnold Dr	1	0	1
Asti Rd	1	0	1
Bodega Hwy	1	0	1
Burnside Rd	1	0	1
Century Court	1	0	1
Crocker Rd	1	1	0
Elphick Rd	1	0	1
Fourth St	1	0	1
Fulton Rd	1	1	0
Gerhard Dr	1	0	1
Grove St	1	0	1
Hall Rd	1	0	1
Kinley Rd	1	0	1
Laguna Rd	1	0	1
Langner Ave	1	0	2
Lomita Ave	1	0	1
Lynch Rd	1	0	1
Millbrae Ave	1	0	1
Moorland Ave	1	0	1
Napa Rd	1	0	1
Occidental Rd	1	1	1
Adobe Rd	1	0	1
Pleasant Hill Rd	1	0	1
Riverside Dr	1	0	2
Roberts Lake Rd	1	1	0
Rohnert Park Expy	1	0	1

South Moorland Ave	1	0	1
Verano Ave	1	1	0
Total	**63**	**11**	**55**

10.9 Collision Types

10.9.1 River Rd

Table 15: Collision Types by Year on River Rd

Collision Type	2015	2016	2017	2018	2019	Total
Dry Pavement						
Broadside	15	20	20	16	12	83
Head On	8	3	6	1	7	25
Hit Object	10	19	19	13	20	81
Other				1		1
Overturned	2	4	2	2	1	11
Rear End	19	24	16	14	12	85
Side Swipe	7	8	11	5	5	36
Vehicle/Pedestrian	2	2		1		5
Dry Total	**63**	**80**	**74**	**53**	**57**	**327**
Wet Pavement						
Broadside		2		1	1	4
Head On			1	1		2
Hit Object	1	3	6	3	4	17
Other					1	1
Overturned		2				2
Rear End	1	4	3	1	1	10
Side Swipe	1	3	1			5
Vehicle/Pedestrian				1		1
Wet Total	**3**	**14**	**11**	**7**	**7**	**42**
Unspecified					1	1
Unspecified Total					1	1
Grand Total	**66**	**94**	**85**	**60**	**65**	**370**

10.9.2 Lakeville Rd

Table 16: Collision Types by Year on Lakeville Rd

Collision Type	2015	2016	2017	2018	2019	Total
Dry Pavement						
Broadside	2	3	4		1	10
Head On		1	1	5	1	8
Hit Object	13	8	11	9	6	47
Other	1			1		2
Overturned	1	2	1		1	5
Rear End	9	16	10	7	4	46
Side Swipe		4	6	2	4	16
Dry Total	**26**	**34**	**33**	**24**	**17**	**134**
Wet Pavement						
Broadside			1		1	2
Hit Object		3	2	3	4	12
Rear End		1	1	1	1	4
Side Swipe	1	2	1		1	5
Wet Total	**1**	**6**	**5**	**4**	**7**	**23**
Grand Total	**27**	**40**	**38**	**28**	**24**	**157**

10.9.3 Bennett Valley Rd Hotspot (PM 12.7-13.6)

Table 17: Collision analysis of Bennett Valley Rd Hotspot (PM 12.70-13.60)

Collision Type	2015	2016	2017	2018	2019	Total
Dry Pavement						
Broadside	1					1
Hit Object	1	3	5	4	1	14
Overturned				1		1
Side Swipe	1	1		1		3
Dry Total	**3**	**4**	**5**	**6**	**1**	**19**
Wet Pavement						
Broadside		2	1	4		7
Head On		1		2		3
Hit Object	1	4	6	13	9	33
Overturned	1	1		1		3
Rear End					3	3
Side Swipe	1	1				2
Wet Total	**3**	**9**	**7**	**20**	**12**	**51**
Unspecified		1				1
Unspecified Total		**1**				**1**
Grand Total	**6**	**14**	**12**	**26**	**13**	**71**

10.9.4 Porter Creek Rd Hotspot (PM 18.66-18.86)

Table 18: Collision analysis of Porter Creek Rd Hotspot (PM 18.66-18.86)

Collision Type	2015	2016	2017	2018	2019	Total
Dry Pavement						
Broadside			1			1
Head On		1				1
Hit Object	1			2		3
Rear End				1		1
Dry Total	**1**	**1**	**1**	**3**		**6**
Wet Pavement						
Broadside	1				1	2
Head On	1					1
Hit Object	1	2	1	9	2	15
Side Swipe					1	1
Wet Total	**3**	**2**	**1**	**9**	**4**	**19**
Grand Total	**4**	**3**	**2**	**12**	**4**	**25**

10.9.5 Calistoga Rd Hotspots

Table 19: Collision analysis of Calistoga Rd Hotspot (PM 11.85-12.07)

Collision Type	2015	2016	2017	2018	2019	Total
Dry Pavement						
Head On		1				1
Side Swipe			1	1		2
Dry Total		**1**	**1**	**1**		**3**
Wet Pavement						
Head On		1		1		2
Hit Object	3	1		3	1	8
Overturned		2			1	3
Rear End	1	1				2
Side Swipe		1	1		1	3
Wet Total	**4**	**6**	**1**	**4**	**3**	**18**
Grand Total	**4**	**7**	**2**	**5**	**3**	**21**

Table 20: Collision analysis of Calistoga Rd Hotspot (PM 15.95-16.45)

Collision Type	2015	2016	2017	2018	2019	Total
Dry Pavement						
Broadside	1					1
Head On			1	1	1	3
Hit Object	4	2	4	5	5	20
Overturned		2	1		2	5
Side Swipe		1				1
Dry Total	**5**	**5**	**6**	**6**	**8**	**30**
Snowy/Icy Pavement						
Overturned	1					1
Snowy/Icy Total	1					1
Wet Pavement						
Broadside			1			1
Hit Object			2	1	1	4
Wet Total			**3**	**1**	**1**	**5**
Grand Total	**6**	**5**	**9**	**7**	**9**	**36**

10.9.6 Bodega Hwy Hotspot (PM 16.65-16.78)

Table 21: Collision analysis of Bodega Hwy Hotspot (PM 16.65-16.78)

Collision Type	2015	2016	2017	2018	2019	Total
Dry Pavement						
Head On		1				1
Hit Object		1	1			2
Rear End		1				1
Side Swipe		1				1
Dry Total		**4**	**1**			**5**
Wet Pavement						
Head On	2		1	1		4
Hit Object	2	1		1	2	6
Side Swipe		1		1		2
Wet Total	**4**	**2**	**1**	**3**	**2**	**12**
Grand Total	**4**	**6**	**2**	**3**	**2**	**17**

10.10 Outreach

The following groups were solicited for feedback regarding the Local Road Safety Plan:

- California Highway Patrol (CHP)
- County of Sonoma
    - Permit and Resource Management Department (PRMD) –No response
    - Department of Transportation and Public Works (DTPW)
        - Engineering
        - Traffic
        - Land Development
        - Road Maintenance
    - Department of Health Services
    - Transportation Authority (SCTA)
- Sonoma County Bicycle and Pedestrian Committee
- Sonoma County Vision Zero Advisory Committee
- Local Tribes –No Response

For a summary of comments and the County's response see table 22 below.

Table 22: Comments Received on LRSP.

	Comment	Page	Response
#1	Retro-reflectivity testing and replacement program for sign panels	4	Added bullet point
#2	Should we enhance the discussion of the data limitations? note that data could be missing	4	Added sentence *"Furthermore some data may be inaccurate or missing due to human error, e.g. a collision was inputted incorrectly or omitted completely."*
#3	explain the definition of collision rate	8	Added language to the methodology section: *"The collision rate equation (see Appendix Section 10.2) uses traffic volumes and segment lengths to calculate the rate of collisions per 100 million vehicle-miles of travel (c/mvm). Collision rate can be a useful metric because it normalizes variables and produces a rate that incorporates traffic volume and segment length. Since the likelihood of a collision occurring increases with traffic volume and roadway length, collision rate can be a useful tool for comparing roadways of varying characteristics. However there are limitations to the equation as well. The equation becomes very sensitive when short segments and/or low volumes are used. The results should always be examined with the underlying knowledge of the inputs used to calculate the rate and should be interpreted with some caution."*

#4	2020 overlay between RR tracks and Trenton-Healdsburg Road includes centerline rumble strip installation	13	done
#5	add "temporary" speed trailer	14	done
#6	Consider future intersection controls, including traffic signal investigate improving line of sight with vegetation removal investigate re-alignment of E. Railroad at intersection? (add to strategies)	18	Done
#7	check significant figures table 4	9	fixed
#8	How does this rate compare to other similar jurisdictions?	1	added paragraph
#9	Recommend a color other than green for the collision map - maybe yellow or blue	2	changed to blue
#10	Does this count as a Vision Zero policy?	3	maybe
#11	Change health services to Department of Health Services	3	fixed
#12	Recommend "Vision Zero Advisory Committee", as that is the name of the body that has convened to make decisions and recommendations on the Vision Zero Action Plan.	3	fixed
#13	I don't think that collisions are "random" - they're predictable and preventable - isn't that the point of having an LSRP?		There is a random nature to the location of these collisions. I agree that there are underlying causes for some areas and those are what we are trying to identify. My point was more regarding the need to look at this from multiple viewpoints for patterns and causes because it is not necessarily readily apparent since these collisions occur randomly throughout the county. The data itself is random in nature but the cause of the collisions are not random.
#14	Global comment: change accident to collision	global	fixed
#15	Are there any plans to install or pursue automated speed cameras?	14	not at this time. I don’t think that speed cameras are legal in California.
#16	What about lowering speed limits & installing speed cameras?	16	Speed limits by law are required to be set at the 85th percentile of travel speed.
#17	Do we know which party was under the influence in these cases? It sounds like the pedestrians?	18	This will take a bit of research within the paper files which I currently do not have access to due to Covid restrictions. I will look into it and revise when I can.
#18	Page 3 says: “HSIP provides municipalities with funding for projects that have the sole purpose of reducing crashes and improving roadway safety. “ Does the inclusion of bicycle collision information in the LRSP make HSIP funds available for the noted necessary “further analysis” on bicycle and pedestrian collisions and corresponding roadway improvements? I.e. can HSIP funds be used for research and analysis or only for roadway improvements? If the latter, then where will the funding come from for the bike/pedestrian	3	HSIP funds are targeted towards physical improvements. Funds are unlikely to be approved for research and analysis purposes. The LRSP was limited to the data that was available. This is a starting point. Future iterations can incorporate additional data as it becomes available. I am hoping to obtain additional data through the Vision Zero program. I am also open to adding any additional data that BPAC can provide.

	collision analysis called for in the LRSP? Also if HSIP funds cannot be used for that further analysis, then I think this LRSP is way too lacking in bicycle and pedestrian analysis and more should be done so that specific safety improvements can be made and thereby funded by HSIP funds.		
#19	Biggest takeaway for me is that for the "emphasis areas" there seems to be a fairly in-depth analysis of collision causes including specific strategies such as road surface changes, signage etc. But then in section 7.10 "Pedestrian and Bicycle Collisions", the report effectively says "this is hard to understand these collisions" so we need to do more analysis. Doesn't seem to even dig into causes. All the "strategies" are rather vague in terms of concrete action. Again on page 24, the table just says "Research bicycle and pedestrian collisions"		I can dig into the causes more deeply based on the data available in the database. There may be additional information that could be useful. Also there are paper copies of each collision report that may provide additional information. Eris alluded to this during the meeting. Obtaining these reports and going through them one by one will be a time consuming endeavor and will have to be part of a future update. This is what I meant by "more research".
#20	Generally, where is excessive speeding accounted for? Most or all of the emphasis segments are well known for excessive speeding. E.g. Bennett Valley Rd, the report cites wet road conditions as an issue but if not for excessive speeding under those wet conditions, would there be as many collisions? Same for Lakeville Hwy and River Rd		Speeding is an issue county-wide. As discussed in the meeting speeding is something that is challenging to address from an 'engineering' standpoint.
#21	Are speed enforcement, traffic calming, road diets strategies that could or should be used more? I don't see any of those mentioned. o I notice that on both Bennett Valley and Porter Creek Roads, one strategy is to explore the use of high-friction roadway for high collision curve sections. Could this have the unintended side-effect of allowing speeders to speed more confidently thereby increasing speeding? (In the same way that a re-paved road surface tends to cause an increase in speeds)		HSIP funds are for roadway improvements. They cannot be used for increased enforcement. They could potentially be used for traffic calming measures or road diets. Sonoma County being majority rural in nature with 2 way rural roadways, there are limited opportunities for these kind of strategies. I am certainly open to suggestions if BPAC can think of particular locations that might benefit from these strategies.
#22	Generally, it seems to me that relying on collision statistics alone to determine unsafe road sections for cyclists & peds is not sufficient because the most dangerous road sections are typically avoided by cyclists and peds. E.g. Large sections of		Yes this is true. Unfortunately HSIP decision process is limited to collision data. That is why I left bike/ped as a broad emphasis area. It allows us to look at this from a zoomed out perspective and may allow us to pursue HSIP funds for a bike safety project. The bike collisions are more of systemic issue of roadways rather than localized areas.

	Hwy 12 in Sonoma Valley, Bennett Valley Rd, Lakeville Hwy.		
#23	Do we know why the 2016 collision numbers are so high across the board compared to other years? Bad weather?	7	We don't know
#24	Did only 1 accident with a high number of injuries push this into prominence? (regarding Arnold dr injury hotspot)	8	Yes. Due to the number of injuries, this got bumped up to an injury hotspot. These analyses are limited and therefore the results need to be interpreted skeptically. I chose not to pursue that hotspot further as an emphasis area because of the limited history there.
#25	Were any of these bicyclist-only incidents? If so, should that be mentioned?	10	I am assuming that if CHP was involved, and there was a collision report created, then the incident involved a vehicle.
#26	Is this the alcohol number, not the outside of Xwalk number?	10	fixed and clarified
#27	Should we previously list out the emphasis areas here?	11	listed
#28	Would this allow us to mention speeding as a factor in these rear ends?	13	yes
#29	The radar trailer has repeatedly been on River Road.	13	added note
#30	Do we have a total for the drunk/drugged driving on Lakeville	14	no we only have collision data, not citation data.
#31	Can we say this is a signal installation or do we know that for sure? (regarding Lakeville/116 improvement)	15	I don't know for sure. I have heard maybe a roundabout?
#32	Radar trailer has repeatedly been on BVR.	15	noted
#33	Can we mention how many collisions?	17	added
#34	Should we mention the geometry of the intersection?	18	added language
#35	I am guessing this punctuation is what was intended.	18	fixed
#36	Do we want to replace the sentence on page 10 with this sentence?	18	changed language
#37	Thank you for the opportunity to review the LRSP for the County. It looks great. The only comment I have is that perhaps the working group being developed for the 7 other jurisdictions producing LRSPs should also be included on your list of partnership groups (similar to the working group for Vision Zero…).	From SCTA	submitted to working group for other jurisdictions

#38	Thanks for the email, glad to see the County is moving along with this item. I'll see if there are any comments we (GHD) may have given we are only just starting to contract with the 7 Agencies on preparation of their individual LRSP. In reading this email, I note an email from Seana about coordinating with the LRSP Working Group, that prepared the procurement. Unfortunately, we've not met as a group and I'm actually having to contract separately with each jurisdiction, but that's not to say we won't coordinate this back with the larger group and the Vision Zero Taskforce. The contracting is taking much longer than anticipated. My initial comment on the Draft is that it appears to be rich with the data, but limited to proposing further analysis and I don't see public input as a component? As I note I'll see what internal review/comment we can provide, but given the email from Seana, were you expecting me to coordinate with the other jurisdictions? We will definitely coordinate once we are under contract where it appears there is overlap between the documents.	From Vision Zero Working Group	Thanks for the email. I was not anticipating coordination between documents with the other jurisdictions. At this point the idea is to circulate internally amongst local jurisdictions and other County agencies for comment. I also wanted to share what our plan ended up looking like as there aren't many examples out there for LRSPs. This is a new requirement by Caltrans and the plans that I have seen vary in style and scope. Once I receive comments from internal agencies, I will make revisions and circulate the document for public input. I am trying to keep the scope narrow at this point while meeting the requirements of a LRSP. The document will develop in complexity through future iterations. My perspective is that the LRSP is a tool for Public Works to target HSIP funding where it will be most beneficial. Also the LRSP should demonstrate to Caltrans through a data driven process that the HSIP funds are being put to their intended use. There is a Vision Zero program being developed by the County Health Services/SCTA that will be much more comprehensive, all-inclusive plan and will include significantly more public input through various working groups and meetings.